**Specification for Assessing the feasibility and timing of large-scale Direct Air Capture with Carbon Storage deployment in the UK**

Tender Reference Number: SA-0923

**Specification of Requirements**

Invitation to Tender for Assessing the feasibility for large-scale DACCS deployment in the UK

Tender Reference Number: SA-0923

Deadline for Tender Responses: 12pm on 27/10/2023

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**1 Introduction and summary of requirements / Preamble**

The Climate Change Committee (CCC) is looking to widen its understanding of the feasibility of carrying out large scale greenhouse gas removals in the UK using Direct Air Capture with Carbon Storage (DACCS). As we consider emissions over the Seventh Carbon Budget period (2038 – 2042), we are examining the role different engineered removals technologies could play in the UK in those years and assessing their interactions with other sectors including power and land use.

The Committee expects that DACCS will play a role in delivering engineered removals over the Seventh Carbon Budget period. For the purpose of this work, we define DACCS as technologies directly capture CO2 from the atmosphere through chemical and mechanical processes to produce a concentrated CO2 output that is subsequently injected into the subsurface for secure storage. This project should assess the range of different direct air capture approaches in development and the variation in their required inputs and costs.

DACCS has progressed in recent years, with small-scale projects in operation and larger projects expected to be built in the next few years. While there are no DACCS sites currently operating in the UK, there is growing momentum behind this technology and businesses in hard-to-abate sectors have expressed interest in funding future projects. DACCS is identified as a key technology in future global greenhouse gas removals, but there are some areas that require further research before the extent of its role, especially in specific locations, can be determined.

The CCC is looking to expand its evidence base and develop modelling which assesses the possible scale and rate of DACCS deployment in the UK. There are many factors that influence this feasibility, such as international progress on developing these technologies, its cost, energy and material input requirements, and on the availability of Carbon Capture and Storage (CCS) network infrastructure. The Committee would like to build a detailed picture of how these factors interact with UK [geographies], infrastructure and power generation.

To inform this work, the CCC is tendering a project to explore 1) when the first large-scale (meaning projects removing at least 1 Mt CO2/year) UK DACCS projects could be deployed and how quickly UK capacity might be expanded, 2) the implications of this scale-up for factors including energy demand, CCS infrastructure and jobs along the supply chain in the UK and 3) how the costs and resource implications of deploying DACCS in the UK compare with similar efforts abroad.

Given that this work is intended to inform CCC modelling for Seventh Carbon Budget advice, the tendered work needs to be delivered by mid-February 2024 at a cost of £60,000 including VAT.

The CCC’s past reports are available here: <http://www.theccc.org.uk/reports/>.

# 2 Background

**The Climate Change Committee**

The Climate Change Committee (CCC) was set up as part of the Climate Change Act. The CCC is an independent body tasked with providing advice to Government on climate change issues, and particularly the setting of carbon budgets, and the monitoring of progress towards meeting those budgets.

The Committee provided advice on the Sixth Carbon Budget (setting a limit on UK emissions in the period 2033-2037) in 2020 and assessed UK progress in its annual Progress Report in June 2022.

**The Climate Change Committee’s work on engineered removals**

To date, the Climate Change Committee has published several reports that cover the role engineered removals could play in UK decarbonisation, including:

* Annual [mitigation Progress Reports](https://www.theccc.org.uk/publication/2023-progress-report-to-parliament/) that assess UK Government progress on engineered removals (including DACCS) against Government ambition and pathways. These reports also assess policy risks for engineered removals and produce targeted recommendations to Government.
* Our 2022 report on [Voluntary Carbon Markets and Offsetting](https://www.theccc.org.uk/publication/voluntary-carbon-markets-and-offsetting/) which explores the role that voluntary carbon markets can play as one mechanism amongst many in developing the engineered removals sector.
* The [2020 Sixth Carbon Budget](https://www.theccc.org.uk/publication/sixth-carbon-budget/#sector-summaries). This sets out CCC pathways for engineered removals with accompanying policy recommendations, evidence and explanations of analytical approach.
* The [2019 Net Zero: The UK’s contribution to stopping global warming report](https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/), which explores the role engineered removals can play in closing the gap to Net Zero GHGs. This report was supported by evidence from a [Royal Society and Royal Academy of Engineering report](https://royalsociety.org/topics-policy/projects/greenhouse-gas-removal/?utm_source=royalsociety.org&utm_medium=redirect&utm_campaign=greenhouse-gas-removal) on different removals methods and the factors affecting their deployment.

