

DELIVERING NET ZERO

Carbon Capture, Usage and Storage

Managing co-dependency is key to success

Carbon capture and storage (“CCS”, or “CCUS” where usage of the CO₂ captured is contemplated) in the UK has been identified as a “necessity, not an option” by the UK’s Climate Change Committee. Five industrial clusters have met the eligibility criteria as part of the UK government’s ‘Track-1’ selection process. And from the end of October 2021 two clusters will be selected to enter into negotiations for delivery by the mid-2020s.

Managing the relationships between co-dependent projects and the allocation of responsibility for long term liabilities will be crucial for the success of a CCUS industrial cluster and its component projects. In this article, we consider how ‘cross-chain risks’ and liabilities are allocated under the UK’s proposed CCUS business models.

A chequered history

CCUS has had a chequered history. Whilst the technology has been available for decades, there are fewer than 30 operational CCS projects globally, and none in the UK. Previous UK projects were abandoned in 2015 after the UK government scrapped its proposed £1 billion support for the technology, just days before COP21. However, as we approach COP26, there is real impetus behind advancing CCUS projects rapidly and at scale - driven primarily by the targets within the Paris Agreement signed, ironically, at COP21.

Whilst CCUS still has its critics, multiple governments and agencies have determined that it is simply not possible to achieve Net Zero without a broad portfolio of technologies, including the wide-scale deployment of CCUS.

CCUS can play critical roles in:

- assisting decarbonisation of hard-to-abate industry (those requiring high degrees of heat, e.g. cement, steel and chemicals sectors)
- providing low carbon dispatchable power
- the production of low carbon ‘blue’ hydrogen
- delivering negative emissions

A framework for delivery

CCUS is not feasible without significant government support. It needs the introduction of a robust regulatory and contractual framework, required to address key hurdles to investment including:

- providing a revenue stream to incentivise carbon capture when the carbon price is currently insufficient to justify that investment;
- to mitigate cross-chain risks involved as a result of co-dependent projects in the value chain; and
- long-term storage liability risk.

In the UK, there have been a number of welcome policy-level developments over the last year, providing greater clarity as to the Government’s CCUS policy and funding ambitions over the next decade. As outlined in the [Prime Minister’s 10 Point Plan](#), the UK’s ambition is to capture 10Mt of carbon dioxide a year by 2030. To achieve this, the UK Government will invest £1 billion by the end of the decade to bring forward four CCUS clusters, with two industrial clusters to be established by the mid-2020s, and a further two industrial clusters by 2030.

Investable business models and a co-ordinated approach to cluster development are required. In December 2020, May 2021 and October 2021, the Department for Business, Energy and Industrial Strategy (“BEIS”) published updates on the proposed CCUS commercial frameworks for business models that apply to power and industrial carbon capture, and to the transport & storage (“T&S”) network (“December 20 Update”, “May 21 Update” and “October 21 Update”, together “the Updates”¹). The support available for hydrogen projects which produce hydrogen from reformation of natural gas and incorporate CCUS (also known as blue hydrogen) was proposed in the

¹ Policy updates are available here: <https://www.gov.uk/government/publications/carbon-capture-usage-and-storage-ccus-business-models> The October 21 Update, published on 5 October, updated the ICC and DPA business models only.

business model for low carbon hydrogen consultation published by BEIS in August 2021 (the “**Hydrogen BM consultation**”). For further details regarding the proposals for a low carbon hydrogen business model, please refer to our article on the [UK Hydrogen Strategy: investable or a risky business \(model\)?](#)

Overview of proposed CCUS business models

T&S network: an economic regulatory funding model, whereby a privately owned T&S owner (“**T&SCo**”) will receive a long-term inflation linked “Allowed Revenue” stream paid by users (i.e., carbon capture projects) via use of system charges for the T&S network (the trunk of the onshore pipeline, an offshore pipeline and a storage site), with a Government Support Package (“**GSP**”) available to cover certain (remote) risks. T&S connection charges for connector or feeder pipelines will not be levied on early users, with costs included instead in the use of system charge.

