PRIVATE CAPITAL REAL ESTATE | INFRASTRUCTURE INVESTMENT

Investing in industrial decarbonisation

Carbon capture and storage and low carbon hydrogen production

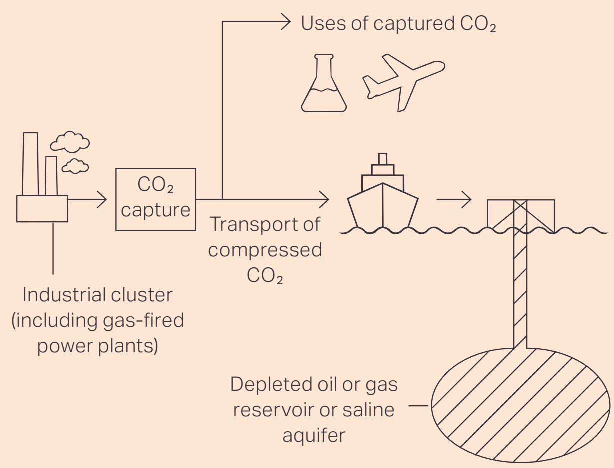
MACFARLANES

Satisfying demand for reliable and dispatchable baseload power generation is a current and key priority for national governments. Even better if that power can be delivered by means of low carbon solutions. At the same time, hard-to-abate industrial sectors (e.g. chemicals, steel and cement) which are feeling pressure from significant financial, competitive and regulatory imperatives, are also focusing on how to decarbonise their operational processes. These needs are super-charging technical developments in the energy infrastructure sector, in particular the development of carbon capture, utilisation and storage (CCUS) and other emerging technologies such as low carbon hydrogen production.

The International Energy Agency (IEA) has reported that appetite for CCUS is increasing among financial institutions. This has been facilitated to no small degree by governments globally having earmarked more than $50bn in public support for CCUS over the past three years[1], and in Europe a related policy shift geared towards long term revenue and risk sharing mechanisms. Meanwhile, low carbon hydrogen production is increasingly tracking this positive direction of travel, and the sector is expected to grow strongly by 2030. The scale of infrastructure required to deliver CCUS and low carbon hydrogen production at a commercially meaningful level presents a significant pipeline of opportunities, and these opportunities are becoming increasingly attractive for investors as government support helps to de-risk what have traditionally been capital-intensive and technically complex projects.

In this article we consider the opportunities and challenges facing the development of the CCUS and low carbon hydrogen production sectors, and the key investment drivers for attracting private capital to the space.

CCUS process



CCUS and low carbon hydrogen production technologies and uses

CCUS technologies primarily involve capturing carbon dioxide (CO_2) from waste gases produced from fossil fuel power stations or hard-to-abate industrial activities and either permanently storing that CO_2 in deep underground geological formations (such as depleted oil and gas reservoirs or saline aquifers), or putting it to productive use (e.g. in the production of concrete, synthetic fuels and chemical feedstocks) turning it into a valuable raw material.

The main types of carbon capture processes include "post-combustion capture" (the removal of CO_2 from industrial exhaust gases after fuel is burned) and "oxyfuel technology" (a combustion process that burns fuel using oxygen instead of air, enabling easier carbon capture and reducing the emission of nitrogen oxide, a harmful air pollutant). Both of these technologies can be retrofitted to existing facilities with high CO_2 emissions.

"Post-combustion capture" and "oxyfuel technology" can also be integrated with waste-to-energy plants, or paired with biomass fuel inputs. The latter comprises a process known as "bioenergy with carbon capture and storage" (BECCS) that generates electricity by burning biomass while capturing and storing CO_2 and in doing so achieves negative emissions.

Another emerging technology is "direct air carbon capture and storage" (DACCS) which removes CO_2 directly from the atmosphere for permanent storage underground.

Low carbon hydrogen production is directed at decarbonising hard-to-abate industrial sectors and complementing the electrification of a more renewables-focused energy system.

Hydrogen has established uses in industrial processes, particularly oil refining and ammonia production. Traditionally these processes have relied on "grey" hydrogen, which is hydrogen produced via steam methane reforming (SMR) of natural gas, a technology that releases significant CO_2 emissions.

