[Continued from Part 1]

3 Economic Case

3.1 Purpose of Economic Case

The purpose of this section is to take the options set out in the Strategic Case for meeting the proposed NLCCP's objectives and apply a value for money analysis to them. This analysis will calculate the Net Present Value to society of all benefits of each option and compare those benefits to the Net Present Costs of the option, calculated on a whole life basis. The ratio of discounted benefits to discounted costs is called the Benefit Cost Ratio (BCR) and is a value for money indicator used in HMT Green Book Guidance. As an example, for a project with a benefit of £200 and a cost of £100, the BCR would be 2.

When evaluating projects, a BCR of 2-4 is considered by government to be "high" and a BCR of 2 can be a threshold when applying for government funding, for instance when the Authority bid successfully for Local Infrastructure Rate finance, the business case had to demonstrate a BCR in excess of 2.

At this stage and given the emerging nature of costs for both carbon capture and transport solutions, it has not been considered prudent to shortlist the options and choose a preferred option. Instead, the options have been ranked by BCR to give an indication of value for money.

The benefits to society of the options have been calculated on the basis of avoided Greenhouse Gas (GHG) emissions, representing the monetary value that society places on one tonne of CO_2 equivalent. This differs from carbon prices, which represent the observed price of carbon in a relevant market such as the UK ETS.

Therefore, the Do Nothing option has no calculated benefits as the GHG emissions are not being captured, each CC option has a net benefit calculated as the GHG emissions avoided by capturing the CO_2, less any CO_2 emitted by the transportation solution. The GHG benefits per tonne are obtained from DESNZ guidance.

The BCR is calculated on the whole life, which for a CC plant is estimated to be an operational life of 25 years. Therefore, discounting is used to reflect the fact that a cost or benefit received in the future does not have the same value as a cost or benefit received today. The discount rate used is 3.5% in accordance with HMT Green Book Guidance.

3.2 Methodology

The Economic Case will consider and compare the costs and benefits of all the potential options identified in the Strategic Case. As seen in Section 2.5.3, above, the Authority is considering several different routes and modes by which the captured CO_2 can reach a storage destination. This gives rise to the options set out below in Figure 13 and Table 8: Summary of CC, interim transport and storage options.

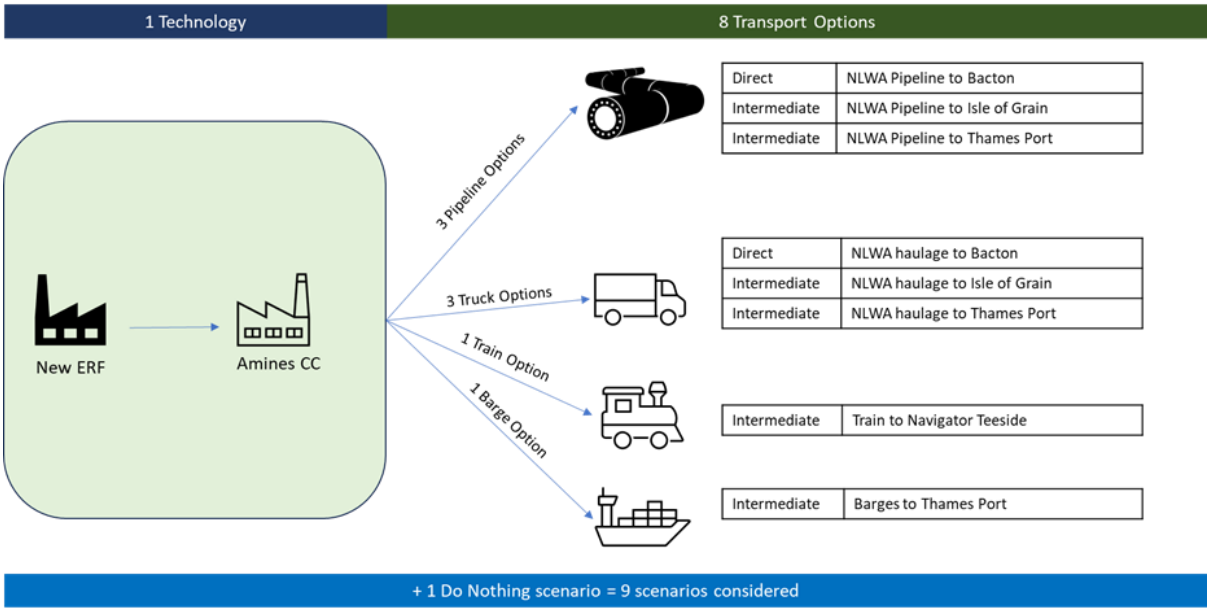

Figure 13: Visual summary of transport options

#	Name	Description of Option
1	Do Nothing	Do not deploy CCUS for the ERF, pay for the CO_2 emissions under the UK ETS
2	Direct Pipeline	Carbon Capture plus transport via NLCCP direct pipeline to Bacton
3	Direct Trucking	Carbon Capture plus transport via NLCCP trucks direct to Bacton
4	Intermediate pipeline to Isle of Grain	Carbon Capture plus transport via NLCCP intermediate pipeline to Isle of Grain

5	Intermediate trucking to Isle of Grain	Carbon Capture plus transport via NLCCP trucks to Isle of Grain (intermediate destination)
6	Intermediate pipeline to Thames Port	Carbon Capture plus transport via NLCCP pipeline to an intermediate port destination on the Thames
7	Intermediate trucking to Thames Port	Carbon Capture plus transport via NLCCP trucks to an intermediate port destination on the Thames
8	Intermediate barges to Thames Port	Carbon Capture plus transport via NLCCP barges to an intermediate port destination on the Thames
9	Intermediate trains to Teesside Port	Carbon Capture plus transport via NLCCP trains to an intermediation destination on Teesside

Table 8: Summary of CC, interim transport and storage options

In order to assess the different options, an economic and financial model has been developed, and the outputs from this will enable a comparison of total lifetime costs, total lifetime benefits (value of carbon captured) and the discounted and undiscounted BCR.

To inform the lifetime costs, the model includes both capital and operating costs, built up from the following components for each option:

- The cost of retrofitting the ERF to accommodate the proposed CC technology;
- All capital costs associated with the CC technology, including the capital expenditure on the plant (CAPEX) and any associated CAPEX such as CO_2 compression, liquefaction on site or intermediate storage;
- Operating costs for the CC and associated facilities;
- The cost of the energy impact on the ERF, including both the reduction in power generated and the additional steam and electricity load from running the CC plant;
- Associated CAPEX and operating costs for the proposed transport solution such as capital expenditure on a pipeline, a truck loading station, a barge jetty or a rail terminal;
- Operating costs for the proposed transport solution; and
- Price for CO_2 storage.

In addition, for all options the impact of the UK ETS was taken into account, either all years for the 'Do Nothing' option, or prior to the CCS solution being brought online for all other options.

In the preparation of the operating costs for each option, the model relies on a number of key assumptions. These relate particularly to the T&S options. The key assumptions include:

- The CC plant would capture 631,750 tonnes of CO_2 per year;
- Under Option 2 (direct pipeline), the CO_2 would initially be transported in gas phase in a pipeline to a less populated area on the outskirts of London. It would then be liquefied and pumped through another pipeline to the cluster or hub, which incurs different costings to a pipeline that doesn't involve liquefaction;
- All standalone road, rail or barge options would require 6000m^3 of intermediate storage at the Edmonton EcoPark to hold up to 3 days of CO_2 prior to loading;
- The road options are predicated on 15-hour operating days, while the train and barge options are predicated on 24 hour operating days;
- The train option would see two departures and two returns from the Edmonton EcoPark per day;
- All the barge options would see 14 barge movements per day from the Edmonton EcoPark; and

- All standalone ship options would require 12,000m^3 of intermediate storage at the appropriate intermediate node to hold up to 3 days of CO_2 prior to loading.

The modelled period is from the earliest likely construction start date for a CC plant, being 1 January 2032, through a three-year construction period and then a 25-year operational period for the CC plant, ending in December 2059. This broadly aligns with the Indicative Plan to Operations, which is set out in Sections 4.3 and 6.4.

In order to model for periods in the future, assumptions have been made on inflation, the UK ETS carbon price and the likely price of carbon storage. Where appropriate these have been subject to sensitivity analysis, which is set out in the Financial Case.

3.3 Outputs from modelling

The primary output metrics are:

- Lifetime capital and operating costs of the CC plant and process, including transport and storage; and
- Lifetime benefits from capture and storage of carbon, which is referred to as the GHG emissions benefit.

The latest government guidance on the valuation of greenhouse gas emissions has been applied, a policy paper entitled "Valuation of Greenhouse gas emissions: for Policy appraisal and evaluation", 2 September 2021. The rationale for valuing such emissions given by the paper is as follows:

"The fundamental purpose of assigning a value to the GHG emissions impacts that arise from potential government policies is to allow for an objective, consistent and evidence-based approach to determining whether such policies should be implemented. Carbon values are used in the framework of broader cost-benefit analysis to assess whether, taking into account all relevant costs and benefits (including impacts on climate change and the environment), a particular policy may be expected to improve or reduce the overall welfare of society.

To reach net zero in 2050 and meet our 5-yearly carbon budgets, a robust approach to valuing emissions is vital to ensure that government takes full account of climate change impacts in appraising and evaluating public policies and projects, whether those policies are intended to reduce emissions or are likely to have the effect of increasing emissions. Such policy decisions often involve making choices between competing policy objectives.

Assigning a value to carbon helps to ensure that such choices are made in a transparent fashion and in a way that seeks to be cost-effective for UK society as a whole."

The BCR is calculated as follows:

$$BCR = \frac{\text{value of incremental benefits}}{\text{value of incremental costs}}$$

As explained in Section 3.1, discounting is used to reflect the time value of money, utilising the HMT Green Book discount rate of 3.5%.

The value of the benefits including for the removal of GHG emissions (in the case of the NLCCP, removal of CO_2) yield a positive BCR for all options except for Do Nothing (Option 1). Therefore, from a social perspective, all options would be preferable to not building the CC plant.

All NLCCP options would capture and store the same amount of CO_2 per annum, so besides technology choice, from an economic perspective, the primary differentiators between options are the costs and carbon intensity of the T&S solutions.

The full table of results is listed below in Table 9.

Ranking	Option	BCR (discounted)	Lifetime Benefits (£bn)	Lifetime Costs (£bn)
1	7 – Intermediate trucking to Thames Port	2.65	10.65	3.82
2	2 – Direct pipeline	2.61	10.83	3.91
3	6 – Intermediate pipeline to Thames Port	2.59	10.67	3.90
4	9 – Intermediate trains to Teesside Port	2.57	10.59	3.91
5	3 – Direct trucking to Bacton	2.57	10.70	3.98
6	5 – Intermediate trucking to Isle of Grain	2.56	10.65	3.96
7	8 – Intermediate Barges to Thames Port	2.46	10.66	4.11
8	4 – Intermediate pipeline to Isle of Grain	2.29	10.69	4.41
9	1 – Do Nothing	0	0	0

Table 9: Economic analysis summary table

Each of the CC options is showing a discounted BCR of above 2. As set out in Section 3.1, above, a BCR above two means that more than double the benefit is being obtained from each £1 spent on the project, which is held by government to be a high benefit and a justification for going ahead with the project.

The lifetime benefits shown are the valuation of not emitting around 632,000 tonnes of CO_2 into the atmosphere each year, less the CO_2 impact of the transport solution. The indicative transport solution CO_2 impact has been measured according to the metrics set out in Table 10. This will be re-examined in the next stage as greater detail becomes available.

Transport Method	CO_2 impact ($kgCO_2e$ per tonne km)
Pipeline	0
Ship	0.044
Truck	0.039
Train	0.027
Barge	0.031

Table 10: CO_2 impact by transport mode

The impact of these different routes can be seen in the lifetime benefits in Table 9, with the highest benefit being the direct pipeline option (option 2) which has a zero variable impact for transporting the carbon. Of the remainder, all intermediate options have similar CO_2 impact, which is relatively high due to the larger CO_2 impact of shipping as seen in the table above.

This is due to the fact that relatively small ships are being estimated (5,000 tonnes), so the CO_2 impact is higher than larger ships. In practice, if many emitters are using an intermediate node then it may be possible to use larger ships, which have a smaller CO_2 impact per tonne. This can be investigated further at the SOC stage.

Truck based options, both direct and intermediate, score relatively well on lifetime benefits, which is a result of truck CO_2 impact being lower than shipping where the ships are not large, as noted above. The CO_2 figures above are based on diesel Heavy Goods Vehicles, so it may be possible to improve

the CO_2 impact by switching to electric trucks, which are now starting to become available. Such trucks could be powered by the ERF when picking up CO_2, offering an additional cost benefit. This will be investigated further at the SOC stage.

Finally, option 9 (intermediate trains) has the lowest level of lifetime benefits, despite the fact that train transport is the lowest CO_2 impact per tonne per km. This is because the train intermediate option has by far the longest route distance compared to other options, cancelling out the additional CO_2 benefit of the transport type.

3.4 Value for Money assessment approach for future phases of Business Case

Given that CC technologies and the T&S market are still developing, we anticipate that the costs for both the technology and the transport and storage options would reduce as the market becomes more established and reliable. This may enable additional options to be brought forward and assessed as the NLCCP progresses in future stages of Business Case development.

As one of the aims of the SA is to identify the solution which also offers the Authority the best Value for Money, the current uncertainty regarding specific aspects of the technology and T&S options is an aspect which requires further detailed assessment throughout the Business Case development process.

The higher certainty of information in future stages of the Business Case should also enable an informed process to convert the long list of options to a viable short list. This down-selection would be conducted on the basis of the strategic objectives and critical success factors set out in Section 2.4, with the outputs of the Economic Case reflected in CSF 2 on value for money.

3.5 Economic Case conclusion

The Economic Case takes into consideration benefits of the CC plant in terms of direct benefits to the Authority, indirect benefits to wider public sector and indirect benefits to society. In the Do Nothing option, there is an external financial cost to the Authority in the form of the ETS liability on the fossil-fuel derived carbon emissions as well as a societal issue in the form of the 700,000 tonnes of CO_2 vented into the atmosphere by the ERF.

There is a societal value to preventing that CO_2 from reaching the atmosphere, which can be measured through the Economic Case. The value of this CO_2 is sufficient to create a positive BCR in any of the other options, making all CC plant options preferable to the Do Nothing option.

3.5.1 Economic Case recommendations

In order to inform future economic case appraisals in the SOC and OBC stages, the following further work should be conducted:

- If feasible, modelling greater usage of transport modes by emitters other than the Authority and hence greater economies of scale, e.g. larger ships; and
- Modelling of alternative transport methods such as electric trucks.

4 Commercial Case

4.1 Purpose of Commercial Case

This chapter explores the commercial means for delivering and operating the proposed CC plant. This includes a summary of the NLCCP's scope, how the various elements of the scheme might best be packaged, the potential procurement and contracting approaches, and how this will be impacted by the funding models chosen. There is also a section to explore how government policy on financial support for the CCUS market in general – and for the NLCCP specifically – may impact on the commercial approach taken.

4.2 Scope packaging and contract options

This section explores the contractual arrangements that will enable the delivery of the various elements required for the NLCCP. It is important to stress that while the assumptions set out in relation to the CC plant are based on soft market testing, this has not taken place for the various transport and storage elements of the scheme; this will be a priority as the NLCCP progresses through SOC and OBC stages.

4.2.1 Carbon capture plant FEED and EPC contracts

The NLCCP will require a range of facilities to be studied, designed and delivered at the Edmonton EcoPark, including both the CC technology and any initial storage and feeder systems for the intermediate transport selected. This is expected to be split between pre-Front End Engineering Design (pre-FEED), FEED and Engineering, Procurement and Construction (EPC) contracts.

The advisory work carried to date for the purpose of the SA indicates that the alignment of these contracts and the project stages should be as follows:

- **SA Stage:** Post pre-feasibility studies, CC technology screening has been undertaken as part of the SA Stage through the Engineering and Technical workstream;
- **SOC – Stage 1:** During the next stage of the NLCCP, the Engineering and Technical workstream will produce a pre-FEED study. This will support the production of a shortlist of technology options (and any associated transport loading and servicing equipment) and a preferred way forward. This will support the procurement of FEED studies will at the OBC stage;
- **OBC – Stage 2:** During this stage the Engineering and Technical workstream will carry out further studies on the shortlisted options with the aim to confirm if the preferred way forward is the preferred option. The Engineering and Technical workstream will develop technical specifications for the procurement of FEED studies; and
- **FBC – Stage 3:** During this stage the Engineering and Technical workstream will use the results of the FEED studies to draw up tender requirements for the procurement of the EPC contractor. The approval of the FBC and any associated release of funds should allow the EPC contract to be signed at the same time as those for transport and a T&SCo.

4.2.1.1 FEED contracts

It is important to acknowledge that FEED studies will be developed during the OBC stage by more than one – and typically two or three – shortlisted EPC contractors, which implies certain sunk costs by the Authority.

However, this is seen as appropriate given the complex nature of the NLCCP and the fact that those contractors that might bid for this work are accustomed to this approach from their work in the oil and gas industry. Conversely, it is assumed that no contractors would be prepared to bid for an EPC contract without having undertaken FEED studies.

Once FEED studies have been developed, the EPC bidders will then be invited to submit tenders for the EPC contract.

4.2.1.2 EPC contract

As set out above, following the conclusion of the FEED studies, it is expected that the Authority will combine all elements of site works required to deliver the CC plant into a single package, and procure a single EPC contract.

EPC contracts involve a company (or a consortium of companies) providing three distinct services to the contracting authority/client: Engineering, Procurement, and Construction. An EPC contractor would directly manage subcontractors, consultants, and suppliers working on the NLCCP. Figure 14 below provides a high-level overview of the potential structure for an EPC contract.

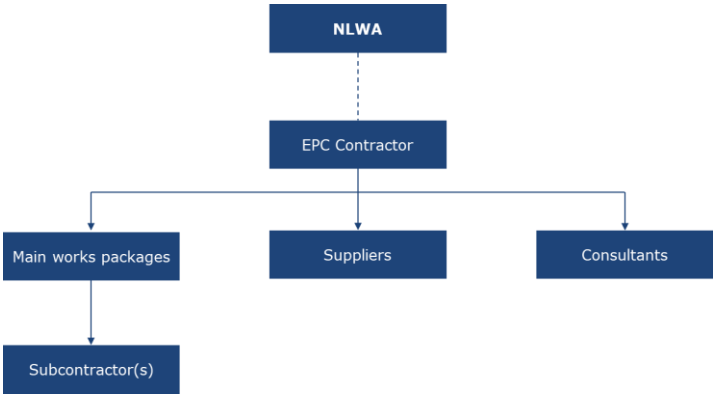

Figure 14: Illustrative EPC contract structure

The key advantage of an EPC contract is that it minimises and simplifies the contractual interfaces that the client has to manage. This is a significant advantage and risk mitigation in cases where clients don't have dedicated project delivery functions.

It is important to recognise that this approach will presents a range of potential disadvantages, including the fact that the client will become heavily dependent on the EPC contractor, and may have less control over the design of the CC plant and less visibility on emerging risks than if they were managing contractors directly.