# 3 Aims and Objectives

The aim of this project is to strengthen CCC evidence and analysis on the feasibility and timing of large-scale DACCS deployment in the UK. For this project, we define large-scale DACCS projects as those with a capacity to remove at least 1 Mt CO2/year.

The three key tasks of this project are listed below, with guidance on the anticipated division of resource between them included as a percentage:

1. Assess when DACCS projects could begin operation in the UK and how quickly capacity could scale up in the 2030s and 2040s. *(40%)*
   * This assessment should take into consideration factors including the planned development schedules of UK CCS networks, UK regulation and UK permitting and planning processes.
   * These assessments should also include predicted costs of the scale-up and, where possible, identify the regions where projects might optimally be sited.
2. Assess the implications of this scale-up on UK systems, infrastructure and jobs. *(40%)*
   * Ideally, this would consider spatial elements of a DACCS rollout in the UK, using Task 1 assessments of where projects might optimally be located.
3. Compare the feasibility of deploying DACCS in the UK with similar efforts abroad, taking account of differentials in countries’ respective costs, regulatory landscapes and access to required inputs. *(20%)*

This project will require the use of models or other analytical tools to produce outputs for Tasks 1 and 2. Where such tools are used, they must be shared with the CCC in an unrestricted and editable format so that they can be used to inform our own modelling for the Seventh Carbon Budget.

# Methodology

**Task 1:** *Assess when DACCS projects could begin operation in the UK and how quickly capacity could scale up in the 2030s and 2040s. This assessment should take into consideration factors including the planned development schedules of CCS networks, UK regulation and UK permitting and planning processes. These assessments should also include predicted costs of the scale-up and explore the regions where projects could be sited (40%).*

This task has four main parts:

1. Identifying the factors that affect the feasibility of deploying DACCS in the UK in the near to medium future (up to the mid-2030s)
2. Analysing the current state of these feasibility factors in the UK and developing projections of how they are likely to change over the 2020s, 2030s and 2040s
3. Using these feasibility factor projections to develop assessments of when large-scale DACCS projects could begin operating in the UK and how quickly subsequent UK capacity might scale up. This assessment should also examine where in the UK scale-up could happen
4. Exploring the costs associated with this scale-up (including how they change over time).

The feasibility factors identified in part (i) should include (but not be limited to): the current state of DACCS technology, the availability of required inputs, supply chain access, access to CCS Transport and Storage (T&S) infrastructure and geological storage and the state of necessary or enabling policy, regulation and guidance. As only some of these factors can be quantitatively assessed in part (ii), bids should include a proposed analytical approach for part (iii) that combines modelling insights with consideration of qualitative outputs from part (ii).

Part (i) should briefly and in simple terms explain how DACCS works and explain its main archetypes (e.g. ‘liquid’, ‘solid’ and any other emerging systems[[1]](#footnote-2)) and identify the inputs, technologies, infrastructures and any regulatory changes necessary to enable large-scale operation of DACCS facilities. Considering these factors alongside the current landscape in the UK, the project should then identify key ‘feasibility factors’ that can act as indicators of UK DACCS readiness in future years.

Part (ii) should produce measurements or assessments of the current state of each of these ‘feasibility factors’ and then, using available credible data and research, estimate how UK levels of these factors will change over coming decades.

Part (iii) should produce minimum thresholds of the ‘feasibility factors’ that must be reached for large-scale DACCS to begin in the UK, identifying dependencies and required sequencing between factors where relevant. These thresholds should then be considered alongside the outputs from part (ii) to assess when large-scale DACCS could begin operating in the UK, and how quickly capacity could scale up throughout the 2020s, 2030s and 2040s. These assessments should provide a breakdown of the types of DAC underpinning this deployment (i.e. amounts of ‘liquid’ or ‘solid’ DAC or other emerging systems), with explanations of the factors (such as costs and inputs) that determine this split.