However, in an effort to reduce the environmental impact of its hydrogen consumption, industry is actively scaling back reliance on grey hydrogen and is instead incorporating "blue" and "green" hydrogen, which have lower CO_2 emissions, into its processes. Blue hydrogen deploys the same SMR approach as grey hydrogen but combines it with CCUS (typically using a "pre-combustion" capture process). Green hydrogen is produced by the electrolysis of water using electricity generated from renewable sources like wind and solar power.

Various emerging technologies are leveraging this shift away from grey hydrogen, including by using low carbon hydrogen as a source of high-grade industrial heat, and as a long-term solution for decarbonising steelmaking. Low carbon hydrogen is also being developed as a clean energy vector and a form of long-duration energy storage (LDES). In the parts of the transport sector where electrification is more difficult, hydrogen-derived sustainable aviation fuels (SAF) and green ammonia or methanol for shipping are highlighted as pathways for net zero emissions.

Investment challenges for CCUS and low carbon hydrogen production technologies

A challenge for operators, who are simultaneously keen to progress proposals to install or retrofit carbon capture technology and present investors with bankable investment opportunities, is that these CCUS and low carbon hydrogen production technologies have had, to date, limited commercial application.

For example, there has been little opportunity to stress-test the "cross chain" interdependency that exists between large-scale CCUS projects and the infrastructure of related "transport and storage infrastructure" (T&S) networks (e.g. pipelines and offshore storage sites) that sit further along the CCUS operational chain. And in particular, there is a risk that plant fitted with CCUS technology could be negatively affected by delays to the construction, or subsequent operational disruption affecting the ongoing availability, of a functioning T&S network.

Elsewhere, low probability, but high impact, risks for the workability of CCUS value chains include:

- "stranded asset" risk, arising if the infrastructure became economically unviable or unusable (e.g. as a result of any unforeseen technological changes); and
- the risk of a major "CO_2 leakage" incident (e.g. escaping from a storage site), which could trigger exposure to material environmental liabilities.

For low carbon hydrogen technologies, a combination of technical and commercial risks, and demand uncertainty, all have the potential to impose substantial constraints on private investment in large-scale production projects. Low carbon hydrogen production is currently more expensive when compared to conventional unabated grey hydrogen production methods. This is especially the case for green hydrogen, due to the current cost of electrolysers, albeit this is a cost which is expected to fall as manufacturing scales up.

Blue hydrogen is expected to provide the majority of the volume of low carbon hydrogen production for industrial decarbonisation in the short to medium term. Here cost competitiveness, cross-chain risks and interdependency with CCUS, along with uncertainty over forecasting different end-user market demands, are seen as key obstacles to sourcing the necessary private investment for such projects, with investors calling for robust public policy support.

In addition, these "first-of-a-kind" projects require material up-front capital expenditure, and sourcing the private investment needed for this is contingent upon guaranteeing future demand for CCUS and T&S services and evidencing the ability to ensure reliable and long-term revenues. A certainty of demand which this nascent market does not yet provide.

It is against this backdrop that we are seeing a significant increase in legislative and regulatory intervention as the UK Government focuses its policy interventions on the development of various "business models" to support the economic viability of, and foster private investment in, CCUS and low carbon hydrogen production projects.

Investment driver 1: Government intervention promoting the future of CCUS and low carbon hydrogen production

A. Achieving decarbonisation objectives

The importance of new or repurposed nationally significant CCUS and low carbon hydrogen production infrastructure in achieving the UK Government's decarbonisation objectives, in particular under its Clean Power 2030 Action Plan[2] and associated climate goals, was spelt out in the recently published "Overarching National Policy Statement for energy", which emphasises the "urgent need" for all types of CCUS and low carbon hydrogen production infrastructure to allow these technologies to play their role in the transition to net zero[3]. The Policy Statement highlights the role of CCUS infrastructure in reducing emissions connected with generating electricity from natural gas, and how it is needed to capture and store CO_2 from hydrogen production from natural gas and for other industrial processes, as well as the use of BECCS and emerging DACCS technology.

> "CCUS will... be a key contributor to energy security and provide the lowest cost pathway to net zero.
>
> **UK Government on CCUS, April 2025[4]**

Correspondingly, with respect to low carbon hydrogen production, the UK Government's latest "Hydrogen Update to the Market" (2025)[5] has acknowledged its "essential role" in complementing the electrification of the energy system, supporting the decarbonisation of critical, hard-to-electrify industrial activities, and delivering low-carbon dispatchable power and inter-seasonal energy storage, in order "to help balance a renewables-based power system".