However, these can be mitigated through ensuring the contract includes appropriate break points to ensure quality of delivery, management of risk transfer, alignment of incentives and the provision of technical supervision. In addition, the balance of advantages and disadvantages is expected to be significantly more favourable for an EPC approach relative to alternative packaging options.

For example, it may be possible to subdivide work on different elements between different design and construction contractors, or to procure separate contracts for each phase of the NLCCP (i.e. traditional Design & Build contracting), but this would require the Authority to accept significant risks in terms of managing complex interfaces.

4.2.1.3 EPC contract forms

Should the Authority proceed with an EPC approach, the form of contract could take one of two main forms:

- **Fixed price contract:** Under this arrangement, the Authority would pay a fixed price to the EPC contractor for a pre-agreed schedule and scope of works. Any overspend incurred on the NLCCP would have to be covered by the EPC contractor, giving them a strong incentive to minimise project delays and cost overruns. However, this framework will generally prompt the EPC contractor to increase their fee to cover such eventualities; and
- **Cost-reimbursable contract:** Under this arrangement, the Authority would pay the actual cost of the works incurred by the EPC contractor. This avoids the increases in fees to cover the additional costs EPC contractors might face in under a fixed-price contract, but such arrangements don't include the incentives for the contractor to minimise delays and cost overruns, leaving the client liable in this respect.

A range of further options that borrow both fixed-price and cost-reimbursable elements are available, and these will be considered in detail when the form of contract is determined at OBC stage.

4.2.1.4 EPC contract phases

Typically, there are three distinct phases of an EPC contract, which are as follows:

- **Engineering stage:** This stage would build on the FEED study undertaken at the previous stage and involve detailed design on all aspects of the proposed CC plant, alongside the provision of an indicative budget and schedule;
- **Procurement stage:** This stage would see the EPC contractor use the detailed design indicative budget and schedule from the Engineering stage to procure all the materials,

equipment (an in particular long-lead items), and subcontractors necessary to deliver the CC plant. They would be expected to abide by all relevant public procurement regulations; and

- **Construction stage:** This stage would see the EPC contractor supervise and manage construction of the NLCCP. This would include managing the contracts of subcontractors, suppliers and consultants, and ensuring the construction meets the required schedule.

4.2.2 Carbon Capture plant operation and maintenance

The Authority will have to determine which entity should operate and maintain the CC plant after completion.

One option would be to contract this to the Authority's subsidiary, LondonEnergy Ltd , which currently manages the EfW facility at the Edmonton EcoPark and will operate the new ERF once constructed. The Authority would need assess the organisation's in-house capability, and ensure it has the resource needed to effectively undertake these roles.

A key phase would involve providing training to operating and maintenance staff as part of the commissioning period. This would typically be undertaken by the EPC contractor – or its subcontractor delivering the CC technology – but this will need to be explored as the project progresses..

The Authority could choose to contract out operations and maintenance to a third party; if it chose to do so, soft market testing would be required. However, this approach would lead to a range of challenges, including giving the Authority less direct control over day-to-day operations, and it having to mitigate risks associated with multiple parties operating on the same site. As such, this approach would create interface issues and is not considered at this stage.

4.2.3 Emerging transport modes

This section sets out the commercial considerations associated with the transport of CO_2 from the proposed NLCCP to a permanent storage site. Soft market testing in this area will be undertaken as at SOC and OBC stage, but a number of high-level assumptions have been made at this stage:

- Initial development of the transport options – as set out in Section 2.5.3.4 – is expected to take place as part of the pre-FEED studies, which will be delivered as part of the existing Engineering and Technical workstream;
- Based on the preferred option(s) selected during the OBC stage, the design and delivery of any facilities required on the Edmonton EcoPark for a transport mode-specific transfer would be expected to be procured via the FEED studies and the main EPC contractor respectively; and
- Any further development and design work required for infrastructure beyond the Edmonton EcoPark and on any vehicles associated with the preferred option are likely to be procured separately to the main FEED studies and EPC contract. The procurement strategy for these elements will be developed at the SOC stage.

It is important to recognise that there is currently a limited market in the transport of liquified CO_2 (to variable degrees across the transportation modes) for the purpose of CCS due to it being a nascent industry. The sections below will set out the commercial implications and applications across transportation modes.

Mode	Descriptor
Pipeline 	CO_2 transport technologies via pipelines are mature, as many pipelines already in operation linked with enhanced oil recovery. Should the Authority decide to pipe the captured CO_2 to a cluster or intermediate node, they could either construct a new pipeline, or repurpose / lease space within an existing pipeline. This would require contractual arrangements with existing owners and operators.

	It is important to note that a number of the pipeline options would require an additional facility on the outskirts of London to convert CO_2 from gas to liquid form, for onward transport to a cluster or intermediate node. Construction of such a facility would require further contracts, and the Authority would also have to consider whether this element should be managed directly or incorporated into its proposed FEED and EPC contracts. The location of this interim facility may affect its viability, with planning consent more likely to be granted if it is within a local authority that is part of the Authority.
Non-pipeline transport	
Transport of Liquified Natural Gas (LNG), Compressed Natural Gas, and Compressed and Liquified Hydrogen occurs across a range of transport modes in the UK, and it is expected that these providers would be able to expand to transport CO_2 in the medium term.	
Road 	If the Authority pursue transporting CO_2 via a fleet of HGVs, a range of commercial decisions would need to be considered. This includes whether to directly procure and operate the fleet or to contract this out to a third party. Operations will likely require specialist containers, which may impact on procurement decisions. In addition, if battery or hydrogen-operated HGVs are considered, then the provision of charging or refuelling points at both origin and final destination would have to be explored. This could require the construction of directly owned and operated facilities, or contracts with one or more suppliers.
Rail 	Using rail could require the construction of a railhead on the nearby West Anglia Main Line to load CO_2 onto waiting trains. This could be contracted directly to Network Rail, a construction firm with a background in designing and delivering railway infrastructure, or a freight operator. The Authority would also have to consider whether this element should be managed directly or incorporated into its proposed EPC contract. Should a railhead be required at a cluster or T&S network cluster, a similar set of contracting options would need to be considered. Once loading facilities are in place, a freight operating company would have to be contracted to run services from the railhead to a cluster or hub. As with the road option, specialist containers may be required, and discussions would need to take place to determine whether such equipment is procured by the Authority directly or its chosen freight operating company.
Inland freight barges 	Using barges to transport CO_2 on the River Lea Navigation canal would present a range of challenges. Although areas in Europe are considering shipping CO_2 via barge,[51] there is no commercial precedent for doing so with small-scale barges that the canal could currently accommodate. If the Authority pursue this option, a range of commercial decisions would need to be considered, including whether to directly procure and operate a fleet of barges. Should the Authority directly operate barges, then a commercial agreement may need to be reached with both the Canal and River Trust – which manage the Lea Navigation Channel – and the Port of London Authority – which manage shipping

[51] Victrol: New shipping partnership offers a breakthrough for reducing CO_2 from Europe's largest industries, 21 March 2022: link here.

	on the River Thames. Engaging with these stakeholders will be a priority as the NLCCP progresses.
Shipping 	Large-scale transportation of CO_2 via ships is less established, but the gas industry has significant experience in transporting gaseous fuels and this is unlikely to present a technical barrier, especially as the vessels and loading technology required is already in use for the transport of LNG and Liquified Petroleum Gas (LPG).

Table 11: Commercial considerations for emerging transport modes

4.2.4 Intermediate and direct transport

As was set out in Section 2.5.3, the final stage in the CCS value chain involves a T&SCo receiving and then injecting captured CO_2 into deep geological storage. The process of transporting carbon up to the point where it enters a T&SCo network can be divided into **direct** and **intermediate** transport.

4.2.4.1 Direct transport

With direct transport, the Authority would be able to send their captured CO_2 directly to a T&SCo facility. It is assumed that the T&SCo would take full responsibility for all further storage and transportation prior to injection (albeit the costs associated with these processes would be reflected in the contractual fees paid by the Authority). This means there would be one contractual arrangement made with a T&SCo, and potentially another contractual arrangement for the transport to the T&S network.

4.2.4.2 Intermediate transport

With intermediate transport, the Authority would route its CO_2 via an intermediate node, whereby a further transport leg is required before their captured CO_2 reaches a T&SCo network. This could require further private agreements with the node operator and any provider for the second transport leg, making the Authority responsible for arranging and procuring multiple commercial transport modes, potentially across various transport modes.

Alternatively, a T&SCo may be willing to take on responsibility for receiving the CO_2 and this further leg, or an intermediate node operator might be willing to receive the CO_2 and then contract with a T&SCo themselves. While market engagement has indicted potential for both approaches, neither approach can be guaranteed at this stage.

It is also important to emphasise that, as with direct transport, any additional costs would be reflected in the fees paid by the Authority. Note that this could include any final-leg transportation by a T&SCo from an onshore location to offshore permanent storage.

These approaches are set out in the depiction of the CCS value chain in Figure 15.

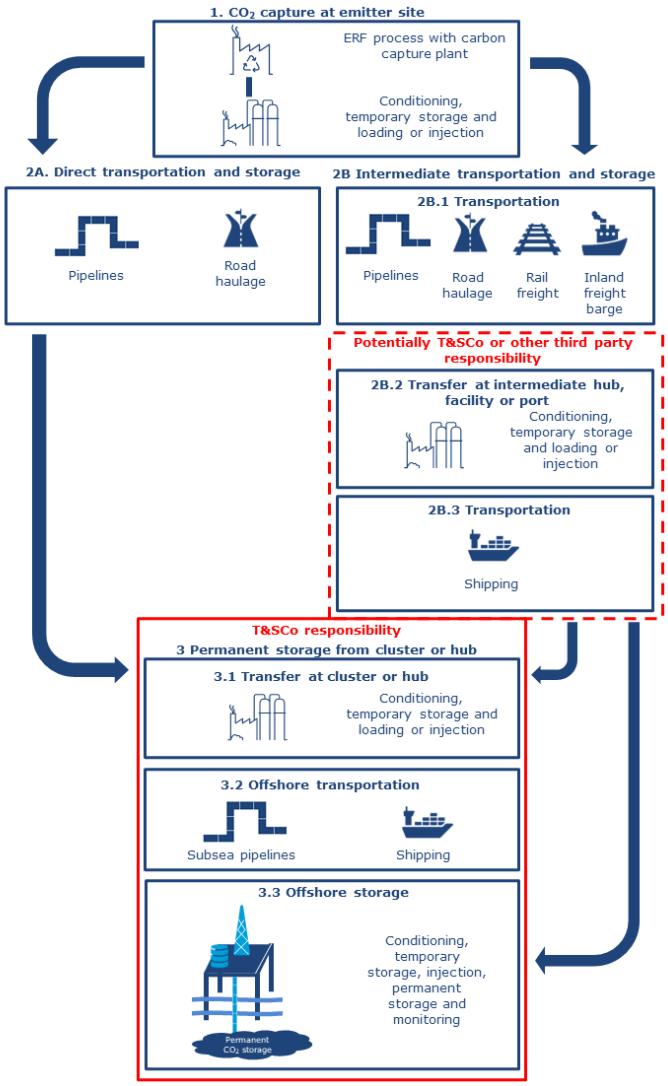

Figure 15: Direct and intermediate transport and storage

Note that the point of transfer to a T&SCo is highlighted in the red boxes around the relevant value chain stages, with the greater degree of uncertainty under intermediate transport reflected by the additional dotted red box. The commercial and contractual options in these areas will be explored further in the SOC and OBC stages.

4.2.5 Permanent storage

The final transport and permanent storage of CO_2 in the UK is regulated separately from CC and funded through the Transport & Storage Regulatory Investment business model. The business model establishes an Economic Regulatory Regime (ERR) linked to a user-pays revenue model, plus a Government Support Package (GSP). It mandates open access networks.

Under this business model, a private company is established – the T&SCo – which will be responsible for construction, financing, operation, maintenance and decommissioning of the T&S network. Within the context of the ERR, the regulator, Ofgem, is to provide a licence to the T&SCo based on key parameters including allowed revenue.

The users of the network – including carbon emitters such as the NLCCP – will pay fees to use the T&SCo's services. These fees will be set by a methodology that allows the T&SCo to recover its costs and an allowed return. The GSP protects T&SCo from some events such as CO_2 leakage if commercial insurance schemes are not available.

4.3 Contract procurement strategy

4.3.1 Procurement packages and indicative plan

As is set out in Section 6.4, an Indicative Plan to Operations has been developed during SA Stage. As part of this, assumptions have been on when the pre-FEED, FEED, EPC and other contracts (i.e. for the intermediate transport and T&SCo) will be procured and be implemented, and the relevant excerpts are set out in Figure 16.

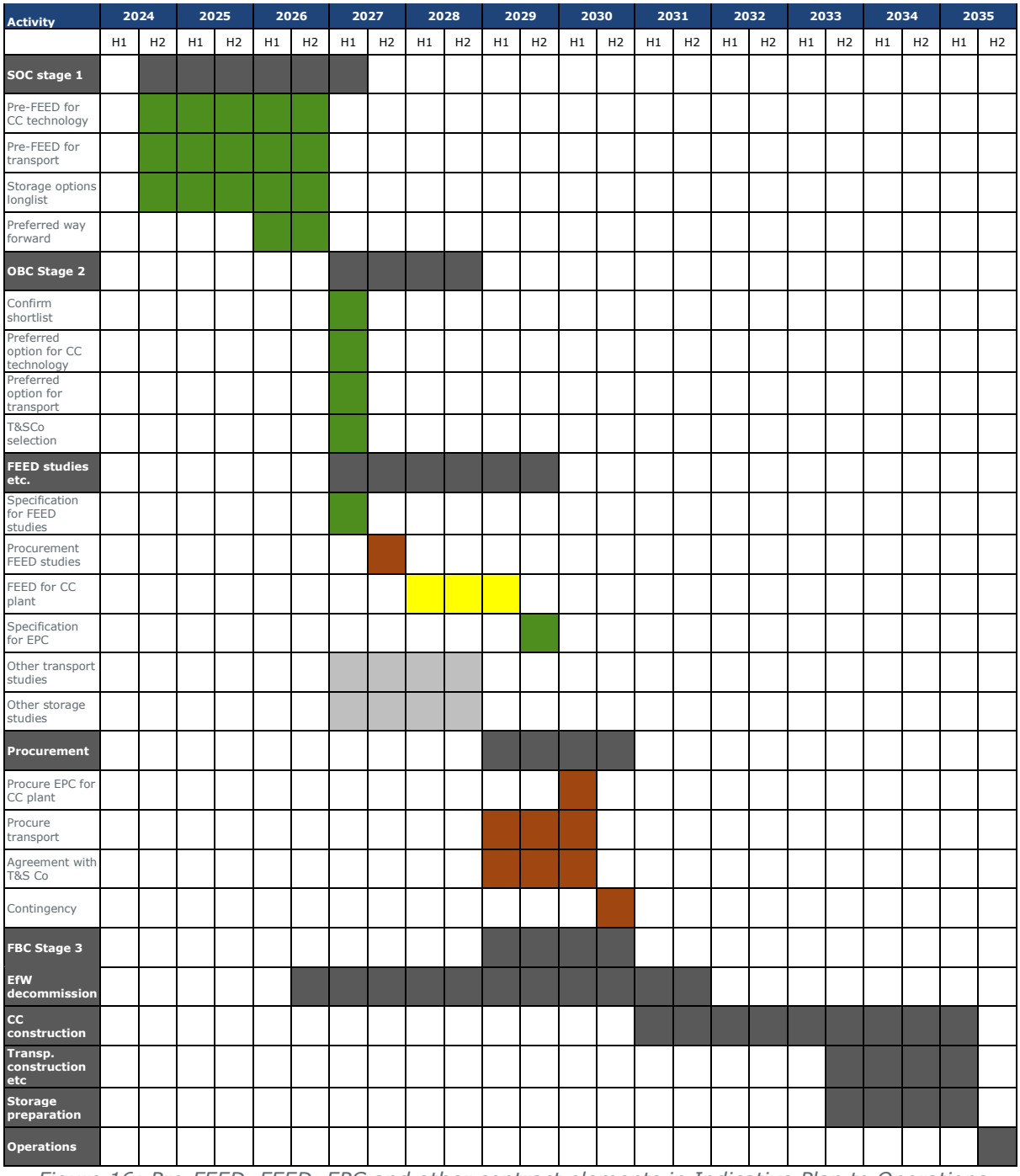

Figure 16: Pre-FEED, FEED, EPC and other contract elements in Indicative Plan to Operations

The key risks associated with this plan are set out in the following sections.

4.3.1.1 Interface between FEED contractors and seeking planning consent

The NLCCP would ideally have selected a specific design for the CC plant prior to submitting either a planning application through the TCPA or DCO. However, this will only be known once the EPC contractor is selected, and waiting until this point to make a submission would create an unacceptable

lag between EPC contract award and receipt of consent (which is required before the start of construction).

As a result, it is assumed that the contractors undertaking the FEED studies will have sufficient information on the proposed CC plant to enable the submission of a DCO or TCPA application. The risks associated with this assumption are reflected in Sections 2.6.1.3 and 2.6.1.9 of the Strategic Case.

4.3.1.2 Studies and procurement required for transport and permanent storage

While the sequence of procurements for the CC plant is relatively well-understood, given the range of potential transport and permanent storage options, further work will be needed to establish both the additional studies and procurement activity required for these elements of the NLCCP.

At present it is assumed that 24 months will be required for additional studies (in parallel with the CC plant FEED) and 18 months will be required for procurement of these elements, with an additional six months provided as contingency. The risks associated with this assumption are reflected in Sections 2.6.1.1 of the Strategic Case.

4.3.1.3 Alignment of contract awards, receipt of planning consent and FBC approval

The plan has been developed so that the EPC, transport and permanent storage procurements conclude simultaneously, and that this occurs within the same six-month period as the receipt of planning consent and the approval of the FBC. This thus represents a critical period for the NLCCP, and these assumptions will need verified and validated at the SOC stage. The risks associated with this assumption are reflected in Sections 2.6.1.3 and 2.6.1.9 of the Strategic Case.

4.3.1.4 Further key assumptions

Further key assumptions underpinning this plan are as follows:

- It is assumed that six months will be sufficient for the procurement of the FEED studies during the OBC development; this essentially starts the process of procuring the main EPC contractor;
- It is assumed that EPC procurement can be concluded within six months on the basis that the FEED procurement and delivery will have already produced an informed shortlist of bidders;
- It is assumed that the EPC contractor will discharge all relevant planning conditions and undertake detailed design and long lead item procurement between contract award and construction starting; and
- It is assumed that the decommissioning and demolition of the existing EfW faciltiy will conclude by 2031, and the EPC contractor can begin construction of the CC plant in early 2032, and should take around three and a half years, with another six months for commissioning.

It is important to emphasise that while this offers an illustrative and high-level overview of when the various stages of the NLCCP may take place, this has not been produced to a sufficient level of detail to provide guarantees in this respect. Further work will be required to confirm this packaging and determine appropriate timescales, and this will be reflected in the Commercial Case in the SOC and the OBC.