Power generation: a 10 to 15 year dispatchable power agreement (“**DPA**”) for new build and retrofit power CCUS plants, based on the Contract for Difference (“**CfD**”) used in allocation round 3 for renewables (“**AR3**”). The DPA would provide an availability payment (a regular payment for availability of both capture and generation) and a variable payment (intended to incentivise the plant to generate ahead of a theoretical ‘reference’ unabated plant but without displacing renewables). As per the CfD, the counterparty will be Low Carbon Contracts Company, with payments passed onto consumers.

Industrial capture: an Industrial Carbon Capture (“**ICC**”) contract provides the ICC plant with payments to cover capex plus a return, T&S fees and opex for an initial 10 year period, with the option to extend for a further 5 year period in relation to support for opex and T&S fees only (if certain market and performance conditions are met). The opex component of the support is also based on the CfD model whereby the capture plant is paid the difference between a reference price and a strike price on the basis of metered output of captured CO₂. The reference price is intended to imitate the ‘avoided’ costs of the carbon price of the ICC (i.e. those costs that the industrial facility would otherwise pay to buy allowances for their unabated emissions) and will follow a straight-line upward trajectory based on the historic average carbon market price under the UK Emissions Trading Scheme (ETS), with adjustment for free allowances forfeited. The strike price will be negotiated and reflective of expected opex, adjusted for inflation. Support is only available in relation to emissions captured and directed to the T&S network (so any carbon utilised would not attract support). The ICC contract will be coupled with government co-funding of capital costs. The ICC contract will include provisions which may be switched on to accommodate a “CaaS” (Capture-as-a-Service) model to support companies to arrange to capture the emissions of another as a service.

Managing CCUS risks

Time is ticking down to the start of negotiations for Track 1 CCUS clusters. In anticipation of the finalisation of the CCUS business models by early 2022, we consider how BEIS intends to address some of the key questions that arise in connection with the design and implementation of the regulatory regime and which will be of particular interest to investors and developers of CCUS projects.

This analysis is based on the “minded to” position set out in the Updates and in the Hydrogen BM consultation. In relation to blue hydrogen production, BEIS proposes that new build plant will be supported under the hydrogen business models. Retrofit of capture technology to existing hydrogen production plant however would be supported under the ICC business model. In relation to the carbon capture side, the “answers” below reference power, blue hydrogen and industrial capture projects - little information has been provided to date in relation to the anticipated models for negative emissions projects, pending the response to the [Call for Evidence on greenhouse gas removals](#).

Cross-chain risks

The success of any carbon capture project will be integrally linked with the T&S network to which it connects, and vice-versa. We consider below some of the fundamental cross-chain risks which have driven much of the design of the various business models:

T&S timing mismatch: *What are the consequences if commissioning of the T&S infrastructure is delayed and is not ready to offtake the captured CO₂?*

- **Power:** Availability payments would be paid to power CCS generators if the CCS-enabled power plant is commissioned, available and performance requirements are met. Variable payments would not be paid, but the generator would operate in the market as an unabated power plant, subject to normal carbon pricing. If the start date has not occurred, then the target commissioning window (TCW) may be extended day-for-day for the T&S network delay.
- **ICC:** The TCW will be extended to the extent any delay is attributable to a failure to make the T&S network available in a timely manner. BEIS is considering its position on providing compensation for any costs incurred in this period.
- **Blue hydrogen:** No direct view is provided in the Hydrogen BM consultation. However, BEIS notes that it is looking into the appropriate risk allocation in circumstances where the hydrogen produced does not meet the required standard and the producer is not at fault (for example due to T&S unavailability). Further work is understood to be underway.
- **T&S:** The T&SCo is expected to manage construction time-tables and budgets without regulatory intervention. The Allowed Revenue would be withheld until the T&SCo is operational. BEIS considers that this

is a sufficient incentive and it is not currently considering further penalties, such as a reduction to the opening regulated asset value (“RAV”). It should be noted that BEIS is examining how “reopeners” (a form of uncertainty mechanism) could be deployed by the regulator to adjust Allowed Revenue in response to un-forecastable risk or material changes in circumstance. However the expectation is that these would only be used in exceptional circumstances such as an unexpected need to connect new users or changes in regulation. Potential investors, in both the T&SCo and in capture projects, will nevertheless be examining any scenarios in which any reopeners could be applied.