In light of this a range of environmental regulations that are intended, either directly or indirectly, to bolster the business case for CCUS and low carbon hydrogen production have been, and continue to be, introduced.

For example, the "UK Emissions Trading Scheme" (UK ETS) implements a carbon pricing scheme that puts a higher price on unabated carbon emissions, and the UK "Carbon Border Adjustment Mechanism" (CBAM), scheduled to be introduced on 1 January 2027, will apply a carbon levy to imported goods in relevant carbon-intensive sectors, including hydrogen, cement and steel.

Recent regulatory policy has also focused on removing barriers to retrofitting CCUS infrastructure on combustion generation plants. It includes updated regulations dealing with "decarbonisation readiness" (DR), requiring operators of all such new and substantially refurbished electricity-generating combustion power plants located in England to demonstrate DR as part of the environmental permit application process, so that these may be converted to hydrogen-firing or retrofit carbon capture technology within their lifetime.[6]

B. Government-backed industrial clusters

UK Government policy is focused on the development of various **"business models"** to support the economic viability of CCUS projects and low carbon hydrogen production, and incentivise private investment, including through the deployment of grants, revenue support and capital funding. This framework is configured around two key underlying features:

- a **"split chain"** approach, separating the ownership, operation and financial risk of:
  - generation/production and capture; and
  - T&S, rather than a single entity having responsibility for the whole process; and
- **"cluster sequencing"**, identifying, evaluating and prioritising suitable industrial clusters or hubs (i.e. the main geographic areas where industrial CO_2 emitters, power plants and capture projects are located in close proximity), with a view to enabling the sharing of T&S.

> The UK is home to 7 major industrial clusters ... which produce 50% of all UK industry emissions. The government supports CCUS development in these clusters to achieve high-impact emissions reductions, reducing risk by enabling the sector to share Transport and Storage Infrastructure
>
> **UK Government on CCUS, April 2025**

Cluster sequencing

The UK's cluster sequencing process is divided into "tracks"[7] and "phases"[8], involving an initial phase for the submission and evaluation of cluster-level plans (including for T&S networks) to determine the most suitable locations to progress deployment, followed by a second phase to select the individual capture projects from within that chosen cluster track.

"Track-1" focuses on mid-later 2020s deployment, the UK Government having chosen: i) the "HyNet" cluster, in north-west England and north Wales; and ii) the "East Coast Cluster" in Teesside and Humberside. In October 2024, the UK Government announced up to £21.7bn of funding over 25 years for these Track-1 clusters, and construction of the T&S network is now underway following final investment decisions reached in late 2024 and early 2025.

Individual capture projects reported to have achieved financial close under Track-1 include, for example, among the HyNet industrial cluster, Heidelberg Materials UK's Padeswood cement facility and Encyclis's Protos waste-to-energy plant located in Ellesmere Port[9]. A number of blue hydrogen projects are also on its project negotiation list for Track-1 expansion.[10] Low carbon blue hydrogen production is reliant on T&S to dispose of CO_2 emissions and co-locating operations around industrial clusters with such shared network infrastructure is both necessary and should help achieve significant economies of scale.

For "Track-2", which is aiming for further deployment by 2030, the "Acorn" cluster in north-east Scotland, and the "Viking" cluster in the Humber, comprise the next CCUS clusters identified for development, with lead operators engaged in negotiations for economic support under the UK Government's business models.

C. Regulatory incentive mechanisms

The UK Government's "business models" for supporting the deployment of CCUS and low carbon hydrogen production technologies are designed to establish appropriate regulatory incentive mechanisms for owners of such power and industrial sector operations.