4.3.2 Procurement Regulations

At present, public procurement in the UK was governed by a regime that was originally enacted to implement EU Directive 2004/18/EC. In England this provided under 'The Public Contract Regulations 2015.'

The regulation requires contracting authorities – within which the Authority would be included – to transparently publish opportunities; this should now take place on the UK-based 'Find a Tender' system. Given that the majority of CC technology providers will not be based within the UK, the Official Journal of the European Union will also have to be used.

Best practice dictates that the contracting authority to issue a Prior Information Notice (PIN) to alert the market to opportunities and allow firms to prepare for formal Invitations to Tender.

This situation is set to change in England, Wales and Northern Ireland following the passage of the Procurement Act 2023, with associated regulations expected to be laid in early 2024 and an expected 'go-live' target of October 2024.

The Act will introduce a new supplier selection regime, based on principles including non-discrimination, fair treatment, value for money, maximising public benefit, transparency, and integrity.

While value for money would remain the core objective of procurement, the Act will require public sector buyers to take a broad view and take account of the national strategic priorities set out in the National Procurement Policy Statement (NPPS).

The NPPS asks public authorities to consider wider public benefits, such as creating new jobs, tackling climate change, improving the diversity of their suppliers, and innovation throughout the procurement process. These principles are consistent with the Authority's sustainable procurement approach, and would allow authorities to consider supporting local community priorities through public purchasing.[52]

Further work will be required to confirm how the coming legislative changes may impact on the commercial strategy the Authority pursues in delivering the NLCCP.

4.4 Funding Options and Contracting Implications

This section explores the commercial and contractual implications of the funding options available to the NLCCP. It complements Section 5.5 of the Financial Case, which – due to the lack of grant support for the cost of building and operating CCS facilities – explores a range of financing options, including the Public Works Loan Board and the UK Infrastructure Bank.

As such, this section focusses on the operational funding mechanisms that may be open to the Authority, and which would enable repayments on any financing obtained. It also considers the implications of changes to government policy in this context.

Two main funding sources could be available to the NLCCP in future:

- Facilitating trading in negative emissions under the UK ETS;
- Business model support during the operational period available through the applicable revenue support models funded by the UK government, such as the Waste ICC contracts currently available for emitters connected to Track 1 and 2 clusters or, in future, the government's proposed competitive allocation model.

4.4.1 Trading negative emissions

As set out in Section 2.3.1.2, at present, only non-biogenic emissions will currently qualify for trading when all Energy-from-Waste emitters are brought within the UK ETS, and as such, it will not be possible to make a return on the capture of biogenic emissions.

However the government has signalled an interest in exploring the sector being able to sell negative emissions, so as to incentivise the growth of the broader negative emissions market, reduce government costs and increase affordability.

Specifically, as part of an update on the proposed Greenhouse Gas Removal business models – which would provide financial support for direct air carbon capture and bio energy carbon capture – in December 2023, the government indicated that it may be minded to enable the sale of negative emissions credits by ICC projects and Waste ICC projects (which are defined in the following section), stating:

[52] House of Commons Library Research Briefing: Procurement Bill 2022-23, January 2023; link here.

'The Government recognises that the sale of negative emissions credits by ICC and Waste ICC projects could be used to reduce government costs of business model support, improve affordability and stimulate the growth of the negative emissions market. The initial restriction on the generation and sale of negative emissions credits could therefore be lifted by the Counterparty in future, as government policy in this area develops.'[53]

This policy change is assumed in the Economic Case and the various sensitivities explored in the Financial Case.

4.4.2 Business model support

At present, major emitters connected to the Track 1 and 2 clusters that have no realistic alternative but to use CC technology to decarbonise their operations are able to access government funded revenue support models as operational funding through the government's Waste ICC contract.

The main function of the current model – whereby the emitter receives a payment per tonne of CO_2 captured and stored – aims to provide funding support that is sufficient to enable investment but does not over-compensate investors.

However, the government indicated that as part of its vision for the UK CCUS market, the current position – whereby Waste ICC contracts are awarded to all applicants who satisfy the assessment criteria – will evolve into a competitive allocation model, with an initial round expected to be launched in 2027.

This would, in theory, remove the current requirement for emitters seeking Waste ICC contracts to be connected to one of the government-selected clusters, albeit distance from these clusters and the potential variance in local T&S infrastructure may mean dispersed emitters remain at a significant cost disadvantage. However, the government has acknowledged that the competitive allocation model will need to address how different projects, sectors and non-pipeline transport projects may participate given their differences.

In addition, it is important to note that while the costs of T&SCOs permanently storing captured CO_2 are currently paid in full under Waste ICC contracts, the CCUS Vision has not committed to retaining this mechanism under the new approach.

The government intends to launch a consultation in 2024 on the future market frameworks for CCUS, and this should provide greater clarity on how the proposed competitive allocation model will operate in practice.

4.4.3 Upcoming consultations

A number of consultations and calls for evidence are expected over the coming year, and these are expected to enable engagement on areas including non-pipeline transport, the trading of negative emissions within the relevant revenue support business model provided by government, and the broader transition from Waste ICC contracts to competitive allocations. The Authority should ensure that the challenges facing Energy-from-Waste facilities and dispersed emitters are voiced in these discussions.

4.5 Alternative contracting and financing models

In addition to the approach set out above – whereby the CC plant is procured through an EPC contract – there are a range of alternative contracting and financing models that could be explored as the NLCCP progresses. These would involve private capital and, potentially, private operation of the facility. These could include:

- **Design, Build, Operate, Transfer (DBOT):** Where the private sector builds the CC plant and ensures that it is operating correctly before transferring it to the public sector;

[53] Department for Energy Security & Net Zero: Greenhouse Gas Removal and Power BECCS business models: update December 2023; link here.

- **Design, Build, Finance, Operate, Maintain (DBFOM):** Where the private sector retains the operation and (usually) maintenance of the new asset, and recharges to the public sector in a similar way to Private Finance Initiative projects; and
- **Carbon Capture as a Service:** Where the private sector provides a fully-serviced solution to capture, transport and store the CO_2. Some T&SCo operators have mooted this solution, though it is not yet clear how it differs from a DBFOM or how it is compatible with the requirement for significant on-site, client specific assets.

These options all reflect variations on obtaining additional risk transfer in exchange for additional cost, as the rate of financing and the margins for operating and maintaining the plant will be higher.

However, depending on the state of the market, these options could be attractive, particularly if the CCS market transitions to a self-sustainable state, as envisaged in the government's CCUS Vision, as referenced in Section 2.2.2.3. These options will be explored further during the SOC and OBC stages.

It is important to stress that different elements of the NLCCP may merit different financing options. For example, while the cheapest financing option for assets constructed on the Edmonton EcoPark could be PWLB, it may be appropriate to pursue the above models or conventional leasing for the transport elements, particularly in case of fleets of vehicles.

It is also important to note that the financing option selected will play a part in determining the contracting strategy, and vice versa. For example, an EPC contract is only likely to be pursued if a form of public financing is selected; should private financing be pursued, it is likely that the various private operations options set out above could be more appropriate.

4.6 Commercial Case conclusion

This Commercial Case has set out the elements that will need to be procured in order to deliver and operate the proposed CC plant.

It highlights the fact that, based on soft market testing, the Authority should procure a number of FEED studies for the CC plant in order to facilitate a competitive EPC procurement for the plant. This reflects the complex nature of the NLCCP, and the assumption that no contractors would be prepared to bid for an EPC contract without having undertaken FEED studies.

This chapter then presents a high-level procurement timeline based on the Indicative Plan to Operations, which has been developed to support Stage 1 SOC development. This shows:

- Stage 2 OBC completion in the second half of 2028;
- Awards for the CC plant EPC contract, transport and T&SCo by the second half of 2030; and
- Service operation by the second half of 2035.

Finally, the Commercial Case sets out how government policy on financial support for the CCUS market may impact on the commercial approach taken, with the following key insights being identified:

- Trading in negative emissions would provide an important revenue stream for the NLCCP, and while government have not enabled Waste Industrial Carbon Capture projects to do so yet, it has publicly acknowledged the benefits of this approach, suggesting policy change in this area could occur; and
- There are currently no revenue support mechanisms open to dispersed emitters such as the NLCCP, and while this may change as the government transitions from the current Waste ICC contracts to a competitive allocation model in the late 2020s, the distances required to transport captured CO_2 may still make obtaining support challenging.

4.6.1 Commercial Case recommendations

The SOC stage should explore the following key areas:

- The scope of the separate studies required for intermediate transport and permanent storage and their interface with the FEED studies focussed on the CC plant;

- Durations of any additional transport and permanent storage procurement activities;
- Whether – under an intermediate transport scenario – separate contractual arrangements would be required with multiple transport mode operators and an intermediate node, or this could be simplified through forms of packaging and sub-contracting (potentially with a T&SCo undertaking permanent storage);
- Whether the FEED contractors will be able to provide sufficient information on the expected CC plant and its operations to enable a planning application to be submitted prior to the EPC contractor – and thus the final designs – being selected;
- How best to assess which entity should operate the CC plant following completion;
- How the Authority can procure the EPC contractor from the pool of contractors undertaking FEED studies in alignment with public procurement regulations; and
- How the contracting and procurement approaches are impacted by the financing strategy adopted by the Authority, given the government's direction of travel towards competitive allocation model.

In addition, the Authority should ensure that the challenges facing it as a waste disposal authority and a dispersed emitter are voiced by responding to upcoming government consultations and calls for evidence on the issue covered in this chapter.

5 Financial Case

5.1 Purpose of Financial Case

The purpose of the Financial Case is to understand whether the preferred option can be delivered within the funding options available to the Authority. A long list of potential options has been developed for the purposes of the SA. These options have been considered to give an overall view of the affordability of the different options. This will help inform the Authority as it engages with key stakeholders such as central government, to promote those policies and regulatory models which will help make CC more affordable for the Authority.

5.2 Introduction

Alongside the Economic Case modelling of the options described in Section 3 to calculate net present values and determine benefit cost ratios, the financial impact of each option has also been modelled. In addition to the costs, this also took into account financing the proposed capital expenditure (assuming PWLB finance at current rates) and treatment of interest and Minimum Revenue Payment (MRP) in line with the Authority's current policies. The MRP is the charge to revenue made in respect of paying off the principal sum of the borrowing undertaken to finance the capital costs.

5.3 Base assumptions of the modelling

The following assumptions have been used for the modelling:

- Construction of the CC facility starts on 1 January 2032 and takes 3 years to complete;
- The CC facility commences operations on 1 January 2035 and has a 25-year operational life;
- Aside for the sensitivities outlined in Sections 5.4.2 and 0, below, the Authority is assumed to be sole user of the transport modes and the modes have been sized accordingly; for example, pipeline sizes, ship sizes, etc;
- The Authority is assumed to finance the required capital expenditure via the PWLB at a rate of 5.5%;
- It has been assumed that there is no requirement to purchase the land needed for pipeline options, so no land purchase costs are included;
- A biogenic fraction of 50% has been used for the residual waste treated at the ERF, therefore 50% of the input waste is assumed to be fossil-derived and subject to the UK ETS; and
- It has been assumed that where the Authority collects more CO_2 than is required to meet its UK ETS obligations, the excess can be sold as "negative emissions" under the UK ETS at the same carbon price.

Prices for the purchase and sale of carbon allowances under the UK ETS are based on forecasts published by DESNZ.[54] These are summarised below in Table 12:

2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
£101	£108	£111	£121	£128	£135	£145	£145	£142	£139
2042	**2043**	**2044**	**2045**	**2046**	**2047**	**2048**	**2049**	**2050**	**2050+**
£135	£133	£133	£134	£133	£133	£135	£134	£138	£138

Table 12: Assumed carbon values

The following sensitivities have been modelled:

- The impact of more users of intermediate transport modes, thereby reducing both the capital and operation costs of those modes;
- UK ETS prices being higher or lower than the prices set out above;
- An alternative CC technology, HPC, being used;
- An increase in CO_2 storage costs levied by the T&Scos; and
- General efficiencies being found across all costs of 10%.

5.4 Financial impact of the NLCCP

The following tables and graphs set out the financial impact of all options, ranging from Do Nothing (no CC plant and pay UK ETS liabilities) through all CC options. The most recent government updates on carbon removal (December 2023) restated the government's commitment to valuing negative emissions in both the Greenhouse Gas Removals (GGR) and power Bioenergy CCS business models. For this analysis we have therefore assumed that the Authority can take advantage of the sale of negative emissions under the UK ETS.

Capital values are expressed in pounds (£) and all operational values are expressed as pounds per tonne (£/t), based on the ERF capacity of 700,000 tonnes. Therefore, each £1/t of Operational Expenditure costs (OPEX) would add £1/t onto the gate fee of the CC plant. Please note that the CAPEX is for information, as the revenue impact of the CAPEX is included within OPEX ("Interest and MRP Cost").

5.4.1 CAPEX impact

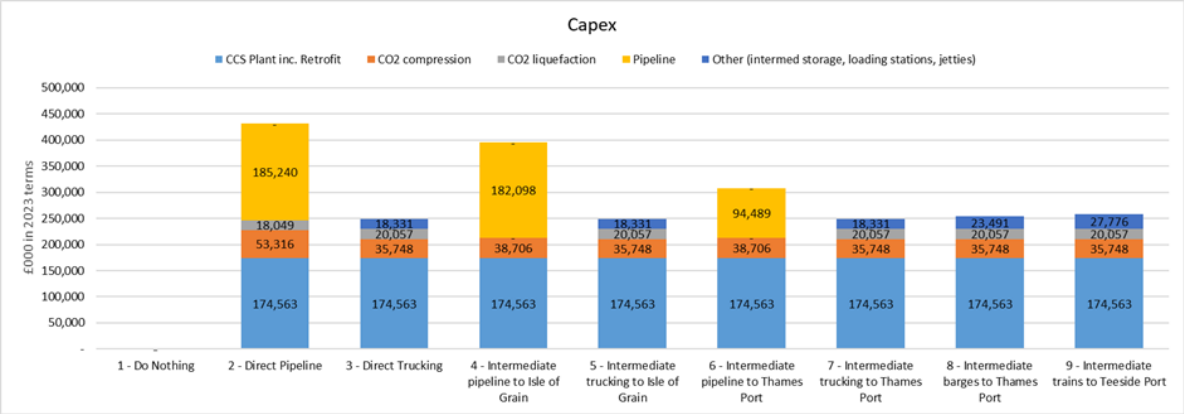

Figure 17: CAPEX impact for all options

From the above, it is clear that pipeline-based solutions have by far the highest CAPEX cost, with the longer distance pipelines (Bacton and Isle of Grain in Options 2 and 4 respectively) resulting in the pipeline itself being the largest single capital expenditure item – larger even that the CC plant.

Whilst the Direct Pipeline (Option 2) is the longest length at 180km, the price is not significantly in excess of the pipeline to Isle of Grain, which is only 70km. This is because laying pipeline through an urban area can be as much as 3 times more expensive than laying pipeline through rural areas.

54 DESNZ: Traded carbon values used for modelling purposes: 2023, 30 November 2023; link here.

Option 2 has 150km of rural pipeline and only 30km of urban, whereas Isle of Grain is almost entirely urban. The same applies for the pipeline to Thames Port, which is only 35km but entirely urban.

In addition to the CC plant, also required on the NLCCP site is significant capital expenditure for CO_2 compression and drying, which is shown in orange on the graph. The additional amounts for some options are due to additional compression being required along the pipeline's route. In the CC plant itself, 6.85% of the total relates to retrofitting of the existing ERF to allow the CC plant to connect to it.

Finally, where CO_2 is being transported by road, rail or barge, additional capital expenditure is required to purify, liquefy and store the CO_2 on the Edmonton EcoPark site, which is shown in grey on the graph. A small element of this is also required for the direct pipeline (Option 1) as a safety measure as the pipeline traverses an urban area for a short part of its path. Where CO_2 is required to be loaded on to vehicles, loading stations costs have been included, the largest of which being £9m for a railhead for Option 9.

5.4.2 Sensitivities on capital expenditure

For a subset of the options – specifically options 2, 4 and 5 – consideration has also been given to other parties sharing part of the capital expenditure cost if they too wished to transport CO_2 on the same route.

Options 2, 4 and 5 were used as an initial view had been taken on what other emitters could share the costs of a direct pipeline or the node on the Isle of Grain. In future, similar work could be completed for the nodes at Thames Port or Teesside Port.

Such sharing has been apportioned on the basis of the amount of CO_2 and also where the entity would join the transport route. The reduced capital expenditure if such sharing arrangements were possible is set out below in Figure 18.

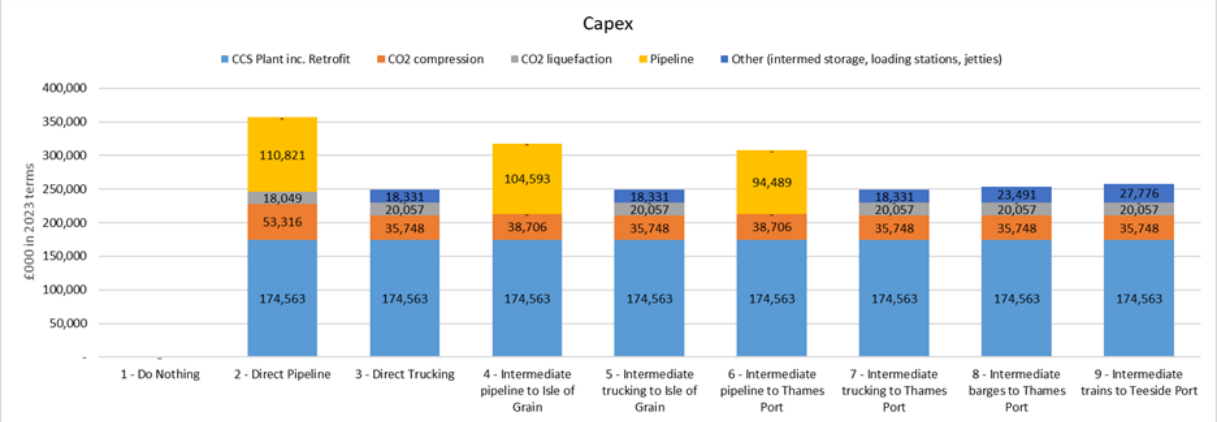

Figure 18: with grouped emitter cost sharing

This sensitivity results in a significant reduction in the pipeline capital expenditure for options 2 and 4, down from £185m to £111m for Option 2 and from £182m to £105m for Option 4. This shows the importance of attracting other sources of CO_2 to make the transport route more cost effective. It could also be an argument for a national approach to CO_2 pipelines in a similar way to national grid infrastructure. For reference, the assumption is that for Option 2, four emitters contribute 1.7Mt of CO_2 annually and for Option 4, seven emitters contribute 6.3Mt of CO_2 annually.

A second sensitivity has been completed for an alternative CC technology – HPC. This has not been included as the base case as it is behind the amines technology in being proven at scale. However, in the timeframe that the Authority is looking to implement CC, it could prove to be a deliverable solution. The graph of capital expenditure for an HPC-based solution is set out in Figure 19 below.