This part of the task should also draw on available data and projections to project where scale-up is likely to happen within the UK, trying to identify optimal siting based on factors including access to CCS infrastructure, atmospheric conditions (such as temperature and humidity), proximity to required input resources (such as renewable energy) and co-location with other types of industrial installations (such as nuclear power plants) for the purposes of heat offtake. If the analysis suggests that these factors play a limited role in determining where DACCS plant should be located, the successful bidder must provide an alternative analytical approach that projects geographic distribution of plants across the UK. To note, the location of plants does not need to be limited to onshore sites (e.g., bids might wish to consider the feasibility of options such as offshore deployment of DACCS). Bidders should specify the level of granularity they think they are able to provide when assessing this geographic distribution, noting that they should consider the spread across different UK nations (England, Scotland, Wales and Northern Ireland) at a minimum. Infographic maps showing possible geographic distribution of plants overlaid with projected CCS networks and renewable generation are desired but not required.

Part (iv) should produce cost estimates of DACCS scale-up in the UK, drawing on available data and projections to produce UK or region-specific costs (capex and opex), where relevant broken down by DAC archetypes (e.g. ‘liquid’, ‘solid’ etc.). Cost profiles should be produced for all years up to 2050, with uncertainty ranges provided where possible. These should be set out in a spreadsheet that can be published alongside the research.

**Task 2:** *Assess the implications of this scale-up on UK systems, infrastructure and jobs. Ideally, this would consider spatial elements of a DACCS rollout in the UK, using Task 1 assessments of where projects would optimally be located. This task should also identify the key enabling actions required to realise the UK’s full potential in DACCS deployment while limiting any negative impacts.*

An important part of assessing the role that DACCS could play in UK removals over the Seventh Carbon Budget period will be reaching a better understanding of how large-scale DACCS affects UK infrastructure, systems and people. This task should use quantitative and qualitative analysis to explore the impact DACCS may have, drawing on Task 1’s projections of build rate and potential geographic distribution of DACCS plants to analyse how a large-scale rollout might affect different parts of the UK.

The task is split into three parts:

1. Identifying two scenarios for DACCS scale-up in the UK to 2050, representing a low-end minimum and a maximum realistic deployment.
2. Use appropriate analytical techniques to assess the impact of each of these scale-up scenarios on UK systems, infrastructure and people. This assessment would ideally consider the geographic distribution of impacts across the UK and identify any areas where positive impacts, negative impacts or bottlenecks are likely to be concentrated.

This task should be focused on using data and modelling to understand the impact that deployment of DACCS could have in the UK. For this task, bidders should propose a detailed methodology proposal and specify the data sources that are likely to be used.

Part (i) of this task should produce two scenarios for DACCS deployment based on Task 1’s assessments of how quickly DACCS could scale up in the UK. If bidders think that more than two scenarios will be needed to assess the potential impacts, they should include this in their bid with an explanation.

Part (ii) should use UK-specific data and robust analysis to assess the impact on UK systems, infrastructure and jobs. This analysis should consider and, where possible, quantify, the impacts of the two DACCS deployment scenarios in following the areas:

* energy demand, specifying the input sources (renewable power and/or other), the type of energy they are providing – heat (including temperature grade) and mechanical, and the resulting impacts on the wider UK energy system;
* demand for materials for construction and where applicable water for operation;
* capacity required of the UK’s CCS T&S infrastructure and geological storage sites;
* land footprint per unit (e.g. Mt CO2) of DACCS facilities and their accompanying infrastructure and any other land impacts;
* UK jobs, expressed in metrics such as the number of direct and indirect jobs resulting from the deployment (expressed in FTE-years) and the occupation and skill-level of the potential employment.

Where possible, this analysis should utilise CCC estimates for metrics such as projected renewable capacity over time or power demand in other sectors. This analysis should ideally differentiate between DAC technologies and their respective impacts. Bids should include proposals for how the analysis in this part of the task is presented, focusing on approaches that combine data summaries (such as tables, charts and infographics) with report text.

**Task 3*:*** Compare the feasibility of deploying DACCS in the UK with similar efforts abroad, taking account of differentials in countries’ respective costs, regulatory landscapes and access to required inputs. *(20%)*

This task should take assessments of the feasibility, cost and impact of DACCS scale-up in the UK and compare them with similar efforts abroad. The aim of this task is to help the CCC to explore the UK’s suitability as a global DACCS hub.

This task is split into two parts:

1. Identifying countries that are most suitable for large-scale DACCS deployment in the 2030s
2. Produce high-level assessments of the feasibility, cost and impacts of large-scale DACCS deployment in the countries identified in part (i)
3. Compare these assessments with the assessment for the UK

As a guide, part (i) could look to identify three to four countries; an extensive longlist is not required. Bids should include details of possible data sources and research that will be used to inform the assessments in part (ii) and may use interviews with relevant experts where necessary. They should also propose an approach for dealing with data gaps and indicate the level of detail that is likely to be provided for these international assessments.