These incentive mechanisms are implemented as financial support under contractual arrangements of typically 10-15 years, with a government-owned entity, the Low Carbon Contracts Company (LCCC), acting as the counterparty, with each revolving around a "Contract for Difference" (CfD) style framework. The main forms of such agreement include the:

- **"Industrial Carbon Capture Contract"** (ICCC), for hard-to-abate, energy-intensive industrial sectors (such as cement, chemicals, refining, etc.). These provide a project owner with revenue support through a payment per tonne of captured CO_2, covering operational expenses, T&S charges, and repayment of, and a rate of return on, capital investment in carbon capture equipment[11];
- **"Dispatchable Power Agreement"** (DPA), for natural gas-fired power generation plants. This incorporates two key elements:
  - "an availability payment", providing a regular payment covering the costs of being available to generate and capture carbon, irrespective of whether the relevant plant is actively dispatching; and
  - a "variable payment", to account for the additional costs of such power generation utilising CCUS, in comparison to an unabated reference plant; and
- **"Hydrogen Production Business Model"** (HPBM), for green and blue hydrogen. This offers financial subsidy provided via the UK Government's regular "Hydrogen Allocation Rounds" (HARs), which is a competitive process resulting in the award of "Low Carbon Hydrogen Agreements" (LCHA) to selected projects. It is designed to help producers overcome operating cost gaps, in this case between low carbon hydrogen and conventional unabated fuel. It includes:
  - "price support", comprising a variable premium payment per unit of hydrogen produced and sold, calculated as the difference between an agreed strike price (reflecting the producer's unit cost of production and allowed return on investment) and achieved market price; and
  - "volume support", a sliding scale subsidy based on sales thresholds, protecting producers in a relatively nascent market with uncertain demand.[12]

Other business model arrangements offering revenue certainty include a specific business model for waste-to-energy projects with CCUS, and new models aiming to support greenhouse gas removals and BECCS power.

D. Transport and Storage Regulatory Investment Model

Further along the operational chain, under the UK's "split chain" approach to CCUS, the T&S network represents a more distinct asset class, offering longer-term infrastructure investment opportunities. A single licensed T&S company entity (T&SCo) is the network operator for each designated industrial cluster track, responsible for its overall management, including the development, construction, financing, operation, maintenance and expansion of that CCUS cluster network's pipelines and storage. With it having such monopolistic features, and as with longstanding privately-owned price-regulated utilities (notably the regional water, gas and electricity networks), the UK Government has developed the "Transport and Storage Regulatory Investment Model" (TRI) for CCUS in a similar manner to those other utilities, offering revenue stability and the reasonable levels of returns expected by investors, in order to attract private investment in what are complex, large-scale, high up-front capital intensive, long-life infrastructure assets.

Key components of the TRI business model include the:

- **"Regulated Asset Base"** (RAB) approach, which underpins the T&S regulatory support framework, in particular whereby Ofgem, the economic regulator, grants a licence to the T&SCo and determines its "allowed revenue" (i.e. the regulated income it can earn to cover costs and a reasonable return on investment);
- **"Revenue Support Agreements"** (RSA), a contract between the T&SCo and a government-appointed counterparty (such as LCCC), covering demand risk, which is intended to mitigate shortfalls in revenues from individual CO_2 emitter plant customers if these prove insufficient; and
- **"Government Support Package"** (GSP), including compensation support agreements to protect T&SCo investors from low probability, high impact risks, as highlighted earlier, for example, "stranded asset" risk and "CO_2 leakage" incidents.

In addition to these business model incentive mechanisms, a range of other governmental funding and grants has been made available to investors in recent years aimed at promoting research and innovation, for example, the £1bn "Net Zero Innovation Portfolio" and associated £20m "CCUS Innovation 2.0 programme", and the £60m "Direct Air Capture and GGR Innovation Programme".[13]

Looking beyond business model regulatory support, for those privately funded emitter projects which may increasingly be able to carry merchant risk, the UK Government has recently published draft commercial principles for a new "CCUS Transition Access Agreement", focusing on enabling such projects that may require no or only limited government subsidy to also connect to T&S networks, expanding overall industry demand.

It must be recognised that the UK Government, while active in supporting the development of CCUS networks, is at the same time confronted by economic headwinds that may increase pressure on it to move towards reducing its own exposure to "business model" subsidy support. This is especially the case given the potential strain on public finances of funding future allocation rounds, in particular in relation to the expansion of large-scale T&S infrastructure and how this is delivered during the current market transition. Proposed arrangements are yet to be determined for new cluster phases, but a careful balancing act will be necessary if there is to be any material change in approach that involves extending merchant risk for private owners and operators (for example, in connection with existing protections such as the RSA and GSP outlined above) without unsettling this nascent sector.