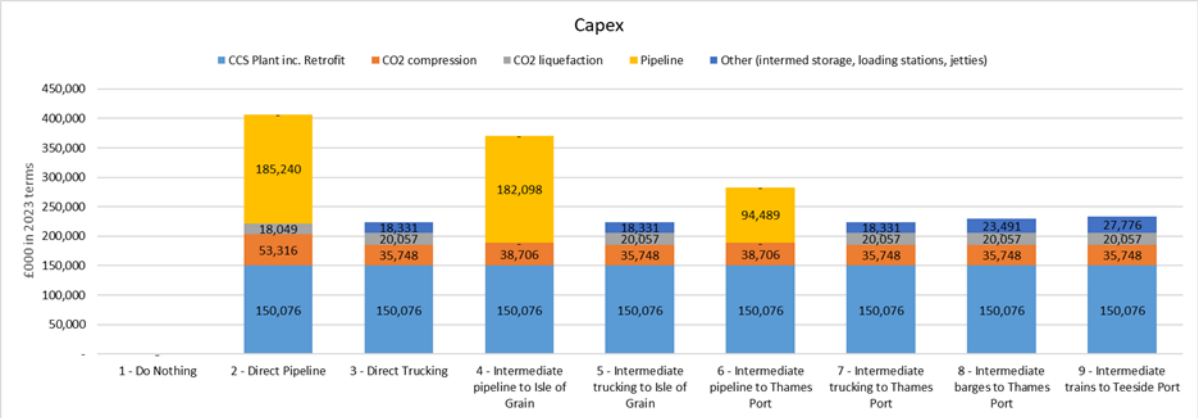

Figure 19: Capital expenditure with HPC Carbon Capture technology

The HPC technology requires less work to retrofit to the ERF and has a lower capital expenditure cost overall, as shown by the reduction from £175m (amines) to £150m (HPC). However, this comes at a cost in terms of the energy impact on the ERF, as set out in the operational expenditure sensitivities below. In addition, the actual capital cost of HPC is still highly uncertain, there is no commercial operating plant, but a single project (Stockholm Exergi) is approaching Final Investment Decision (FID) and potential deployment, and an EPC contractor has been selected. Finally, a downside sensitivity has also been calculated on the potential for capital cost overruns, and specifically allowances and contingencies. This has been estimated on the basis of the Association for the Advancement of Cost Engineering (AACE) methodology to identify the actual cost uncertainty. The AACE methodology defines cost uncertainty based on the level of engineering, technological complexity, and appropriate reference information.

The impact is different depending on the transport mode, with some transport modes (such as trucks) being well established and less prone to overruns compared to (for example) pipelines. The range of possible additional capital expenditure allowances/contingencies is from £18m (direct trucking) up to £102m (direct pipeline). Whilst pipelines are an established technology, there is significant uncertainty in estimating the likely costs of long-distance pipelines, given the significant level of permissions, wayleaves and other requirements. As more CC plants and transport are delivered, certainty around costs should increase.

5.4.3 Annual financial impact in levelised cost terms including operational costs

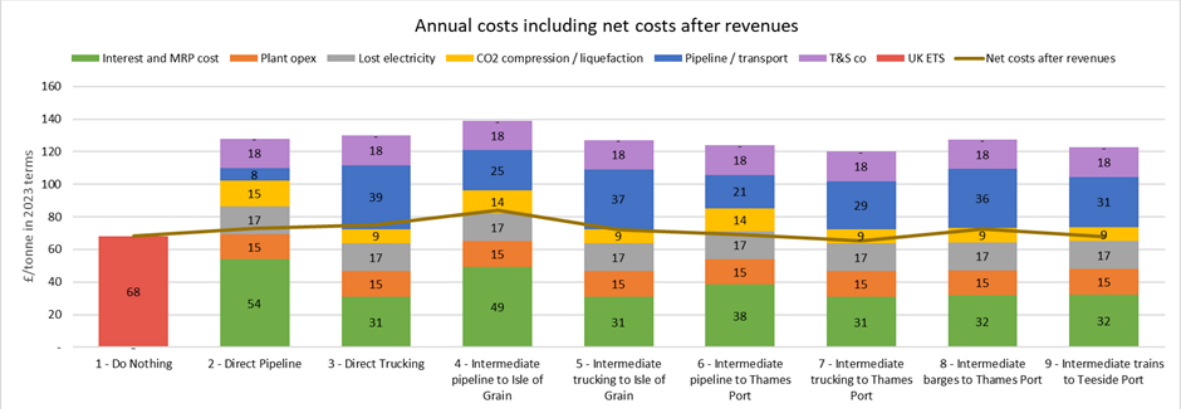

Figure 20: Operational expenditure of the options

This graph sets out the cost of all options, starting with Do Nothing option, which is an estimate of the cost to the Authority of being subject to the UK ETS and having to pay under the ETS for the fossil-derived CO_2 emitted. The Do Nothing cost assumes the Authority buys ETS allowances at the prices forecasted for the mid 2030's when the CC plant could be implemented. Those forecasts – DESNZ traded carbon values used for modelling 2023 – are for ETS allowances to be in the £130-145/t range, considerably higher than the current price (~£35/t in March 2024) and estimates for the next few years (~£70/t).

5.4.4 The importance of the UK ETS carbon price including sensitivities

For the CC options (2-9), as noted at the start of Section 5.4, the revenue due from the biogenic fraction of the carbon has been included; this is denoted by the brown line across the graph. This line represents what the net £/t cost would be when revenues from the sale of negative emissions are included. This highlights the importance of EfW facilities being able to sell negative emissions under the ETS, as it makes up a significant element of revenue. For reference, negative emissions revenues for each CC option are £55/t, which is between 39% and 46% of total costs.

To illustrate the impact of the carbon price on the finances of CC, two sensitivities have been completed with the traded carbon price either 20% higher or 20% lower than the DESNZ forecast. The outputs are set out in Figure 21 and Figure 22.

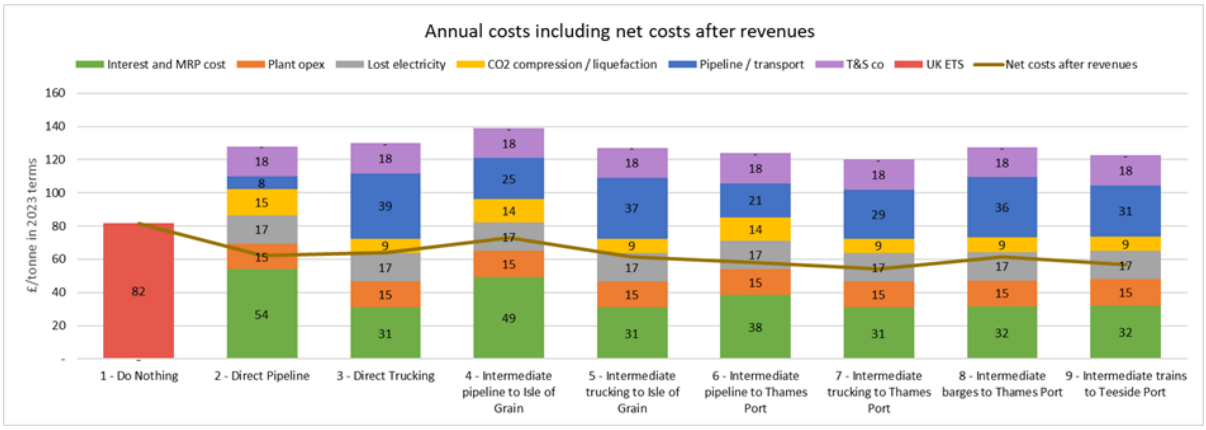

Figure 21: Carbon prices 20% higher than forecast

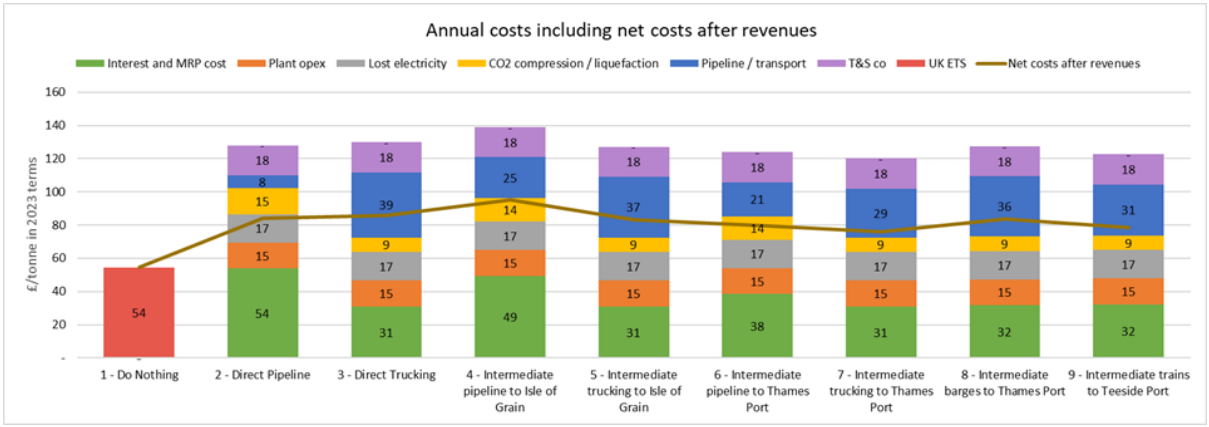

Figure 22: Carbon prices 20% lower than forecast

The graphs above illustrate the dual impact of the carbon price assumption – lower carbon prices make the comparator (Do Nothing) cheaper but all CC options more expensive as negative emissions revenues are reduced. The reverse is true for higher carbon prices, with all the CC plant options being cheaper than Do Nothing under a high carbon price sensitivity.

The breakeven point when comparing the cheapest option (Option 7) to the Do Nothing option is ~£133/t. Therefore, unless further efficiencies are delivered across the CCS chain, the carbon price under the UK ETS needs to be £133/t for the Authority to be financially equal between pursuing CCS or buying carbon allowances under the UK ETS. Under the DESNZ forecast, this level is set to be exceeded in 2037, though this could be earlier when inflation is factored in.

It should be noted that if the Authority was not a dispersed emitter and therefore the transport cost could be removed, the breakeven point would be significantly reduced to £100/t UK ETS price. Without transport costs, the total £/t cost of CCS could be as low as £90/t before negative emissions revenue.

5.4.5 Plant operational expenditure and alternative technologies (HPC)

This section sets out the different aspects of operational expenditure and illustrates the impact of moving to an alternative CCS technology (HPC) as a sensitivity.

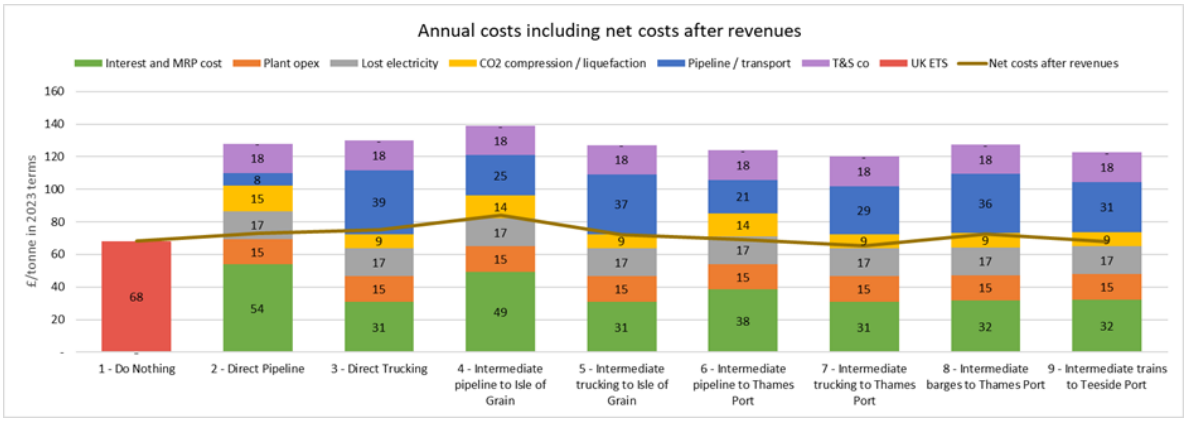

Figure 23: Operational expenditure by option, assuming Amines CC

The graph above shows that the CC plant's operational expenditure (orange) and lost electricity revenues (grey) make up a relatively significant element of the costs, with the impact of lost electricity being slightly higher at £17/t compared to £15/t for amine technology. This is due to both CC technologies requiring a significant amount of power to operate, either a combination of steam and electricity (amines) or electricity only (HPC). The HPC technology requires the CO_2 to be compressed before going to absorption, which requires more power than the amines technology. In addition, the amines technology allows for a topping turbine to be installed to recover additional electricity from the steam as part of the process, which offsets the power loss. The power loss has implications both for district heating and private wire connections and the Authority should take account of the potential CC power requirements in its long-term planning.

The impact of the HPC technology is somewhat different as the following sensitivity shows:

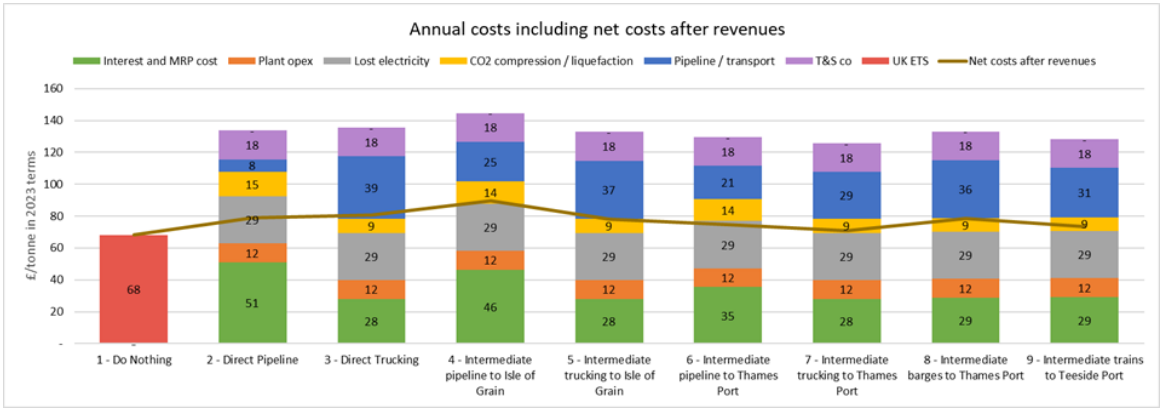

Figure 24: Operational expenditure by option with HPC technology

Whilst the CC plant operating costs are reduced under HPC, as is the capital expenditure required (see above), the power requirement (and hence lost electricity revenues) are significantly higher at £29/t (from £17/t). Overall, HPC technology is around £6/t more expensive than amines unless the power requirement can be mitigated as the technology is applied at scale.

5.4.6 Transport and T&SCo costs

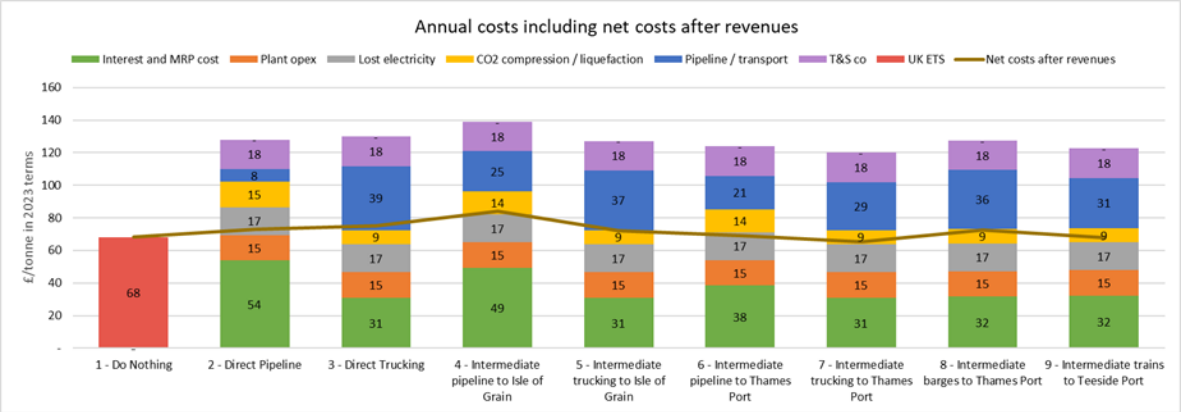

Figure 25: Operational expenditure by option

The operational expenditure cost with the widest variation across options is Pipeline / Transport (dark blue) which takes into account either the cost of maintaining the pipeline (Options 2, 4 & 6) or the cost of transporting the CO_2 by other means (Options 3, 5, 7 & 8). In addition, for intermediate pipeline options (Options 4 & 6), the cost of shipping the CO_2 from the pipeline terminus to the storage is also included.

For the intermediate options (options 4-9), estimating the operational expenditure cost of shipping from the intermediate destination to the storage is challenging, as it depends heavily on the amount of CO_2 being transported and hence economies of scale. It is also a new area, with CO_2 transport ships only recently starting to be commissioned and likely to increase in size (and therefore efficiency) over time.

At present, standalone options assume a ship size of 5,000 tonnes, but ships as large as 85,000 tonnes have been proposed, though this would be subject to demand. With that in mind, a sensitivity has been completed on some of the intermediate transport options which assumes a cluster of emitters sharing a pipeline / or intermediate shipping costs, with 22,000 tonne ships instead of 5000 tonne ships as this is the largest size of CO_2 ship currently being ordered.

Options 2, 4 and 5 were used as an initial view had been taken on what other emitters could share the costs of a direct pipeline or the node on the Isle of Grain. In future, similar work could be completed for the nodes at Thames Port or Teesside Port.

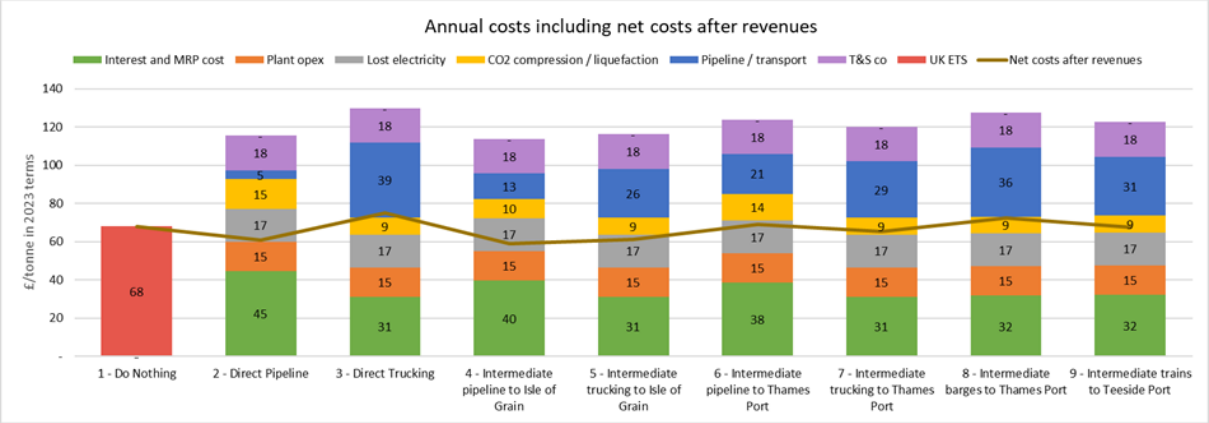

Figure 26: Operational expenditure of the options with economies of scale due to clusters

In this option the capital expenditure and transport costs for options 2, 4 and 5 have been reduced significantly, reductions of £12/t (option 2), £25/t (option 4) and £11/t (option 5). This leads to option 4 being the cheapest of all, £4/t cheaper than Option 7, which is the cheapest in the baseline. As the market develops and it becomes clear which emitters will be adding CCS in South East England, it may be that economies of scale will become the base case and further savings could be

identified. Economies of for using Thames Port as an intermediate destination in will be modelled in future business cases.