Construction delays to capture projects: What are the consequences if the initial capture project is delayed and is not ready to use the T&S network?

- **Power:** Significant delays could result in the power project falling outside of the TCW, resulting in the erosion of the term of the DPA and of the revenues received over the life of the project. BEIS considers a period of 12 months to be an appropriate TCW for the initial contracts. An ultimate longstop date resulting in loss of support is proposed to fall a further 12 months following expiry of the TCW. Sponsors will be keen to ensure adequate “buffer” periods are incorporated within milestone dates and will be examining the possibility of extending those dates beyond the relatively limited extension events in the current CfD (particularly to cater for the impact of cross-chain delay). Although these dates may be extended for force majeure, the DPA counterparty will be entitled to terminate for force majeure first occurring before the milestone requirement is met (i.e. the final investment decision is taken) that causes delays of at least 18 months to ensure funding is not blocked indefinitely. Where the T&S network is operational, T&S capacity fees may still be payable, although BEIS is considering whether this may be met by consumers. BEIS is also considering the feasibility of a payment from the delayed user to cover T&S critical opex in circumstances where the delayed user is the first user. Investors will be keen for confirmation by BEIS of whether this will be met taxpayers or consumers (which is currently under consideration), or will fall on the capture project.
- **ICC:** Similarly, delays may mean that ICC projects complete construction outside of the 12 month TCW. The relevant industrial facility will then bear the risks for any delays beyond this (subject to standard force majeure protection). BEIS is considering whether to include a right for the ICC contract counterparty to terminate for prolonged force majeure. Payments to the industrial facility under the ICC contract will not commence if the carbon capture facility’s construction is not completed. A long-stop termination event is also envisaged, falling 12 months following the expiry of the TCW.

- **Blue hydrogen:** BEIS envisages the risk of construction delays in respect of the low carbon hydrogen production plant would remain with the developer. No information on contract terms is available yet but our expectation is that a TCW and long-stop date would likely apply as terms will be based on the CfD model.
- **T&S:** The protection afforded to T&SCo - which will face a revenue gap as it will not be in receipt of the anticipated user T&S fees until the first user joins the network - is still under consideration, but BEIS is minded to:
 - allow deferral of the return and depreciation that the T&SCo would have been able to collect and to allow this to be “rolled up” and recovered across the operational life of the network;
 - provide for a recovery payment to cover T&SCo’s opex until the first user connects (potentially by consumers or taxpayers); and
 - establish a contingent mechanism if these measures are not sufficient to enable the recovery of Allowed Revenue over time, allowing recourse to consumers or taxpayers.

Underutilisation risk: What are the consequences if the T&S network is underutilised?

It is expected that the T&S network will be underutilised in the early years, as its initial capacity will be sized to take into account the connection of future users. In addition to this “utilisation build-up” risk, there are risks of unexpected underutilisation, for example due to expected users not connecting on time or at all, users utilising less capacity than expected, or users disconnecting early. In the December 2020 Update, options considered by BEIS to cater for these risks included:

- Government funding to plug the ‘revenue gap’ via the CCS Infrastructure Fund (“CIF”);
- Deferring the revenue from the early operational phase to later in the operational phase;
- Incentivising T&SCo to find and connect more users;
- Building a ring-fenced financial reserve as part of the Allowed Revenue ‘building blocks’; and
- A contingent mechanism whereby consumers or taxpayers pay for any remaining under-recovery of Allowed Revenue (as mentioned above).

BEIS has since confirmed a number of ‘minded-to-positions’, although it continues to work through the interactions. In relation to utilisation build-up, BEIS is minded to close any revenue gap suffered by the T&SCo in the early operating phase by providing an upfront capital contribution through the CIF. In relation to other underutilisation risks, BEIS is minded to mutualise under-recovery of Allowed Revenue, in whole or in part, across users, with a contingent mechanism to protect the T&SCo in the early operational phases if this is insufficient. It does not intend to require a financial reserve or impose an utilisation incentive on T&SCo, although these may be

considered once clusters have matured and the carbon price is sufficient to incentivise more users to capture emissions.