# Outputs Required

The outputs of this work should include:

* **An Excel spreadsheet and table in the report covering Task 2,** setting out the UK DACCS deployment scenarios used for the analysis and any other analytical outputs that can be summarised in this form.
* **A final report to publishable standard that includes an executive summary of key findings, an introduction and chapters covering Tasks 1, 2 and 3.** The introduction should include a short background paragraph on engineered removals in the UK, covering both the UK Government and devolved administrations’ ambitions and policies in this area. The report should make good use of clear and accessible charts, tables and infographics. There should also be a conclusion that summaries any overarching messages for the research and links the findings back to the UK engineered removals policy context.

Bids should clearly set out what outputs would be included. We welcome suggestions on the potential ordering of the sections in the report.

Where excel workbooks are used these should be shared, fully unlocked, and linked to the rest of the excel workbook sheets where applicable. The CCC should have full capability to update any workbooks.

Where quantitative analysis is carried out, the CCC should have sight of how this has been done and have access to sufficient information (e.g. through provision of workbooks) to replicate the analysis with different assumptions or new data for future work.

Bidders will likely have to make use of pre-existing knowledge/contacts to deliver the outcomes above, and the CCC welcome this. However, all findings/methodologies used in this project should be made transparent and all findings should be provided in a publishable format. Any limitations on sharing (e.g. external to the CCC) should be specified as part of the tender.

In addition to the above, interim deliverables will be required, including slide packs for key milestones, a webinar to discuss interim findings with relevant experts and a steering meeting with CCC Committee members if necessary.

# Ownership and Publication

The key output deliverables will be handed over to the CCC, who may choose to publish these as supporting evidence on their website. Spreadsheets should be open access and unrestricted, to enable full QA of results and assumptions.

# Quality Assurance

This project must comply with the ‘CCC – Quality Assurance of Evidence and Analysis’ guidance[[2]](#footnote-3) and bidders must set out their approach to quality assurance in their response to this ITT.

All research tasks and modelling must be quality assured and documented. Contractors should:

* Include a quality assurance (QA) plan that they will apply to all of the research tasks and modelling,
* Specify who will take lead responsibility for ensuring quality assurance and ensure that this responsibility rests with an individual not directly involved in the research, analysis or model development,
* Provide QA log to demonstrate the QA undertaken, including who undertook the QA and the scope, type and level of QA that has been undertaken (e.g., a log entry only stating ‘the data was checked’ will not be sufficient),
* Allow for a meeting with CCC staff to run through QA performed.

Sign-off for the quality assurance must be done by someone of sufficient seniority within the contractor organisation to be able take responsibility for the work done. Acceptance of the work by the CCC will take this into consideration. The CCC reserves the right to refuse to sign off outputs which do not meet the required standard specified in this invitation to tender.

The successful bidder will be responsible for any work supplied by sub-contractors and should therefore provide assurance that all work in the contract is undertaken in accordance with the quality assurance expectation agreed at the beginning of the project.

# Timetable

The proposed timeline is set out in Table 1:

Table 1 - key milestones

|  |  |
| --- | --- |
| **Date** | **Action** |
| 03/11/23 | Kick-off meeting |
| 18/12/23 | Interim presentation on Task 1 and analytical approach for Task 2 |
| 25/01/24 | Latest date for delivery of underlying data/findings. |
| 08/02/24 | Latest date for delivery of a draft of the final report for CCC feedback. |
| 23/02/24 | Latest date for delivery of final report and findings (including any updates based on earlier CCC feedback). |

In addition to the formal reporting points, the CCC would expect to have regular scheduled discussions (e.g. weekly virtual meetings) to ensure the work is progressing as expected.