Turning to T&SCo costs, whilst this is not the largest element of operational expenditure (£18/t), it remains a key area of uncertainty as the market develops. To illustrate the impact of T&SCo costs on the modelling, we have completed a sensitivity of an increase of £15/t of CO_2 stored in the cost that T&SCo's levy to accept CO_2 into storage. The impact is as follows:

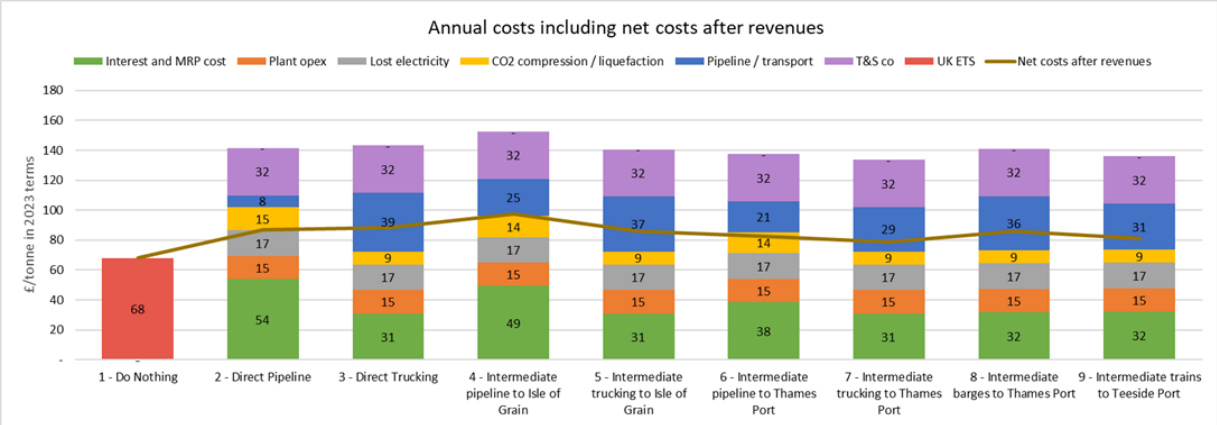

Figure 27: Operational expenditure of the options with T&SCo cost increase to £35/t stored

This increases the fees paid to the T&SCo by £14/t of waste input to £32/t of waste input. The increase is £14/t instead of £15/t because not all of the 700,000t of carbon emitted by the ERF can be captured by CC plant; as set out in Section 2.4.1.1, the modelling suggests that around 632,000 tonnes of CO_2 is captured, and £15/t multiplied by 632,000 and then divided by 700,000 is £13.54, which can then be rounded to £14/t.

5.4.7 The impact of cost efficiencies

In the CCS Vision statement published in late 2023, DESNZ set out an ambition for CCS delivery in which an expectation for future cost efficiency was clearly expressed. The basis for this optimism is that CCS is at an early stage of development and as it is rolled out at scale, methods will be found to improve efficiency and reduce cost. Therefore, we have performed a sensitivity at 10% cost efficiencies across the board to see where this takes the costs.

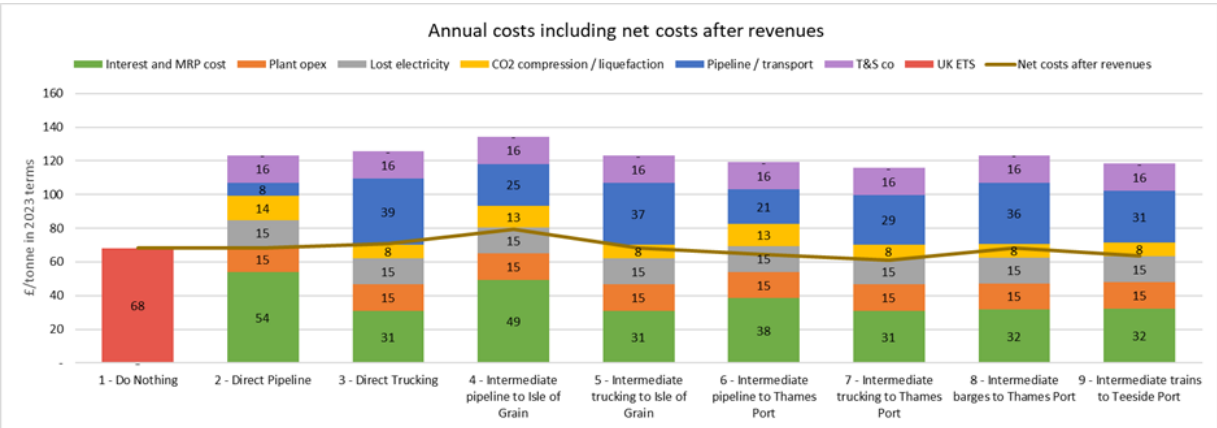

Figure 28: Operational expenditure of the options with 10% overall cost efficiencies

Increase efficiencies of 10% result in all options been more cost effective and the cheapest option (Option 7, trucking to Thames Port), has a lower breakeven UK ETS carbon price of £128/t.

5.4.8 Financial impact conclusion

From the analysis presented above, there is a positive message that, given certain assumptions, CC plant can be cost comparable or cheaper than paying for UK ETS allowances on the CO_2 emitted. The main assumptions are as follows:

- That where CCS is applied to ERF facilities, that the UK ETS allows for negative emissions credits, effectively allowing the EFW operator to sell additional CO_2 credits into the ETS, giving a revenue stream to the CC plant of £68/t; (subject to the market price of CO2 under the UK ETS)
- That UK ETS allowances do reach the levels currently being forecast by DESNZ by the mid-2030's, levels of in excess of £133/t and that such levels are sustained; and
- In order for CCS to be cheaper than paying UK ETS allowances, it is helpful if other emitters are transporting CO_2 in a similar way to the Authority, as economies of scale on transport (especially pipelines and shipping) would significantly reduce the financial impact on the Authority.

It is clear from the analysis that the Authority is suffering a cost of being a dispersed emitter – the transport cost for the CC options (including capital repayment) is in the range £30-40/t, which is comparable to other estimates of the additional transport cost of EFWs not near a cluster of £35/t.[55] The sensitivities in Section 0 show that significant savings can be made of up to £25/t if many other emitters use the same transport mode.

For context, the figures have been expressed as £/t as it is acknowledged that the Authority's waste will vary over time and therefore the net impact on the levy will be a function of the number of tonnes of residual waste that the Authority treats at its facility (estimates for 2024/25 of ~570kt). Actual figures will vary depending on the level of Authority tonnages and whether the ERF accepts third party residual waste, which would improve economies of scale.

Finally, it is worth noting that the application of the UK ETS to waste facilities represents a significant new burden on the Authority's finances and hence the finances of the constituent boroughs, regardless of whether they decide to do CCS or not. This should be a material part of any discussions about future local authority financial settlements.

5.4.9 Financial impact recommendations

The following recommendations are suggested:

- That further investigation is done into the potential for clusters / grouped emitters, as these options appear to be the most affordable if other emitters are also transporting CO_2; and
- Further investigation is made into the potential for low or zero carbon trucks, as these could offer the lowest cost and lowest CO_2 impact for the initial phase of removing the CO_2 from site.

5.5 Funding and financing sources

5.5.1 Sources of finance

At present the Authority uses public sector finance from the PWLB to finance the NLCCP. This is generally the lowest cost of finance, is available to the Authority and is consistent with the Authority providing public sector assets run by the public sector for the benefit of the people of North London.

An additional public sector financing route would be by way of the UK Investment Bank (UKIB), who provides preferential rates on PWLB funding for local authorities pursuing a range of infrastructure projects, potentially including CC. Initial conversations with UKIB indicate interest from them in the NLCCP. Public sector financing (either with or without UKIB) would be a strong contender for any CCS plant and associated capital expenditure.

55 Eunomia Research and Consulting: CCUS development pathway for the EfW sector, Diagram E1-3, accessed 19 March 2024; link here.

Given the risks inherent in a technology which is still maturing, the Authority can also explore private sector financing routes as a method of de-risking the NLCCP. This could include the options set out in Section 4.5 in the Commercial Case.

All the private sector financing options are variations on obtaining additional risk transfer in exchange for additional cost, as both the rate of financing will be higher, as will the operating margins for operating and maintaining the plant. However, depending on the state of the market these options could be attractive in particular if/when the CCUS market transitions to a self-sustainable state as envisaged in the government CCUS Vision published in 2023. This would mean that many EFW CCUS projects were being financed and the private sector risk premium was being reduced as projects were successfully delivered. These options will be explored further during the SOC and OBC phase.

It is not necessarily the case that one financing option will be applicable to all capital expenditure. Where the assets will be constructed on the NLCCP site, e.g. the CC plant, the cheapest financing option could be PWLB, but for assets not on the Edmonton EcoPark site, (e.g. Ships, Trucks, intermediate storage, etc), it may make sense for other options to be explored, such as those above and also leasing, especially for vehicles.

5.5.2 UK financial support for CC project costs

In addition to the costs of fitting and installing CC plant at an emitter site, the UK and other countries see availability of T&S as a key barrier. This applies both to T&S being developed in the first place and its continuing availability when required by the emitter site. UK policy seeks to address the 'chicken and egg' part of the challenge by supporting T&S and emitter projects simultaneously and the ongoing 'cross-chain' risks by the government taking on a significant amount of those risks. The government anticipates that, as the market matures, these risks will increasingly be manageable by commercial entities.

The UK has developed a suite of 'business/revenue models' to provide ongoing support – generally by enabling companies to recoup some or all of their capital expenditure and operational expenditure costs over a set period. As well as the Waste ICC (and main ICC), other related business models include policies for dispatchable power, bioenergy CCS, other engineered GGR and hydrogen, as well as a commercial and regulatory regime for T&S networks.

Current policies are focussed on these measures, as well as the extent to which current or future needs for support are reduced through carbon pricing mechanisms such as the UK ETS. Although there are multiple grants available for further research and innovation projects, there is no evidence (or devolved administration) grant support for the cost of building and operating CC plants. Even if these were available, the policy logic of the government's business models would suggest that obtaining such grants would result in a corresponding level of support from the business model.

5.5.3 International financial support

In terms of other markets, the US is in a strong position, building on its historic experience in using CO_2 to enhance oil recovery rates from declining oil fields. The US Inflation Reduction Act enhanced pre-existing tax breaks to give a credit of up to \$85/t CO_2 permanently stored and up to \$60/t CO_2 used in enhanced oil recovery or other industrial purposes. In addition, the 2021 Bipartisan Infrastructure Law provides over \$12bn in investments in next generation CC, direct air capture, integrated CCS and industrial emissions reduction demonstration projects and CO_2 T&S infrastructure.[56]

In Europe, the European Commission has identified CCS as a key technology but has yet to set out how it will respond to the challenge issued by the US Inflation Reductive Act. At an EU level, this is likely to lead to significantly increased support for CCS from its Innovation Fund as well as the Horizon Europe research programme.

Within Europe (although not in the EU), the leader in terms of practical projects is Norway, with its 'Longship' project in construction. It has a significant role for the state in setting a supportive

56 Global CCS Institute: US, Norway Use Taxes, Credits to Lead World in Carbon Management, 20 September 2023; link here.

regulatory environment and managing cross-chain risks. There are also subsidies to cover up to 100% of capital expenditure and operational expenditure for the first 10 years.

As with the UK, these markets see an essential role for the state in getting CCS off the ground, with a concerted effort required both to cover the difference between likely costs and projected revenue and 'cross chain' risks where these projects can only be viable if the whole supply chain is developed simultaneously – from capturing CO_2 to the facilities to transport and permanently store it.

6 Management Case

6.1 Purpose of Management Case

The Management Case sets out how the scheme will be managed and delivered in accordance with the Authority's requirements for the NLCCP. It demonstrates the robust arrangements are in place for the delivery, monitoring and evaluation of the NLCCP.

6.2 Introduction

At this stage of NLCCP's development, the Management Case is a high-level overview of the structures in place to deliver the SA Stage and proceed to Stage 1. The structure of this Case is in line with HMT Green Book guidance.

6.3 Governance, Approvals and Organisational Structure

This section addresses the organisational structure and approach to the NLCCP development at the SA Stage. During subsequent stages of the Business Case, the Management Case will elaborate on Authority's approach to developing the NLCCP for future stages including procurement, delivery, contract management and the operate and maintain phase.

6.3.1 Governance & approval process

The Standing Orders (June 2023) set out the Authority's powers, functions, and administrative procedures. The Orders set out how the Authority conducts its business at political and officer level. The governance structure and relevant procedures for the NLCCP are in line with the procedures set out in the Standing Orders. The NLCCP's review and approvals are managed through the Project Lead and Project Director, with their responsibilities explained below in Section 6.3.2.2.

6.3.2 Organisational Structure

The NLCCP organisational structure is set out in the PEP; see **Error! Reference source not found.**. T his section sets out roles and responsibilities within the NLCCP team and describes the overarching governance.

6.3.2.1 Carbon Capture Steering Committee

The Carbon Capture Steering Committee (CCSC) has been established for the NLCCP and will provide strategic direction and advice on project-related issues throughout the NLCCP's lifecycle. The CCSC is not a decision-making body and is managed internally by the Authority. The CCSC receives periodic updates from the Project Lead.

The role of the CCSC is to:

- Input in the strategic direction and reinforcing the Authority leadership of NLCCP;
- Provide advice and guidance on relevant functional issues facing NLCCP;
- Provide guidance and agree on possible countermeasures/ management actions to address specific NLCCP related risks; and
- Provide strategic and technical advice to create synergy and uniformity between the Authority activities, policies, and other projects.

6.3.2.2 Senior Officers

The Managing Director of the Authority is the Senior Responsible Officer (SRO) for the development of the NLCCP through the SA Stage and Stage 1.

The SRO provides leadership and strategic direction and owns the NLCCP vision and strategy. Under the SRO, the Project Director is responsible for the overall success of the NLCCP, whether the NLCCP meets its objectives, delivers the required outcomes, and realises the required benefits. Together, the two roles are responsible for managing the NLCCP as a whole.

The Project Lead is accountable to the SRO and Project Director. The Project Lead is responsible for the day-to-day management of the NLCCP, with responsibility to ensuring the deliverables are on track, providing feedback and support, and ensuring that the project team works together toward the NLCCP's success. The Project Lead is also responsible for establishing the governance and management framework, delivering the outputs and desired outcomes, and realising the required benefits.

Core decisions are taken by the Project Lead and the Project Director. The Project Lead is supported by six workstreams which are delivered through the appointment of advisers, who are contracted up to Stage 2, to deliver the required workstream scopes.

6.3.2.3 Advisory team

As previously set out in Section 1.4, the multidisciplinary team of advisors are contracted by the Authority to provide specialist input in relation to the development of the NLCCP. The six workstreams and their associated descriptions are listed below.

- **Project Management (PM) and Assurance:** Establishing all project management controls putting in place the necessary governance and gateway procedures based on the HM Treasury Guide to Developing the Project Business Case and the Infrastructure and Projects Authority Assurance Process;
- **Engineering and Technical:** Undertaking detailed design development to deliver CC solution which considers all integrated requirements with the ERF and future transport and permanent storage network;
- **Business Case Development:** Developing the NLCCP Business Case following the Five Case model guidance established by HMT Guide to Developing the Project Business;
- **Market and Stakeholder Development (MSD):** Leading and assisting on the building of effective relationships with all relevant internal and external stakeholders, potential transport and storage operators and other regional emitters. Also, identifying and accelerating opportunities to establish a regional and/or London-wide CC cluster;
- **Planning, Environmental & Stakeholder:** Leading on planning and environmental policy review, circulation of updated environmental constraints maps, and commencement of stakeholder mapping for consenting process; and
- **Economic and Financial:** Leading and developing an initial model and working with the Engineering and Technical workstream to secure model inputs and agree model parameters. Also preparing the Economic and Financial Cases of the SA and subsequent Business Cases, and supporting MSD and P&R workstreams.

6.3.2.4 Organisational Structure at the SA Stage

The joint Authority and advisory team for the NLCCP is made up of individuals encompassing all six workstreams. Figure 29 below provides the organogram for the NLCCP.

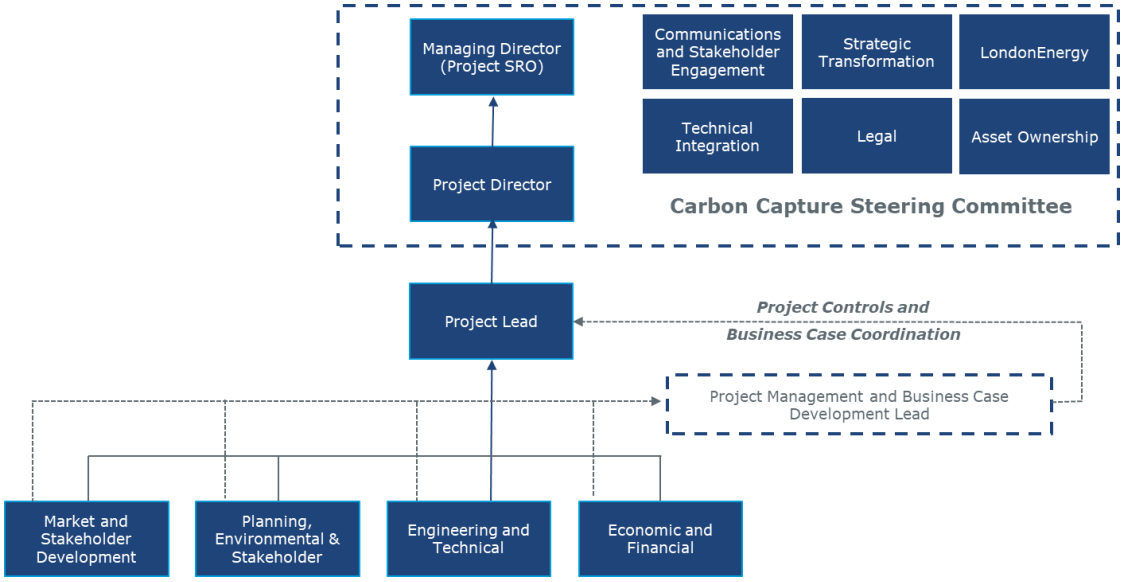

Figure 29: Organogram for the NLCCP

6.4 Indicative Plan to Operations

An Indicative Plan to Operations has been developed during SA Stage, and this is summarised in Figure 29. It is important to emphasise that while this offers an illustrative and high-level overview of when the various stages of the NLCCP may take place, this will be kept under review as the NLCCP develops and updated at Stage 1. At present the Indicative Plan to Operations shows an operational start date of 2035. The timeline for key activities, including Business Case development is listed in Figure 30. Further information regarding key assumptions and risks of the contracting approach can be found in Section 4.3.1.