Investment driver 2: unlocking private capital

As with any commercially nascent technology, there are currently meaningful investment challenges for investors in CCUS and low carbon hydrogen production technologies. When compared to renewable heavyweights such as solar PV and wind projects, which are typically backed by long-term PPAs with creditworthy offtakers, both CCUS and low carbon hydrogen production projects have different operational and technical risks and are subject to newer and evolving regulation. These characteristics present challenges for CCUS and low carbon hydrogen production projects as they look to achieve bankability and secure finance.

However, notwithstanding this, it is clear that the long term investment thesis for these technologies is strong as they stand to benefit from the positive effects of an accelerating global commitment to net zero targets and the significant government policy interventions that are being put in place to support it.

The IEA report that investment in CCUS grew more than 15-fold in the years from 2020 to 2025, from around $0.3bn to over $5bn. And spurred on by the more than $50bn in public support that has been committed to CCUS projects over the past three years[14], investment into CCUS is today at its most geographically diverse[15].

Alongside increased investment, more than $15bn in commercial debt has flowed across CCUS-related transactions over the last two years alone, with the UK accounting for approximately 85% of that lending[16]. This influx of debt capital recognises the significant potential offered by the CCUS and low carbon hydrogen production sectors and underscores the emerging opportunity to lend into a sector with government-supported revenue certainty and attractive risk-adjusted returns.

The long term financial viability of both the CCUS and low carbon hydrogen production sectors is dependent upon securing sufficient private capital investment. However, the challenge is ensuring the bankability of these projects, particularly given that predictable revenue models and clear risk-allocation frameworks are not yet mature.

In the UK, this pursuit of bankability is supported by a comprehensive package of regulatory incentive mechanisms (see above, Investment driver 1, Sections C-D) designed to provide the revenue certainty that lenders require and in particular the “split chain” and “cluster sequencing” business model approach:

- In disaggregating the value chain so that capture, transport and storage are developed, owned and operated by separate specialist entities, the “split chain” model promotes bankability by allocating risks to the parties best placed to manage them, enabling T&S infrastructure to be regulated as a utility-style asset with predictable, inflation-linked revenue streams, and facilitating third-party access and cost mutualisation.
- The “cluster sequencing” model takes a phased, co-ordinated approach to deployment by selecting clusters of capture projects alongside their shared T&S infrastructure as integrated packages. By using anchor projects to underwrite initial infrastructure and sequencing build-out projects to fill remaining capacity the “cluster sequencing” model leverages economies of scale, reduces per-unit costs and is underpinned by a comprehensive suite of government-backed business models and funding commitments that provide the revenue certainty lenders require.

In practice, the two models are considered to work in tandem: cluster sequencing provides the co-ordinated deployment mechanism that brings multiple projects forward together, whilst the split chain structure provides the commercial and regulatory architecture for allocating risks, revenues and responsibilities amongst participants within each cluster.

Scaling CCUS and low carbon hydrogen production technologies will require widening the pool of participating investors and lenders, from commercial banks to private credit fund lenders, insurers and institutional investors. Traditional bank lenders have historically been slower to develop the sectoral expertise and risk appetite necessary to underwrite first-of-a-kind transactions driven by clean energy technologies, and in doing so have created a financing gap that private credit fund lenders have been increasingly keen to fill. For private credit fund lenders with the expertise to navigate the technical, regulatory and commercial complexities of the sector, the opportunity to generate attractive risk-adjusted returns while contributing to measurable environmental outcomes represents a rare alignment of financial and strategic objectives.

CASE STUDY

Net Zero Teesside Power and Northern Endurance Partnership JV

In December 2024 financial close was reached on sister projects:

- Net Zero Teesside Power (NZT Power), a joint venture between BP and Equinor which once completed aims to be the world's first gas-fired power station with fully integrated CCUS provided by the NEP infrastructure[17] which is capable of generating up to 742 MW of flexible, dispatchable low-carbon power; and
- the Northern Endurance Partnership (NEP), a CO_2 transportation and storage joint venture between BP, Equinor, and TotalEnergies. The NEP aims to reduce CO_2 emissions from major industrial regions by using CCUS technology to transport CO_2 via an offshore pipeline into subsea injection facilities located below the North Sea seabed which have capacity to permanently store up to an initial four million tonnes of CO_2 per year[18].