Management of underutilisation risk will be an important consideration for investors and it remains to be seen how feasible mutualisation amongst other users will be whilst the number of users are low. Users are likely to wish to see a cap on their exposure, unless they are permitted to recover the additional cost via its DPA or ICC contract. How this approach will work for new build blue hydrogen producers is also an open question. The strike price under the contract for difference proposed for these projects is intended to include T&S transport costs and no reopener has been put forward to date.

Exercise of termination rights by the counterparty under the ICC contracts and DPA terms, particularly as a result of poor technical performance (e.g. failure to achieve a minimum CO₂ capture rate), whilst necessary from a consumer protection perspective, may exacerbate underutilisation issues. Depending on the design of the mutualisation mechanism, how this discretion is exercised may be important for all projects comprised within a cluster.

Stranded asset risk: What are the consequences if the T&S network becomes a stranded asset?

Taken to the extreme, under- or non-utilisation could crystallise “stranded asset” risk - i.e., where the T&S network becomes redundant or uneconomic. In addition to the loss of the remaining investment, sponsors and the T&SCo may face accelerated decommissioning (with a likely shortfall in decommissioning funding accrued through the Allowed Revenue). BEIS has indicated that this ‘low probability, high impact’ risk is one that would be covered by the government support package (the “GSP”). BEIS has emphasised that other measures to address delays in connections or underutilisation (described above) would be engaged first, including the contingent mechanism allowing recourse to consumers and taxpayers. BEIS is currently contemplating that T&SCo’s assets would be considered “stranded” and that there would be a right to trigger the GSP if each of the following criteria were met for reasons outside the control of T&SCo:

- injected volume over a given rolling period falls materially below the planned utilisation;
- support from contingent support measures is no longer available; and
- other mitigation measures undertaken (e.g. mutualisation of costs) are insufficient.

BEIS is minded that the GSP covers the remaining investment up to the RAV as well as the possibility of further operating expenditure to preserve the asset for future use, or to prepare it for accelerated decommissioning depending on decisions made about the future of the asset. Further work will be done on valuation of agreed protection, but it is expected that this will cover both debt and equity, although penalties are

being considered (for example for persistent failure to meet availability standards), eroding investor protection.

T&S outages: What are the consequences if the T&S assets are not operating and able to transport and store the captured CO₂ from relevant projects?

- Power: A T&S outage not attributable to the generator would constitute a relief event under the DPA. In these circumstances the captured CO₂ rate would be deemed, allowing availability payments to continue, but variable payments would not (similar to the delayed delivery of the T&S network described above). BEIS is considering giving the DPA counterparty a right to terminate the DPA in the event of prolonged outages of the T&S network (the duration of which is yet to be determined). In these circumstances compensation would be payable to cover invested capital costs. BEIS considers compensation should comprise development and pre-development costs, decommissioning costs, financing and contractual break costs, and construction costs relating to the facility. Deductions would be applied to take account of any savings made by the generator, the residual economic value of the facility and the repayment or amortisation of construction costs (if any).
- ICC: The ICC facility is expected to be protected from this risk. In the October 21 Update, BEIS confirmed that support will include (i) qualifying costs (although which costs would be covered is still under consideration), and (ii) the return of forfeited allowances to compensate for additional UK ETS costs.
- Blue hydrogen: As with the risk of delayed delivery, further work is being undertaken to assess this.
- T&S: BEIS is considering an availability incentive that would reduce Allowed Revenues and incentivise the T&SCo to maintain the availability within the set target. The design of this has yet to be confirmed. The incentive may apply in-year, across multiple years to incentivise T&SCo and/or be subject to a penalty floor. BEIS is considering a penalty floor so that the reduction in Allowed Revenue would be limited to ensure financeability of the T&SCo. The ultimate sanction for persistent failure is likely to be revocation of the economic licence if enforcement processes do not improve performance. BEIS acknowledges that the design of this incentive will need to account for the impact of planned outages for ongoing maintenance, as well as unplanned outages that are outside of T&SCo’s control.

Construction and operational cost overruns

The early CCS projects are likely to be first-of-a-kind projects in scale and, in some cases, in technology, and as such, the risk of construction and operational spend having been underestimated will be significant. Whilst the regulatory regime may provide some assistance, developers may also seek protection through the terms of their construction contracts.