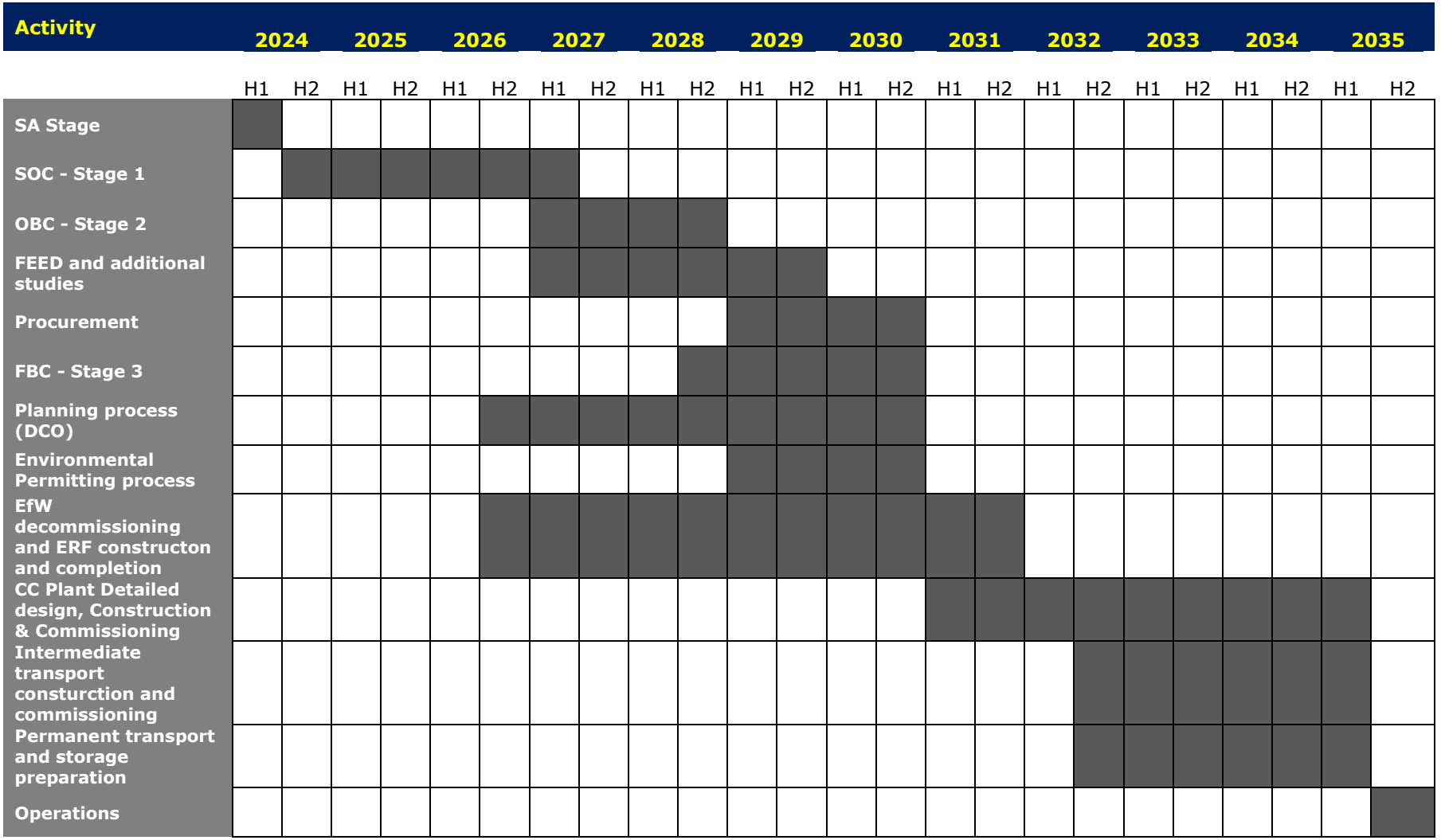

Figure 30: Indicative Plan to Operations

6.5 Assurance

To successfully deliver a large and complex project, different levels of assurance and staged approvals must be integrated into the Business Case development process. Setting up an assurance process will ensures that the NLCCP has relevant procedures which stay aligned with the business rationales. Assurance provides an independent and impartial assessment to check if the NLCCP's objectives can be successfully delivered and ensure that the SA and Business Case (SOC and OBC) activities are on track.

This section outlines both the external and internal procedures which the Authority will require while completing the SA, SOC, and OBC stages.

6.5.1 Gateway Process

For large infrastructure projects in the public sector, it is best practice to follow the Cabinet Office Gateway Review Process. The Cabinet Office Gateway Review Process examines programmes and projects at key decision points in their delivery lifecycle and provides assurance prior to progressing successfully to the next stage. The Gateway Process is overseen by the Infrastructure and Projects Authority (IPA) who arrange and manage independent assurance reviews of major government projects. Table 13 below demonstrates the various gateways for the Business Case process.

Gateway	Business Case Stage	Description
Gate 0	SA	Ongoing assurance of projects at the start, delivery and closing stages. Gate 0 is not a formal requirement of the Gateway process.
Gate 1	SOC	'Business Justification' prior the detailed planning phase.
Gate 2	OBC	'Delivery Strategy' prior to the procurement phase.
Gate 3	FBC	'Investment Decision' prior to contract signature.
Gate 4	Post Business Case (Implementation and monitoring)	'Readiness for Service' prior to 'going live' and implementation of the scheme.
Gate 5	Post Project (Evaluation and feedback)	'Operational Review and Benefits Realisation' following delivery of the NLCCP, establishment and/ or decommissioning of the service.

Table 13: Gateway Process

6.5.1.1 Gate 0

At the SA Stage, only Gate 0 is relevant. Gate 0 should consider and outline the scope and viability of the NLCCP. Gate 0 should examine whether the scope includes identifying the objectives of the NLCCP, how the NLCCP fits within the Authority's strategy and wider UK CCS and procurement policy, and the market appetite for the NLCCP. The Gate should have further consideration to viability of the NLCCP, including:

- If the programme is supported by key stakeholders;
- The NLCCP's potential to succeed with the Authority's current delivery plan;
- Any interdependencies with construction of the ERF or projects in the Authority's portfolio;
- The arrangements for leading, managing and monitoring the programme should also be considered;
- The project risks and risk management plan should be incorporated; and
- The provision for financial and resource arrangements for the next stage should be outlined.

Gate 0 is not a formal requirement of the Gateway process, and therefore is not necessary to move to Stage 1. However, for the purposes of the SA Stage, the Authority will undertake a Gate 0 review as part of its internal governance process.

The Gate 0 review will be undertaken by the Authority following submission of the SA report and a presentation of the findings and recommendations to the Project Lead, Project Director and Project SRO by the project team.

6.5.2 Internal Assurance

To ensure a high standard for assurance, the IPA has developed the 'three levels of assurance,' which is the best practice for project assurance. The three levels of assurance will need to be implemented at Stage 1.

The first level of assurance should be carried out by the PM workstream, who manage the NLCCP risks. The PM workstream ensures the Business Case team submits required documentation on time. Within the PM workstream, the Project Manager provides the first level of assurance, this is consistent with the 'HM Treasury Guide to Developing the Project Business Case' and the 'Infrastructure and Projects Authority Assurance Process.'

The second level of assurance is provided by the Project Director at the Authority. The second level of assurance should not directly manage risk but will have a management function within the NLCCP team. This level should ensure the first line of assurance is properly designed, in place, and operating as intended.

The third level of assurance should be provided through an independent auditor. This level provides an analysis of effectiveness of governance, risk management, and internal controls, including the first and second levels of assurance. The third level of assurance should provide assurance reviews before Approval Gates, with the third level of assurance being implemented before the NLCCP enters the Authority's Stage 1 approval process. Due to the separation needed for the third level of assurance, the Authority will have to procure the services of the independent auditor without any intervention or recommendations from workstream advisors.

Figure 31 below provides an overview of each level of assurance.

Figure 31: Three levels of assurance

6.6 Stakeholder Engagement

Stakeholder engagement and management was undertaken during the SA Stage as part of the MSD workstream. Further information on findings to date is attached in **Error! Reference source not found.**.

The MSD workstream informed the development of the NLCCP during the SA Stage by providing market insights, including potential T&S solutions and approaches to CCS taken by major carbon emitters in the UK. The core MSD actions include:

- Identifying opportunities for partnerships and shared T&S infrastructure;
- Engaging with a wide range of stakeholders, including emitters and T&SCos, to build relationships and strengthen our understanding of the UK CCS market as it relates to the Authority;
- Reviewing and analysing relevant policy and regulation developments related to CCUS, including business models (e.g. Waste ICC), strategy (e.g. CCUS Vision), and policy (e.g. negative emissions credits); and
- Learning from the wider NLCCP community.

6.6.1 Stakeholders

In order to carry out stakeholder engagement effectively, a two-tier categorisation system was introduced as follows:

- Tier 1 consisted of those deemed critical to immediate market development activities of the NLCCP to inform the SA Stage; and
- Tier 2 stakeholders will require engagement when the NLCCP is at a more mature stage (e.g., options around T&S solutions identified and starting to take shape).

Figure 32 below provides an overview of the stakeholder categorisation.

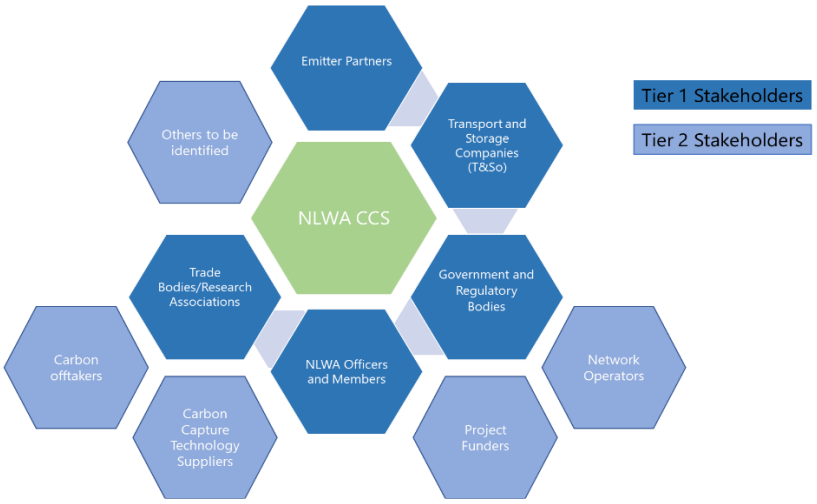

Figure 32: Stakeholder Categorisation

Table 14 below provides further information on the rationale for each group within the categorisation.

Tier 1 Stakeholder Group	Rationale
Emitters	It is critical to understand the approach of similar / nearby emitters, including appetite for collaboration in capturing a certain tonnage of CO_2 and the quantities of CO_2 from the London / Southeast region. Emitters in close

	proximity may also have similar challenges as the Authority, as a dispersed emitters, and knowledge-sharing and partnerships could be explored.
T&SCo	The Transport element remains one of the most significant challenges in realising the NLCCP. Potential T&S solutions that are technically and commercially viable need to be identified and explored through engagement to increase understanding of options. Establishing a deliverable transport route to reduce the cost and complexity of the NLCCP is critical.
Government and Regulatory Bodies	As the CCS and waste landscape in the UK are at a point of transition, it is critical the NLCCP is fully informed and acting on any relevant policy and regulation updates, as well as understanding their implications on the feasibility of the NLCCP – in particular around the business models relevant to the Authority as a dispersed emitter and whether the government will develop policy in relation to negative emissions credits.
The Authority Officers and Members	The residents of the Authority's seven constituent boroughs will be most impacted by the development of the NLCCP. It is important they stay informed on project developments and how it affects them. Their support is essential because it requires awareness and support within the Boroughs to support the Authority decision making in order to move past the SA Stage.
Trade Bodies/Research Associations	Relevant bodies can provide critical market and policy insight and intelligence, as well as enable engagement by acting as convener for introductions with key players or influencing government.
Tier 2 Stakeholder Group	**Rationale**
Carbon Capture Technology Suppliers	This involves engaging with technology suppliers as part of the technology screening process undertaken during the SA Stage. This is being explored in the technical and engineering workstream.
Project Funders	Following financial and economic modelling, engagement with funders can take place once there is better understanding of associated costs of critical activities (e.g., T&S approach).
Network Operators	As the market for transport methods for CO_2 matures, and / if pipeline transport is explored / deemed feasible, the Authority should start engaging with network operators.
Carbon Offtakers	If utilisation is explored (CCUS as opposed to CCS), the Authority will need to explore and engage with potential offtakers.
Others to be identified	As the SA stage progresses, other stakeholder groups may be identified.

Table 14: Stakeholder Group Rationale

After categorising stakeholders into groups and tiers, the MSD workstream identified and prioritised stakeholders within each priority segment who are critical to the NLCCP's success by using the Power / Interest Matrix. The Matrix is a common technique for categorising stakeholders based on their power and influence over a project's success and their interest in the project. This exercise was key to prioritising engagement during the SA Stage due to the significant number of stakeholders identified. Figure 33 demonstrates the Power / Interest Matrix.

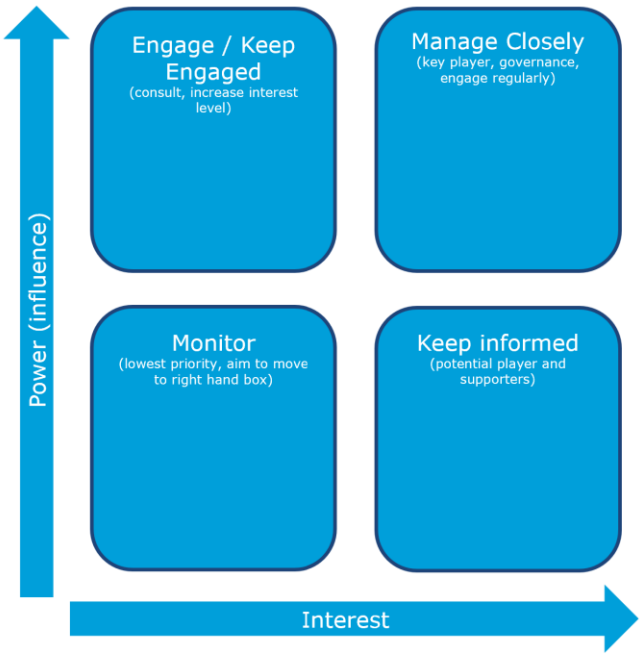

Figure 33 - Power / Interest Matrix

The Power / Interest Matrix separates stakeholders into four key categories, which are listed below.

- **Manage Closely *(High Interest / High Power)*** Stakeholders with a high level of involvement and influence over the progression of the project. Regular engagement is needed.
- **Engage / Keep Engaged *(Low Interest / High Power)*** Stakeholders who have a high level of power or influence over the progress of the programme but are not necessarily directly involved in or impacted by it. They are important influencers of the key stakeholders and will often provide the information upon which go / no-go decisions are made.
- **Keep Informed *(High Interest / Low Power)*** Stakeholder that may be impacted by the project development but have little influence on the progression. It is important to keep them satisfied and have clear communication.
- **Monitor *(Low Interest / Low Power)*** Stakeholders that require a general level of communication. They may not be directly involved in or impacted by changes but would benefit from clear communication.

Stakeholders that fall in the high power and high interest spectrum are those that the Authority will want to engage regularly, whereas stakeholders at the low power and low interest spectrum do not require regular and detailed communication.

Prioritisation can and will change as the NLCCP and engagement progresses – stakeholders will naturally move across the various categories, which will be reflected within the live MSD Engagement Plan. This will involve a process of continuous adaptation and refinement as MSD activities progress and project strategy evolves.

For the SA Stage, the NLCCP advisors agreed initial categorisation of stakeholders in a joint workshop, whereby stakeholders with the potential to provide some form of a T&S solution, partnership /support, or critical knowledge and / or with closer proximity to the Edmonton EcoPark were placed in the top two quadrants, whereas those perceived to potentially provide less relevant information for the Authority were placed in the lower two quadrants. The MSD workstream will identify appropriate points to re-visit the stakeholder categorisation to inform future phases of work.

6.6.1.1 MSD Overview

below sets out a high-level overview of the MSD work from September to the end of March 2024 when the SA will be submitted.

Due to the fast-moving nature of the CCS market in the UK, it is critical that the Authority stays informed on market and government developments and retains momentum in engaging with key stakeholders during Stage 1. Therefore, a number of key activities and outputs will remain the same in Stage 1, including gathering market intelligence and government developments, and the ongoing management of stakeholders.

In addition to the above, MSD in Stage 1 will commence with advisor workshops to re-visit stakeholder tiers and prioritisation, including updating the MSD strategy to reflect the approach and plan for Stage 1. It is also expected to include closer linking of MSD activity to the emerging T&S options and various technical studies being conducted by the advisors.

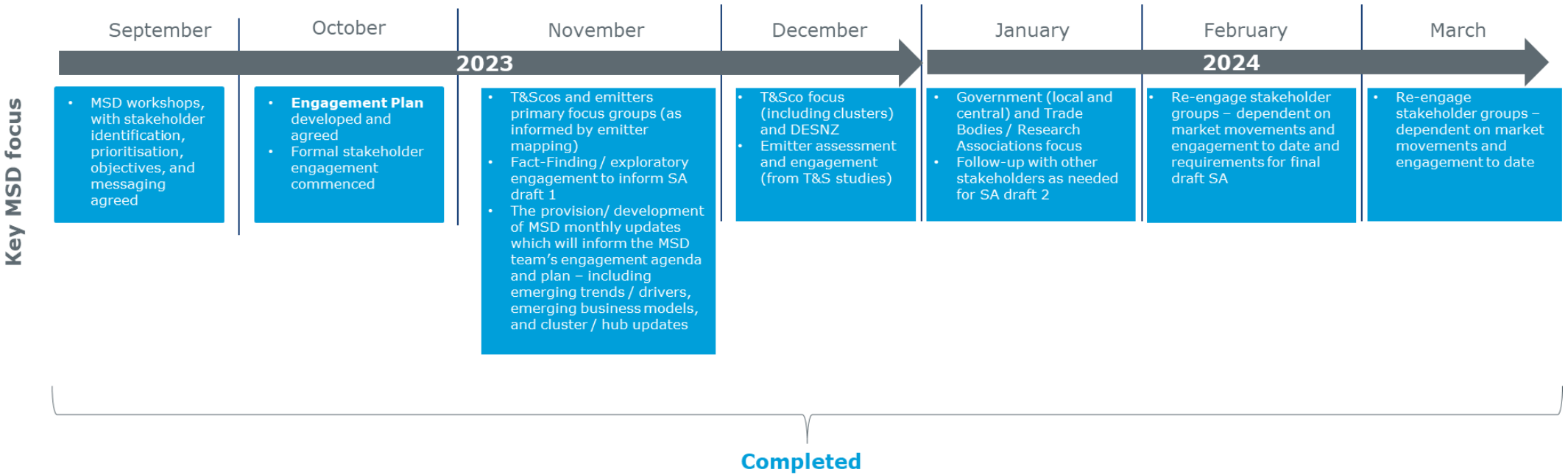

Figure 32: Timeline for MSD activities

6.7 Permitting, planning and consent

This section considers the planning, permitting and other potential consenting requirements for the proposed NLCCP.