Together, NZT Power and the NEP form the backbone of the “East Coast Cluster”, one of the first two CCUS clusters selected by the UK Government, covering Teesside and the Humber.

The projects were supported by £8bn in combined debt financing arranged by Société Générale and provided by a consortium of over 20 lenders including NatWest, Lloyds, Mizuho, Barclays, BNP Paribas, ING, Santander, Bank of China and MUFG[19].

Key to securing the required investment was the revenue predictability provided by the UK Government's regulatory framework. NZT Power benefits from a DPA[20] with a 15 year term which provides fixed availability payments decorrelated from market, commodity price and dispatch risk. The NEP is underpinned by the TRI regime, which provides revenue stability and thereby reduces the risk that the infrastructure will not perform. The transaction demonstrates how long-term government revenue support combined with private capital and strong sponsor commitment can deliver bankable decarbonisation projects at scale.

Investment driver 3: sustainable finance

Private capital, in particular from private funds with institutional investors pursuing sustainability focused or impact-driven strategies, has an increasingly significant role to play in financing CCUS and low carbon hydrogen production infrastructure. However, for fund managers and their investors, deploying capital into these emerging technologies raises questions around sustainable finance classification, regulatory disclosure and the credibility of impact claims.

A consideration for fund managers marketing into the EU is the classification of CCUS and hydrogen-related investments under the Sustainable Finance Disclosure Regulation (SFDR). Where a fund promotes environmental characteristics (an "Article 8" fund) or has sustainable investment as its objective (an "Article 9" fund), managers must assess whether investments in CCUS and hydrogen infrastructure qualify as "sustainable investments" within the meaning of SFDR, including considering the "do no significant harm" (DNSH) principle and adherence to minimum safeguards. Investments in blue hydrogen, for example, which rely on natural gas feedstocks, require careful analysis under the DNSH assessment, given the residual emissions associated with the SMR process, even when combined with carbon capture.

Closely related is the question of EU Taxonomy alignment. The EU Taxonomy Regulation establishes detailed technical screening criteria for determining whether an economic activity qualifies as "environmentally sustainable". Carbon capture and storage activities, and certain forms of low carbon hydrogen production, are recognised within the Taxonomy's climate change mitigation criteria, subject to meeting applicable thresholds. For instance, hydrogen production may qualify where lifecycle greenhouse gas emissions savings are at least 73.4% relative to a fossil fuel comparator, a standard that green hydrogen can typically satisfy but which blue hydrogen projects may find more challenging depending on capture rates and upstream methane emissions. Fund managers making Taxonomy-aligned claims in pre-contractual disclosures and periodic reporting must ensure that underlying investments demonstrably satisfy these criteria, supported by robust data and independent verification.

In practice, even fund managers pursuing Article 9 impact strategies that do invest in activities capable of meeting Taxonomy alignment often elect not to report on their Taxonomy alignment, given the difficulties associated with satisfying the Regulation's stringent technical screening criteria and obtaining the requisite independent verification. Similar challenges may arise in respect of investments in CCUS and low carbon hydrogen production infrastructure, where the nascent nature of reporting frameworks and limited availability of verified emissions data may further complicate any alignment assessment.

For private funds with explicit impact mandates, CCUS and hydrogen present both opportunity and complexity. On the one hand, these technologies are widely acknowledged as essential components of credible net zero pathways for hard-to-abate industrial sectors where electrification alone is insufficient. Impact investors focused on climate mitigation may therefore view such infrastructure as directly aligned with their investment theses, particularly where projects can demonstrate measurable, additional emissions reductions. On the other hand, impact investors must navigate the risk of perceived "fossil fuel lock-in" - the concern that investing in technologies associated with continued fossil fuel use, such as blue hydrogen or gas-fired power generation with CCS, may be seen as prolonging the operational life of carbon-intensive assets rather than facilitating a transition from them.

This tension is acutely felt in the context of fund-level exclusion policies and investor side letters. Many institutional investors maintain exclusion lists or restrictions on exposure to fossil fuel-related activities. Fund managers must carefully assess whether investments in CCUS-equipped gas-fired power stations or blue hydrogen facilities fall within the scope of such restrictions and ensure that their fund documentation, including investment policies and sustainability-related disclosures, accurately reflects the nature of these investments.