Cost overruns: To what extent do the carbon capture project sponsors bear the risk of construction and operational cost overruns?

- **Power - construction cost overruns:** The generator takes construction cost risk/ reward as the availability payment is set at signing the DPA. In relation to costs arising from a change in law, BEIS has confirmed its intention to follow the overall approach taken to the 'Qualifying Change in Law' ("QCIL") definitions in the AR3 CfD when it comes to the equivalent definitions in the DPA, providing a degree of cost and revenue protection for generators in respect of QCILs that constitute "discriminatory changes in law", "specific changes in law" or "other changes in law". If any capex savings are made as a result of a QCIL, a payment will be due to the DPA counterparty.
- **Power - operational cost overruns:** The variable payment calculation will take into account the higher gas costs, lower carbon costs, T&S fees, and other higher costs faced by the power CCUS plant. The generator would also be protected from inflation risk under the DPA. Protection for the generator from opex cost increases resulting from a QCIL is also foreseen (with a corollary payment to be made by the generator in respect of any savings).
- **ICC - construction cost overruns:** The ICC facility will be protected to some degree in the event capital co-funding is provided. According to the October 21 Update a capital grant may be provided, capped at the lesser of a fixed amount and a percentage of actual capital costs (to be determined in negotiations). The grant will be "last spend", incentivising industry to fully exploit other sources of capital first, with the HMG grant filling any gap between that and actual construction costs up to the cap. Overruns exceeding the cap remain with the industrial facility and must be met through private funds. BEIS is considering how much, if any, of any costs savings may be shared with the ICC facility.
- **ICC - operational cost overruns:** According to the October 21 Update BEIS has decided to provide a single operating expenditure reopener (up to a negotiated cap) one year after start of operations, recognising the uncertainty in operating costs for first-of-a-kind ICC projects. The elements which may be reopened will be those elements included in baseline costs but where considerable uncertainty exists, and for which actual costs can be evidenced. Thereafter the ICC facility will bear the risk of increased costs, although protection against inflation will be provided, with opex indexed to the Consumer Price Index.
- **Blue hydrogen - construction cost overruns:** The Hydrogen BM consultation envisages that cost overruns would be managed by the producer via contingencies in the budget. There may be some mitigation in relation to cost increases if the producer has secured capex support through the Net Zero Hydrogen Fund, depending on the terms of that support.

- **Blue hydrogen - operating cost overruns:** The strike price under the hydrogen production contract is intended to represent the price required to cover fixed and variable costs of production, financing costs and equity return. Although indexation of the strike price is proposed, no strike price reopener has been put forward to date in the event that operating costs are higher than expected.

Cost overruns: To what extent is T&SCo exposed to construction and operational cost overruns?

- **Construction:** In the December 2020 Update, BEIS was considering an ex-ante assessment of the construction of transport facilities, alongside an ex-post assessment of the construction of storage facilities and the transfer of existing assets for CCUS application. BEIS has revised this position in the May 21 Update, and has stated that it will consider the robustness and risks in the negotiation period and consider which elements are better assessed ex-ante and ex-post. This is likely to be an area of focus for the T&S investors in the Track 1 clusters, and may well influence the final cost assessment framework in the enduring regime.
- **Operations:** The regulator will provide for an allowance for efficient operating expenditure during the operating period.
- **Inflation:** T&SCo Allowed Revenue building blocks would be inflation-linked to mitigate the risk of inflation.
- **Re-openers:** There may be a set of limited and defined reopeners for elements that could not be efficiently estimated during the price control review or for force majeure type events impacting costs. Further analysis will be undertaken.

Liability risks

CO₂ leakage: What protections will T&SCo have against long-term storage leaks?

A significant storage leak, that could not be resolved through further investment, would result in an end to user payments due to users no longer being able to send CO₂ to the store. This would effectively end the business. T&SCo is expected to ensure this risk is sufficiently remote through careful selection of storage sites, and the full exploration and use of commercial insurance. However, as with stranded asset risk, the GSP would act as an insurer of last resort to T&SCo, where private insurance is not available. The GSP would be triggered if the leak from the store would mean:

- carbon could no longer be stored;
- revenue could no longer be taken from users; and
- the regulator decided that there was no prospect of appropriate further investment remediating the problem (taking advice from the Oil and Gas Authority (the OGA)).