6.7.1 Planning Consent

6.7.1.1 Approach to Achieving Planning Consent

The CC plant situated at the Edmonton EcoPark will require land use planning consent prior to its construction and operation. However, there are potential options open to the Authority in terms of the mechanism for achieving the requisite consent.

Planning consent can be obtained in one of two ways:

- A planning application under the TCPA 1990 ; or
- A DCO application under the Planning Act 2008.

6.7.1.2 NSIP Considerations

The route adopted will depend on whether the proposed scheme is considered to be a NSIP, as set out under Section 31 of the Planning Act 2008 (PA2008). When considered in isolation, the CC plant is unlikely to clearly fit within the thresholds set out within the PA2008, and CCS is not specifically referenced. This is because no specific reference is made to CCS within Section 14, however, the transport method chosen may fit within the definition of an NSIP. This may be the case where the final transport solution is identified as a pipeline. In this instance the scheme will fit more clearly within the definition of NSIP, for example, onshore pipelines over 16.093 km in length are classified as NSIPs and require a DCO. In addition, in terms of transporting CO_2 by ship, ports and associated infrastructure that process at least 5 million tonnes of material (including CO_2) per year would qualify as NSIP projects and require a DCO from the Department for Transport. The designation of CC plant will remain under review as the transport solution is developed and confirmed at the OBC stage (Stage 2).

Where it is unclear whether a project is an NSIP or not (and therefore whether it is approved under the DCO or TCPA route), an applicant can seek a direction from the SoS to have their project considered for NSIP status. This requires a legal case be made to either argue that a proposed development is an extension to an existing NSIP or by making a case under Section 35ZA of the PA2008 for a direction by the SoS under 35(1) of the Act - that the scheme be treated as development for which development consent is required. To do this requires specialist legal advice and support.

An example of where a CC project has been accepted as an NSIP following a Section 35 request is Cory's recently proposed CC plant at their Riverside Resource Recovery facility in Belvedere, South London (known as the Cory Decarbonisation Project). For this project, the SoS made the Section 35 Direction stating that the Scheme could be categorised as an NSIP and as such, could pursue a development consent under PA2008. This was due to the following reasons:

- It was considered that the Cory Decarbonisation Project will play an important role in enabling an energy system that meets the UK's commitment to reduce carbon emissions and the government's objectives to create a secure, reliable and affordable energy supply for consumers; and
- The Cory Decarbonisation Project would provide and support the decarbonisation of energy from waste derived CO_2 emissions in the UK, delivering over a million tonnes of CO_2 savings per annum, and supporting the achievement of a fully de-carbonised district heating network that crosses local authority areas.

Countering this, there is an example of a CC project taking the TCPA route. In January 2023, a planning application was submitted to Stockton-on-Tees Borough Council for a 'carbon capture facility for an existing energy-from-waste site.' This was subsequently approved, and conditions are currently being discharged.

There is currently no clear pathway for the NLCCP, as decisions regarding the consenting status of a CC project tend to be made on a case-by-case basis, dependent upon the size and nature of proposed

facilities. If there is any ambiguity over whether the proposed scheme is an NSIP, given the potential repercussions, it is recommended that a Section 35 direction from the SoS should be sought.

Further information regarding the two pathways to planning consent and key considerations can be found below.

6.7.1.3 TCPA Pathway

The TCPA application process should be used if the proposed NLCCP is not considered to be a NSIP and there being little appetite to seek a Section 35 direction, from the SoS, to have the NLCCP considered as such. In this situation the Authority would need to make an application for planning consent to the LPA for Planning Permission under the provisions of the TCPA.

The steps for the TCPA application process are set out below in Figure 33.

Figure 33: Steps for TCPA application process

Benefits

Benefits for the TCPA pathway include the following:

- An application could be less time consuming to prepare as there is no statutory requirement for pre-application consultation (including publication of the Preliminary Environment Information Report);
- It is generally considered to be easier to make any post-consent changes, as the non-material and minor material TCPA application processes are better established with statutory timeframes for determination; and
- The application is likely to be less expensive both in terms of the application fee and any other consultant fees.

- Disbenefits

Disbenefits for the TCPA pathway include the following:

- The chances of approval being granted is generally considered to be lower. If the public perceives disbenefits in a planning application, Members of the Planning Committee may decide to refuse an application;
- There is a chance that a planning application could be 'called-in' by the SoS and it would then end up being decided at Inquiry – much like an examination, this process can be resource intensive;

- There is more uncertainty around the timescales for determination, as applications regularly run past the statutory period for determination, and as referred to above, the application could also be called in by the SoS; and
- Because of the likely complexity / scale of the scheme, it would require a level of resourcing that a lot of local authorities could struggle to provide – particularly where there is no Planning Performance Agreement (PPA) in place. Moreover, as CCS is an emerging technology, the local authority may not have any experience of dealing with such a planning application.

Risks

The strategic risk of 'delayed approval of Town and Country Planning Act application' is detailed in Section 2.6.1.3. There is also the risk of the 'refusal of planning application by the consenting authority (TCPA) results in project delays and increased costs.' To mitigate this risk, the NLCCP team should:

- Develop a comprehensive planning and community engagement strategy which seeks to proactively manage and minimise failure of planning approval;
- Carry out early pre-application discussions with PINs / the LPA; and
- Ensure the project design aligns closely with national and local planning policy objectives.

6.7.1.4 *DCO Application pathway*

As discussed in Section 6.7.1.2 the DCO application process should be used if the proposed NLCCP is considered to be a NSIP. The steps for the DCO application process are set out below in Figure 34.

Figure 34: Steps for DCO application process

Benefits

Benefits for the DCO pathway include the following:

- The DCO process is considered to be more Applicant driven, given that the majority of work is intended to take place by the Applicant prior to the application being submitted / accepted;
- Once submitted, the certainty of timescales and their rigorous application by PINS provides greater certainty over when a decision will be made. This can be particularly useful where grant funding with strict deadlines as a condition may be involved;
- Further efficiency is afforded by bringing together in one place, and through one examination, a consent for a development with the ability to compulsory purchase land, to stop-up and

create highways and a range of other powers can save time and ensure a consistent approach;

- There is a high consenting rate, with information published by the government in July 2023 indicating that 94% of DCOs have received consent;
- Where a project generates mixed opinions locally, the DCO process can be considered to apply a more objective approach to decision making;
- The need for national infrastructure is established by the National Policy Statements (NPS) and DCO applications are tested and determined in accordance with the relevant NPS. As such, the principle of NSIPs are essentially already accepted; and
- Successfully securing NSIP status for the NLCCP places a priority on the development which would be less apparent if the TCPA route were sought. This in turn would reflect a commitment (by government and NLWA) to expediting the achievement of planning consent to ensure that net zero targets through the use of emerging technologies are secured.

Disbenefits

Disbenefits for the DCO pathway include the following:

- The DCO process and particularly the pre-application and examination stages are considered to be much more labour intensive than a regular planning application, for example, at least one round of statutory consultation is required prior to the application being submitted, and there is little / no flexibility in terms of any deadlines set in the timetable;
- PINs advice notes 'the role of local authorities in the development consent process' making it clear that local authorities are not obliged to participate in the DCO process, but it is strongly encouraged. Lots of local authorities are suffering in terms of resourcing, which could be problematic considering the amount of time that DCO's require. It is more likely that a PPA will be required to ensure that the DCO is properly resourced – which will have an associated cost;
- There is smaller scope for any pre and post consent changes to a DCO when compared with a regular planning application. Mainly due to the level of detail that is required to be provided with an application, but also due to the DCO change process, which is understood to be time consuming and potentially resource intensive e.g., as a material change to a scheme may require a further examination. Information provided as part of the consultation on NSIP reforms advises that applications for non-material changes to DCO's are taking between 2 and 16 months to determine. The consultation information also states that there has only been one application for a material change to a scheme since the PA2008 consenting process was introduced. The primary reasons for this are considered to be a lack of clarity over the materiality of changes and as there is no statutory timeframe for decisions on non-material change applications to DCOs. This could be problematic where changes may be necessary to achieve innovation, cost savings or time savings. Therefore, the need to draft a DCO that is not overly restrictive and prevents advancements needs to be highlighted. One way of potentially achieving flexibility is to assess the likely worst-case scenario, with any other potential options falling within the likely worst case; and
- Greater uncertainty over the application fee, which depends on a number of unknowns e.g., the number of Inspectors, the number of days required for the examination. They are also more expensive than a regular TCPA application. However, the fee is broken down in more stages / payable at different milestones, and as such is likely to be more spread out than a TCPA (where the entire application fee is paid upon submission of the application).

Risks

The strategic risk of 'delayed approval of DCO application' is detailed in Section 2.6.1.9. There is also the risk of the 'refusal of DCO results in project unviability.' To mitigate this risk, the NLCCP team should:

- Develop a comprehensive planning and community engagement strategy which seeks to proactively manage and minimise failure of planning approval;
- Carry out early pre-application discussions with PINs / the planning authority; and
- Ensure the project design aligns closely with national and local planning policy objectives.

6.7.1.5 *DCO and TCPA Further Information*

As discussion of the options progresses towards the identification of a preferred option, further consideration (and recommendation) on the most suitable consenting route will be identified.

6.7.1.6 *Interaction with the ERF DCO*

A full review of the ERF DCO and its associated Requirements (planning conditions), has been carried out – full details of which are set out in Section 3. Based on the current understanding of the proposed NLCCP, it is not anticipated that there would be a need to make any consequential changes to the approved design of the ERF. As the NLCCP evolves however, it is recommended that this position is kept under review – particularly in the context of DCO Requirement 4: 'detailed design approval.'

6.7.1.7 *Planning Policy*

The development plan is at the heart of the planning system, with plans setting out a vision and a framework for the future development of the area, addressing needs and opportunities in relation to housing, the economy, community facilities and infrastructure.

The existing and emerging development plan comprises:

- Appropriate National Planning Policy and accompanying Planning Practice Guidance;
- The London Plan: The Spatial Development Strategy for Greater London (adopted March 2021);
- The NLWP (adopted 2022);
- The Enfield Plan: Core Strategy 2010-2025 (adopted November 2010);
- The Enfield Plan: Development Management Document (adopted November 2014);
- Edmonton Leeside Area Action Plan (adopted January 2020); and
- New Enfield Local Plan 2019-2039 (emerging draft local plan, June 2021).

In summary, this concludes that:

- There is clear national, regional and local policy support for the principle of a NLCCP at the Edmonton EcoPark, which has the potential to contribute to national targets to reduce carbon emissions and reduce the impacts of climate change.
- The proposed NLCCP is also supported by the sites policy allocation for waste related activities and its recognition as a Strategic Industrial Location / Opportunity Area, where such uses will be encouraged.
- The transport solution for the captured CO_2 will have planning policy implications. Extant planning policy favours the use of non-road transport methods. However, there is no policy presumption against the use of road for freight/ HGVs - rather a policy presumption in favour of using alternatives to road.

6.7.1.8 *Environmental Matters*

The NLCCP will need to be carefully considered, taking account of the site's environmental constraints. Regardless of the consenting route adopted, a full Environmental Impact Assessment[57] which considers the extent to which the proposed CC plant has any significant environmental effects must be prepared.

It is anticipated that an EIA would need to assess the following topics in detail:

- **Transport:** Due to the need to secure a means of transporting significant quantities of captured carbon from the ERF to a final, long terms disposal point;
- **Ecology:** Due to the statutory need for all development proposals to demonstrate a net biodiversity gain;

[57] In March 2023, the Department for Levelling Up, Housing and Communities sought views on a proposed new system of environmental assessment - 'Environmental Outcomes Reports' - to replace the current EU-derived environmental assessment processes of Environmental Impact Assessment. In this regard, any future environment assessment work in respect of the NLCCP must reflect any future legislative changes.

- The water environment – particularly **flood risk**: As a consequence of the site falling within a Flood Zone 2 area;
- Amenity effects - **noise and air quality**: Due to the potential noise and air quality effects (both positive and negative) on local communities that the proposed development is likely to have. Most notably, the NLCCP site is located within an established Air Quality Management Area; and
- **Landscape and visual effects:** Although in an established industrial location, the NLCCP would comprise some significant additional structures, which will be viewed by several existing sensitive receptors, for example, users of the National Cycleway Network Route, which runs the length of the adjacent Lee Valley Navigation Channel corridor.

Further detail on these key environmental topics is summarised in Table 15 below.

Environmental Consideration	Description
Noise	Whilst the proposed CC plant site sits outside a Noise Management Area (NMA), the location of an NMA, approximately 200m west of the site, must be considered as the transport solution develops.
Air Quality	The site sits within Air Quality Management Area (AQMA), due to annual mean nitrogen dioxide and daily mean particulate concentrations not meeting air quality objectives. The main source of these is road traffic. In developing a transport solution for the CC plant, it will be important to have full cognisance of the locality's air quality status – especially if any reliance is to be placed upon a solution which has the potential to add to baseline nitrogen dioxide levels.
Traffic (if a road-based solution)	Whilst a transport solution for the CC plant has yet to be developed, cognisance must be given to prevailing planning policy, which seeks the use of rail and water transportation in favour of road, where possible. Allied to this is the consideration the site sits in an AQMA, which has been allocated due to the area's high volumes of road traffic. As a transport solution for the CC plant is developed, it will be important to consider alternatives to road transportation, and where road transportation is the only feasible option, the extent to which mitigatory measures can be adopted.
Flood risk	The site is located predominantly in a Flood Zone 2 area. These are areas that have between a 1 in 1000 (0.1%) and 1 in 100 (1%) annual probability of flooding in any given year and are considered medium risk sites. As a result of this, and because the development area is likely to exceed 1ha, a full flood risk assessment will be required as part of any planning submission. If the CC plant stores chemicals, then this will have a direct bearing upon the way in which the site is assessed in flood risk terms.
Landscape and visual effects	Whilst the site does not sit within any notable landscape designation, it does sit immediately west of the London Metropolitan Greenbelt. It is not anticipated that the integrity of the Greenbelt would be directly affected. However, as the transport options develop, consideration of this designation must be borne in mind – especially if an option which 'passes through' or directly affects the Greenbelt is chosen.

Biodiversity	The proposed development site is in close proximity to multiple ecological designations. Whilst it is not anticipated that any of these designations would be directly affected by the proposed NLCCP, cognisance of any indirect effects on these features will need to be taken at the appropriate assessment stage. Further, to comply with extant national planning policy, the preferred development option must incorporate a minimum 10% net in biodiversity. It is likely that a 10% gain from this baseline will not represent an onerous undertaking.

Table 15: Summary of Environmental Considerations

Other EIA topics such as cultural heritage; major accidents and disasters; waste and materials impacts; socio-economic effects; vibration etc. may be required, but this will need to be determined at a formal EIA scoping stage which, takes place once the outline detail of the CC plant has been established.

6.7.1.9 Further Consideration

It is noted that Enfield Borough Council are in the early stages of preparing their updated Local Plan. An early draft of this indicates that the Council will be expecting local developments to achieve enhanced levels of biodiversity net gain, a minimum of 20%, double that prescribed nationally. This possible emerging policy could therefore impact upon the biodiversity net gain that the NLCCP must include within its wider design.

6.7.1.10 *Stakeholder Enga*gement

The approach for the planning stakeholder engagement will build upon the MSD workstream, using established stakeholder maps and intelligence as a starting point for consultation and engagement to support the planning application. The level of stakeholder engagement associated with any planning application will depend on the planning strategy adopted. For an application under DCO procedures, there are fixed, statutory pre-application consultation stages that must be adhered to. However, for a TCPA application, the level and nature of pre-application engagement is more flexible.

Key stakeholders for any planning application are likely to be the same regardless of whether consent is pursued via a DCO or TCPA route. Whilst some key stakeholders can be identified in the absence of a preferred transport solution, others will vary according to how the captured carbon is ultimately transported from the Edmonton EcoPark, for example, should the Authority rely on all captured CO_2 being transported from the Edmonton EcoPark via road, the Highways Authority would be a key consultee/ stakeholder. However, should a barge/ shipping option be preferred, the Canal and River Trust and the Marine Management Organisation would be fundamental stakeholders; or Network Rail if rail is identified as the preferred option.

Regardless of the transport solution, key planning stakeholders at this stage can be identified as:

- Enfield Council (as the host LPA);
- The remaining six Local Planning Authorities that make up the Authority (Barnet, Haringey, Camden, Islington, Hackney) – and most notably Waltham Forest and Haringey Council, which is located close to the Edmonton EcoPark;
- The Environment Agency;
- Natural England (for ecology/ protected species/ protected sites); and
- Thames Water (for wastewater treatment/ discharge requirements).

As the NLCCP develops further key stakeholders will be identified in collaboration with the LPA / Planning Inspectorate as part of formal pre-application discussions.

Regardless of the approach to consenting, a comprehensive plan for managing stakeholders throughout the NLCCP lifecycle must be developed.

6.7.2 Environmental Permitting

For environmental permitting purposes, a post combustion CC plant is a Part A (1) 6.10 activity 'in its own right when the CO_2 is being captured for geological storage'[58]. It could also be a directly associated activity with a combustion activity installation when the CO_2 is captured and used for other purposes.

It is expected that the existing environmental permit for the ERF would undergo a variation to add the installation of the CCS plant and associated infrastructure. In preparation for the environmental permit application, the CC plant will undergo a 'BAT' review in line with the EA's 'Post-combustion carbon dioxide capture: best available techniques (BAT)' guidance.

CC readiness is currently a requirement imposed on combustion plants above 300MWe to enable future capturing and storing of CO_2 following a plant upgrade. However, consultation is underway to consider application of carbon capture readiness to Energy from Waste (EfW) plants and by removing of the 300MWe threshold and renaming it Decarbonisation Readiness. This is expected to be done as part of the amendment of the 2009 Carbon Capture Readiness requirements, following a review of consultation responses. Should that go ahead, it is proposed to come into force after 1 July 2024.

It is proposed that in order to demonstrate carbon capture readiness, a relevant statement will be produced as part of the environmental permit variation application, following the UK government's most updated carbon capture readiness guidance. More information on the applicability of CCS as part of the permit variation application will be sought from the Environment Agency as part of the pre-application liaison process.

The EA's guidance covers both new plants and retrofits to existing power plants. The guidance identifies environmental issues to address. It includes, among others, the requirement to complete an assessment to demonstrate plant adaptation to climate change risks.