> The distinction between "transitional" activities – which facilitate decarbonisation within sectors that cannot yet achieve net zero – and activities that perpetuate fossil fuel dependency, is nuanced and requires clear articulation in offering documents and investor reporting.

The sustainable finance regulatory landscape continues to evolve in ways that will shape private capital flows into these sectors. The European Commission's ongoing review of the SFDR framework, and its proposals to introduce product categorisation labels (including a dedicated "transition" category), may offer a more workable classification for funds investing in CCUS and hydrogen as part of a broader decarbonisation strategy, provided fund managers can demonstrate credible transition plans at portfolio level. In the UK, the Financial Conduct Authority's Sustainability Disclosure Requirements (SDR) and investment labelling regime similarly require careful consideration; fund managers using labels such as "Sustainability Impact" must ensure that their CCUS and hydrogen investments satisfy the applicable criteria, including evidence of intentionality, measurability and additionality. As both the EU and UK regimes mature, fund managers will need to remain agile in adapting their disclosure practices, investment processes and impact measurement frameworks to keep pace with regulatory and investor expectations.

Regulatory outlook

The regulatory framework underpinning the operation of CCUS infrastructure covers a mix of statutory rules and complex planning and licensing procedures spread in different ways across the chain of capture, transport and storage. These rules and procedures, which continue to be developed, include multi-faceted on/offshore licensing requirements and financial provision for post-operational decommissioning, overseen by regulatory authorities such as the UK Government's Department for Energy Security and Net Zero (DESNZ), its economic regulator Ofgem, and the North Sea Transition Authority (NSTA).

For low carbon hydrogen production, the UK Low Carbon Hydrogen Standard provides transparent and robust production standards and certification, which it is important continue to be maintained to support product demand.[21]

As the markets for both CCUS and low carbon hydrogen production develop it is expected that the complexity of regulation and the number of applicable players will increase. Indeed, the UK Government has indicated that as part of its roadmap to build a competitive commercial market for CCUS by 2035 – moving from "market creation" to "market transition" - it intends, among other things, to develop policies for non-pipeline CO_2 transportation (via road, rail, and ship) to support deployment in locations beyond the chosen industrial clusters, and with respect to addressing opportunities for encouraging cross-border network transfers.

The UK Government has issued a "call for evidence" which considers "unbundling" the CO_2 transport and storage value chain into distinct, independently operated and owned entities. Under its future commercialisation of these networks, this would involve having both licensed "TCos" and "SCos" with a view to creating a platform for the development of market competition and reducing entry barriers for such new, more specialised private operators.[22]

The UK Government is also due to publish its updated "UK Hydrogen Strategy" later this year, which will set out its latest plans for accelerating low carbon hydrogen production and wider market integration.

Given the breadth of applicable policy and regulation, and the number of authorities involved, specialist legal and technical advice is essential when navigating these detailed areas.

Conclusion

The environmental case for CCUS and low carbon hydrogen production is clear, as these technologies provide an increasingly proven route towards enabling the decarbonisation of power generation and hard-to-abate industrial activities. Indeed, as these technologies develop, and the government support matrix within which they sit matures and becomes increasingly sophisticated, the associated investment case is becoming similarly attractive for both private capital investors and lenders.

The CCUS and low carbon hydrogen production sectors offer a long-term structural growth story underpinned by mechanisms that are able to provide long-duration, inflation-linked revenue. These conditions have the potential to unlock substantial further private investment, positioning the UK as a global leader in carbon management and low-carbon hydrogen and delivering enduring value for investors, industry, and the wider economy alike.

Contacts

Andrew Hughes
Partner
DD +44 (0)20 7849 2918
andrew.hughes@macfarlanes.com

Tim Redman
Partner
DD +44 (0)20 7849 2100
tim.redman@macfarlanes.com

Nigel Price
Consultant
DD +44 (0)20 7849 2572
nigel.price@macfarlanes.com

Katherine Hensby,
Head of Banking and Finance Policy
DD +44 (0)20 7849 2594
katherine.hensby@macfarlanes.com

Rachel Richardson
Head of ESG
DD +44 (0)20 7849 2480
rachel.richardson@macfarlanes.com

End notes

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MACFARLANES

20 Cursitor Street, London EC4A 1LT | T +44 (0)20 7831 9222 | macfarlanes.com