Quality: What if there are issues with the quality of CO₂ captured and injected into the system?

- **Power:** The generator will be responsible for continuous quality monitoring and emergency venting system design, to ensure that out-of-specification CO₂ does not enter the T&S network. Any vented CO₂ would not be accounted for as captured CO₂ under the DPA payment mechanism and would be subject to carbon pricing.
- **ICC:** The ICC facility will also be responsible for continuous quality monitoring and emergency venting system design. The ICC facility would also be responsible for ensuring minimum defined capture rates are met and this will be monitored by the metering of carbon captured.

It is noteworthy that BEIS considers the capacity for T&S networks to be able to accept CO₂ from dispersed sites and international sources, either transported by ship, road or rail (non-pipeline transportation), will be vital for the long-term objectives of achieving carbon budgets and net zero. It therefore intends to develop the licence conditions and business model arrangements so that non-piped sources of CO₂ can be accommodated by the T&S model.

Decommissioning liabilities: How will decommissioning liabilities for the T&S network be funded?

BEIS published a [consultation on the decommissioning regime for CO₂ T&S networks](#) (the “consultation”) in August, which closed on 26 September 2021. Similar to the nuclear decommissioning regime, a funded decommissioning regime is proposed for the offshore elements of CCUS in the UK.

Decommissioning costs are allowed as part of the building blocks forming the Allowed Revenue of the T&SCo. It is proposed that under the terms of the OGA’s carbon dioxide appraisal and storage license, the money collected for decommissioning for each storage site within the T&S network would build up a decommissioning fund over the operational period. Under the proposals, the T&SCo would be required to ring-fence the decommissioning revenues to meet the future decommissioning obligations, with the Offshore Petroleum Regulator for Environment & Decommissioning’s (“OPRED”) agreement needed for the withdrawal of funds for decommissioning activities. However, the fund may be built up over time through investment (like the Nuclear Liabilities Fund), with day to day management of the funds proposed to be by the operator / T&SCo.

BEIS is considering further how to address a potential shortfall in the decommissioning reserve if there is an

early closure of the T&S network meaning that sufficient funds had not yet accrued. BEIS’ view is that the shortfall risk (and any upside in the event of a surplus of funds) should be managed by the T&SCo. However, in the remote scenario where shortfall remains after exhausting all T&SCo measures and mitigations, BEIS is consulting on an enhanced securities regime, which is an adapted version of the decommissioning securities regime currently in place for oil and gas.

Where existing oil and gas assets are transferred into the T&S network for use in CCUS, the consultation proposes expanding the discretionary power allowing the Secretary of State to issue a Change of Use Relief for offshore pipelines and wells that are transferred to a CCUS project, provided that the CCUS decommissioning fund is topped up by an amount, approved by OPRED, to take account of the additional decommissioning liability.

In addition the consultation proposes to amend some of the current obligations set out under the Petroleum Act 1998 and CO₂ licencing regulations to avoid duplication of financial security obligations and to review the process for agreeing a post-closure plan with the OGA. The consultation also considers calculation of decommissioning liability.

Investors in the T&S network will need to examine the proposed regime carefully, particularly given that a disposal of the T&S network will not relieve a party of liability for decommissioning under the current regime.

Conclusion

The deployment of CCS in the UK represents a major opportunity, in particular for those areas which are either heavily industrialised and carbon intensive, such as in the North East of England, or which are centres for oil and gas production (such as the UK Continental Shelf). If selected in Track 1, these regions will be at the forefront of the UK’s energy transition.

But to unlock this potential, the focus must be to continue on the more granular details of the relevant business models. As will be evident from this publication, the risk matrix is complex and many of the key elements are still under consideration by BEIS. These will need to be resolved in fairly short order for T&S negotiations to begin in November. All eyes now turn to Track 1 selection process and the further business model updates due in Q4 2021 and Q1 2022, which will be critical if the UK government is to meet its ambitions for CCUS technologies by 2030.

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