Preparation of any environmental permit or permit variation applications is subject to completion of the SA Stage, which will determine the Business Case and proposed deployment timeline for the CCS solution of the ERF.

The main aspects of the permit application process are detailed in Figure 35 below.

[58] Post-combustion carbon dioxide capture: best available techniques, 2 July 2021; link here.

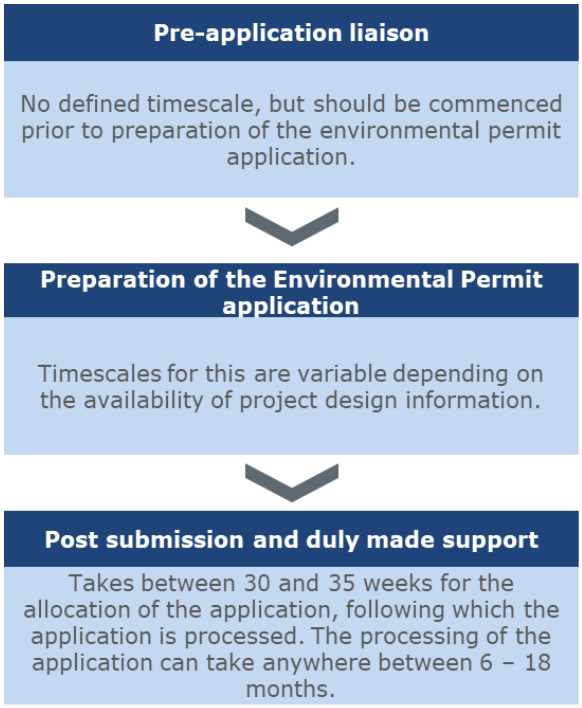

Figure 35: Permit Application Process

A pre-application advice request should be submitted to the EA, setting out the operator details, permitting approach, expected assessment and programme. This submission will also identify whether a meeting is required (defined as enhanced pre-application support) to discuss aspects where there is uncertainty in the approach. The enhanced pre-application support is a chargeable provision.

As part of the application, the relevant application forms will need to be completed as per EA guidance. At the time of writing, these comprise Parts A, C2, C3 and F1.

6.7.3 Other Environmental Consents

Establishments already subject to environmental regulation may possess relevant information for managing environmental risks, although additional details might be necessary to address major accident hazards. Additional consents which may be required for the NLCCP include both COMAH and HSC. This section details further information regarding HSC and COMAH, and the implications of both consents for the NLCCP.

6.7.3.1 Hazardous Substances Consent

It is currently understood that HPC and an amine-based solution are the two frontrunners for the chemical/ solvent used to facilitate the capture of carbon emissions. For both technologies, it will be important to understand:

- The extent to which solvents/ chemical need to be stored on site i.e., total quantities; and
- Whether such substances are classified as hazardous substances in accordance with the list of substances and controlled quantities set out in Schedule 1 to the Planning (Hazardous Substances) Regulations 2015.

This is because separate consent, HSC, will be needed if specified hazardous substances are stored or used at or above specified controlled quantities.

Should the proposed CC plant attract the need for HSC, this is usually applied for at the same time as planning consent. The competent authority for issuing HSC is the LPA.

The requirement for HSC also has a bearing on how the proposed development will be assessed in environmental terms at the planning application stage – specifically in relation to the assessment of flood risk effects.

The site for the proposed NLCCP is located within a Flood Zone 2 area. If HSC is not required, then the proposed NLCCP would be categorised as *'less vulnerable'* development. In flood risk policy terms, this category of development is acceptable in Flood Zone 2 areas.

However, if HSC is required, the NLCCP would be categorised as a *'highly vulnerable'* development. Such a category of development in a Flood Zone 2 remains acceptable in flood risk policy terms, although compliance with an established 'Exception Test' must be demonstrated.

To pass the Exception Test it must be demonstrated that:

"a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall."[52]

Given the nature of the proposed development, it is highly probable that these two tests can be fully complied with by the proposed NLCCP. In this regard, whilst the potential need for a HSC would have implications for the way in which any planning application is assessed, it is not considered that this would pose a substantial risk to the project.

6.7.3.2 Control of Major Accident Hazards Regulations - COMAH

The objective of the Control of Major Accident Hazards Regulations 2015 (COMAH) is to minimise the impact of a significant accident on individuals, local communities, and the environment. These regulations are established based on the quantities of 'dangerous substances' that are stored, or used on-site. 'Dangerous substances' include substances with a categorised health, physical or environmental hazard; and a number of specific named substances. Whether COMAH is applicable to any specific plant is determined by comparing the threshold quantities outlined in the Regulations to the quantities associated with the planned activities at a given site. Sites governed by COMAH are categorised as either "lower" or "upper" tier, depending on the amounts of designated 'dangerous substances' present. The upper tier is more demanding, imposing additional responsibilities and requirements on Operators.

<u>Key COMAH Regulations</u>

COMAH Regulation 4 establishes a general duty for operators to take all necessary measures to prevent major accidents and minimise their impact on people and the environment. The regulation acknowledges that complete elimination of all risks may not be possible, emphasising the importance of proportionality in enforcement. The phrase 'all measures necessary' is interpreted to include this principle, with judgment applied to evaluate the effectiveness of implemented measures.

In high-hazard situations, stringent standards are required to ensure acceptable risk levels. The principle of reducing risk to a level as low as reasonably practicable is highlighted for both human and environmental risks. The ideal approach is to avoid hazards whenever possible, and 'all measures necessary' encompass actions to mitigate the effects of major accidents.

Specific reports may not always be required to comply with this regulation. For top-tier establishments, existing safety reports, emergency plans, hazardous substances consent, and planning permissions should offer sufficient evidence. Similarly, for lower-tier establishments, the Major Accident Prevention Policy (MAPP), hazardous substances consent, and planning permissions are typically adequate.

Applicability to NLCCP

As part of the SA Stage, the Technical and Engineering workstream completed an initial screening exercise for the implementation of the CC plant at the currently under construction ERF. The screening exercise presented a systematic screening of different CC technologies identifying the most promising and favourable solutions as amine-based and HPC.

The quantities of substances foreseen to be present or used for amine or HPC CC processes are not expected to exceed the threshold quantities set out within COMAH, and on this basis, the regulations will not apply.

For amine CC processes, some of the amine degradation products that are generated during operation and accumulated in the solvent solution may be within scope of COMAH, depending on the amount and concentration. However, the concentration of this degradation product is not expected to exceed the COMAH concentration threshold of 5% by weight in any liquid stream. The expectation is that the concentration of dimethyl nitrosamine is likely to be in an order of magnitude of 1% by weight. For defined hazard categories and specific substances, the associated threshold quantities for upper and lower tier facilities are set out in Schedule 1 of the 2015 COMAH Regulations.

During the CC technology and solvent selection, the applicability of COMAH will be evaluated, based upon the combined quantities and concentrations of 'dangerous' substances which may be present at the ERF and CC facilities (plant and associated infrastructure). The determination of COMAH applicability will involve conducting a screening exercise to assess whether the chemicals present in both the ERF and those intended for use at the NLCCP would activate the relevant COMAH Regulations. Should COMAH apply, the CC plant will have related obligations, which will differ depending on whether the CC plant meets the "upper" or "lower" tier threshold quantities.

6.7.3.3 Implications of HSC and COMAH

The implementation of HSC and COMAH should not impede the development of the CC plant if necessary precautions will be taken ahead of time.

HSC would be obtained in parallel and as part of the planning consent. This is because the determining authority for HSC is the LPA under a TCPA application and the SoS for a DCO application. The potential requirement to obtain HSC poses limited risk to the CC plant as the site is not located in a Flood Zone 3 area, in which gaining consent for operations requiring HSC can be very difficult.

COMAH should not interfere with the timely completion of the CC plant if necessary precautions are taken ahead of time. This includes the need for COMAH being evaluated during the CC technology and solvent selection. This evaluation will be based on the combined quantities and concentrations of 'dangerous' substances. Other Potential Consents

Other potential consents required for the proposed NLCCP could include[59]:

- Fire risk assessment (The Regulatory Reform (Fire Safety) Order 2005);
- Permit for transport of abnormal loads (Road Vehicles (Authorisation of Special Types) (General) Order 2003 or under the Road Traffic Act 1988);
- Building regulations approval (Building Regulations 2010);
- Pipeline safety notice (the Pipeline Safety Regulations 1996); and
- Control of Substances Hazardous to Health (COSHH) (2002).

[59] Consents listed in section 6.7.3.4 were listed in a DCO for an ERF in Cambs

6.8 Risk Management

6.8.1 Introduction

At the SA Stage and Stage 1, project risks are tracked and managed by the PM workstream. In order to manage the NLCCP and strategic risks, there are two key documents, the Risk Management Plan (RMP) and the Risk Register. The RMP sets out the proposed approach for the undertaking risk management for the NLCCP during the SA Stage. It provides the overlying processes to manage risk, while the Risk Register records, categorises and tracks the individual risks identified.

This section details the process implemented for the NLCCP to manage and mitigate risks, and forward looking activities for risk management in Stage 1. Further information regarding strategic risks see Section 2.6.1.

6.8.2 Risk Management Scope

The PM team's risk management strategy covers all project and functional activities within the Authority including the six workstreams. The RMP, Risk Register, and overall approach to risk management has been developed considering relevant best practice and existing linked processes and procedures. The scope of risks outlined in the RMP encompasses two categories, the internal and external contexts of the NLCCP. Internal context includes factors within the NLCCP, such as the project objectives and capability of the project team. External context includes political, legal and environmental factors, among others which may impact the NLCCP.

6.8.3 Governance

To manage project risks, various roles have been allocated to ensure that risks are identified, managed, and resolved in a timely fashion. These roles span all workstreams and the Authority Management, with various degrees of responsibilities being assigned to each role. Figure 36 below provides an overview of various roles of individuals who will be managing risk at the SA Stage.

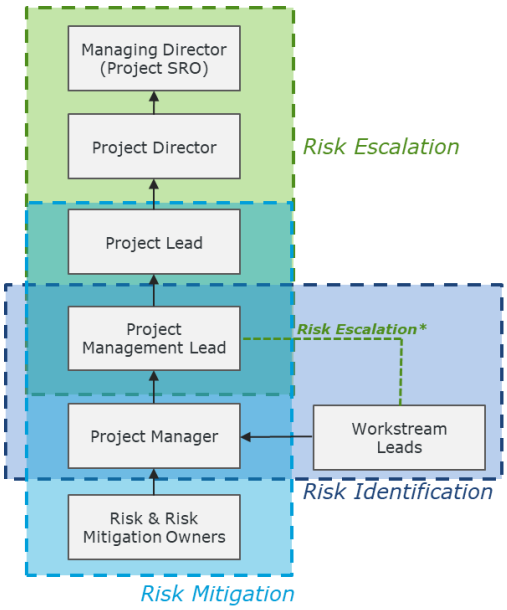

Figure 36: Risk Management Roles and Responsibilities

Within the governance structure for risk management, the Managing Director (Project SRO), and Project Director are responsible for any showstopper risks escalated to them. The Project Lead is responsible for reviewing any escalated risks raised by the Project Management Lead, and for escalating any showstopper risks.

Under the Project Lead, the Project Management Lead is responsible for the identification, mitigation, and escalation of risks. This includes overall responsibility for establishing and taking overall ownership of the risk management process. Under the Project Management Lead, the Project

Manager is responsible for identifying and managing all risks applicable to the NLCCP on a day-to-day basis.

All other Workstream Leads are responsible for identifying project risks within their workstream and escalating any workstream risks to the Project Management Lead. Risk Owners are accountable for monitoring and mitigating individual risks assigned to them. Risk Mitigation Owners are named individuals accountable for delivering the individual mitigating actions assigned to them. Both the Risk Owners and Risk Mitigation Owners report to the Project Manager.

6.8.4 Risk Management Process and Mitigation

All Processes for managing risks are aligned to industry standards including the Risk Management Standard and ISO31000. Following industry standards will facilitate increased cost certainty and schedule certainty during earlier stages of the NLCCP. A high-level overview of the risk management process, used to manage all risks, is outlined below.

- **Establish the Context** of risk management for the NLCCP. This includes the risk management process, and governance structure for managing, including roles and responsibilities.
- **Identification** of risks which is informed by risk workshops and risk reviews.
- **Analysis** of risks by implementing scoring. Qualitative risk analysis to prioritise response actions. In the SA Stage risks are scored on their probability and impact, with scoring agreed in Workshops and Reviews.
- **Evaluation** of risks which creates a key risks dashboard. In the SA Stage, the key risks are high-level strategic risks that may shape the overall direction and feasibility of the NLCCP.
- **Treatment** with 'mitigating actions' agreed and implemented. In the SA Stage, the most significant risks are high level and strategic. Mitigating actions will form the basis of treatment plans to reduce the probability and impact of risks.

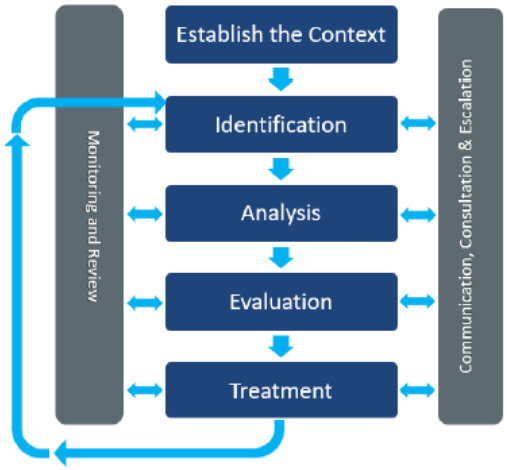

Figure 37: Risk Management Process

6.8.4.1 Risk Treatment & Escalation

Risk mitigation within the NLCCP should first be 'treated' with mitigating actions included within the risk register. Mitigation occurs through monthly risk reviews with the PM team and relevant advisors, who collate risks, then discuss and amend the risk impact and mitigating actions. Regularly reviews and updates of the risk register is crucial for effective risk mitigation, if however, there is a risk that is difficult to mitigate then it can be escalated.

Risks can be escalated to the NLCCP Project Lead or Project Management Lead for further review and input. The NLCCP Project Lead may escalate the risk to NLCCP Project Director or NLCCP Managing Director (SRO). This would occur when a workstream becomes unable to manage a particular risk or deliver the agreed mitigating action. This can be enacted through the monthly meetings for the workstream and must be carried out in agreement with the Risk Owner. Once the issue causing the escalation has been resolved it can be returned to the Risk Owner for ongoing management.

To escalate a risk, the risk must be:

- A new or changed risk with a significant 'current impact' (High – Very High);
- A risk that can no longer be managed, with further help or guidance required; or
- A key mitigation for the risk that can no longer be delivered and help or guidance is required.

6.8.5 NLCCP Risk Register

To record, categorise, and track individual risks, a Risk Register is utilised. A Risk Register provides the project team a clear understanding of the risks faced, their potential impact to objectives, as well as an understanding of the actions that are required to mitigate these risks and contains the following, but is not limited to:

- Clear statements of the root cause(s) supported by a description of the risk and accompanying impact;
- Existing controls and mitigation strategies in place to manage the risk that links directly to the stated cause and potential impact of the risk to ensure action is taken to address the risk; and
- Ownership of risk and any given timeline to implement mitigating factor of risk.

6.8.5.1 Risk Impact

Within the entries, the 'Risk Impact' entry aims to assess the probability and impact of any identified risks, utilising a scale from 1-5. Risk impact is split into a Probability, and Impact section. Table 16 demonstrates the ranking for the Risk Impact categories.

Ranking	Description for Probability	Description for Impact
1	Negligible	Very Low
2	Unlikely	Low
3	Possible	Medium
4	Probable	High
5	Almost Certain	Very high

Table 16: Ranking for Risk Impact Categories

A combined score is then calculated to demonstrate the risk impact. To calculate the combined score, the probability and impact scores are multiplied.

The Risk Impact is decided during Risk Assessments, which are conducted during workshops in order to brainstorm and identify a wide range of risks with the project team. The Risk Impact score is collectively agreed with all advisors at the risk workshops, with expert input being provided from the relevant advisor.

The top strategic risks have been identified, with mitigating actions approved. For further information regarding these risk see Section 2.6.1.

6.8.6 Stage 1 Activities

As the NLCCP transitions into Stage 1, it's crucial to maintain a dynamic and responsive approach to risk management. This will include updating the risk register to capture new risks, reassessing existing ones, and documenting the effectiveness of mitigation strategies. The PM workstream will continue to chair risk workshops and Monthly Risk Reviews, enabling the NLCCP team to share insights, update risk priorities, and refine mitigating strategies.

6.9 Management Case conclusion

The Management Case for the NLCCP demonstrates a robust structure for managing the SA Stage and clear insights for Stage 1. An Indicative Plan to Operations has been created to outline the potential timescales for the NLCCP. However, at this stage there are key assumptions which outline the timescales for the NLCCP. These assumptions include:

- The SOC, OBC, and FBC activities are expected to run from the second half of 2024 to the end of 2029;
- That the Authority will seek a DCO for the planning process. If the Authority goes through the TCPA pathway then timescales will change; and
- Intermediate transport construction has been assumed to take four years, but this will need verified and validated as the NLCCP progresses and an intermediate transport option is chosen.

At the SOC stage, the business case will be continuously updated, with the addition of pre- FEED studies, the shortlist of options and preferred way forward identified, and the development of the procurement and contracting strategy.

Timescales for the planning process will depend on which planning route the Authority ultimately takes. At this time, there are two consenting routes which the NLCCP may take – a planning application under the Town and Country Planning Act (TCPA) or a DCO. There are benefits and disbenefits to both pathways and as the preferred development option evolves (especially the preferred transport solution), greater clarity on the most suitable consenting route will be possible. If it is likely that the NLCCP will pursue a DCO pathway for consenting, specialist legal advice and support must be sought by the Authority.

Regarding Permitting for NLCCP, it is not expected that COMAH will apply, however, this will need to be revisited when a preferred CC technology is selected. HSC may be required for the CC plant, and if required the Authority would probably need to apply for HSC at the same time as planning consent. In the SA stage, risks were predominantly identified and monitored. As planning for the NLCCP progresses, more risks are expected to occur in the next stages of the project lifecycle. To ensure effective risk mitigation in Stage 1, risks will need to be continuously identified and reassessed, with risk mitigation action refined.

6.9.1 Management Case recommendations

In the SOC and future stages of the Business Case the following activities should take place.

- Further external assurance measures will need to be implemented as the NLCCP enters Gate 1 of the Gateway Review Process;
- The Authority should continue to consider the appropriate planning pathway for the NLCCP and review policy around new CC projects being proposed as NSIPs;
- Consider the extent to which further planning and environmental work could be carried out at the next stage of the CCS project to facilitate consideration and rationalisation of the emerging design options;
- Once a preferred CC technology is chosen, the NLCCP team should reevaluate if COMAH and HSC will apply to the CC plant;
- The Authority should consider what work should be prioritised to ensure consent can be obtained without delays; and
- Timely risk management should continue, with the regular identification, analysis, evaluation, and treatment of risks.