# Challenges

The specific challenges that the CCC envisage with this project include:

* + Assessing the factors that enable the scaling up of DACCS capacity despite current global capacity being limited to a small number of small and medium-scale projects.
  + The evidence on technological readiness and scalability of DACCS changing growing and changing during the project.
  + Sourcing and gaining access to relevant data needed to assess geographic/geospatial elements of the analysis.
  + Bringing together a number of analytical questions in Task 2 and developing an analytical approach that can produce insights from diverse data (qualitative and quantitative, spanning from energy systems modelling to estimating regional jobs growth)
  + Limitations on available evidence for feasibility, cost and impact of DACCS in other countries.
  + Gaining access to relevant experts in other countries to get useful insights on DACCS feasibility, cost and impact abroad.
  + Establishing links with businesses, research organisations and academics to ensure there are no gaps in the assessments of feasibility and impact of DACCS in the UK.
  + Keeping the focus on the feasibility, cost and impact of DACCS given strong interactions with other areas such as offset markets, other removals approaches and residual emissions in hard-to-abate sectors.

Bids should set out how these risks will be managed alongside any other risks and challenges to successfully undertaking this work.

# Ethics

All applicants will need to identify and propose arrangements for initial scrutiny and on-going monitoring of ethical issues. The appropriate handling of ethical issues is part of the tender assessment exercise and proposals will be evaluated on this as part of the ‘addressing challenges and risks’ criterion.

We expect contractors to adhere to the following GSR Principals.

1. Sound application and conduct of social research methods and appropriate dissemination and utilisation of findings.
2. Participation based on valid consent.
3. Enabling participation.
4. Avoidance of personal harm.
5. Non-disclosure of identity and personal information.

# Working Arrangements

The successful contractor will be expected to identify one named point of contract through whom all enquiries can be filtered. A CCC project manager will be assigned to the project and will be the central point of contact.

# Skills and experience

CCC would like you to demonstrate that you have the experience and capabilities to undertake the project. Your tender response should include a summary of each proposed team members experience and capabilities.

Contractors should propose named members of the project team and include the tasks and responsibilities of each team member. This should be clearly linked to the work programme, indicating the grade/ seniority of staff and number of days allocated to specific tasks.

Contractors should identify the individual(s) who will be responsible for managing the project.

# Consortium Bids

In the case of a consortium tender, only one submission covering all of the partners is required but consortia are advised to make clear the proposed role that each partner will play in performing the contract as per the requirements of the technical specification. We expect the bidder to indicate who in the consortium will be the lead contact for this project, and the organisation and governance associated with the consortia.

Contractors must provide details as to how they will manage any sub-contractors and what percentage of the tendered activity (in terms of monetary value) will be sub-contracted.

If a consortium is not proposing to form a corporate entity, full details of alternative proposed arrangements should be provided. However, please note CCC reserves the right to require a successful consortium to form a single legal entity in accordance with Regulation 28 of the Public Contracts Regulations 2006.

CCC recognises that arrangements in relation to consortia may (within limits) be subject to future change. Potential Providers should therefore respond in the light of the arrangements as currently envisaged. Potential Providers are reminded that any future proposed change in relation to consortia must be notified to CCC so that it can make a further assessment by applying the selection criteria to the new information provided.

# Budget

The budget for this project is £60,000 including VAT.

Contractors should provide a full and detailed breakdown of costs (including options where appropriate). This should include staff (and day rate) allocated to specific tasks.

Cost will be a criterion against which bids which will be assessed.

Payments will be linked to delivery of key milestones. The indicative milestones and phasing of payments can be adjusted and agreed with the contractor and Project Manager. Please advise in your tender response how this breakdown reflects your usual payment processes:

In submitting full tenders, contractors confirm in writing that the price offered will be held for a minimum of 60 calendar days from the date of submission. Any payment conditions applicable to the prime contractor must also be replicated with sub-contractors.

The Committee on Climate Change aims to pay all correctly submitted invoices as soon as possible with a target of 10 days from the date of receipt and within 30 days at the latest in line with standard terms and conditions of contract.

# Evaluation of Tenders

Contractors are invited to submit full tenders of no more than 25 pages, excluding declarations and CV’s. Tenders will be evaluated by at least three CCC staff.

CCC will select the bidder that scores highest against the criteria and weighting listed below, see the ITT for further information.

**EVALUATION CRITERIA AND SCORING METHODOLOGY**

|  |  |  |
| --- | --- | --- |
| Criterion | Description | Weighting |
| 1 | RELEVANT EXPERIENCE / DEMONSTRATION OF CABABILITY | 15% |
| 2 | MANAGING YOUR RELATIONSHIP WITH THE CCC | 10% |
| 3 | QUALITY ASSURING THE SERVICES YOU PROVIDE | 10% |
| 4 | MANAGEMENT STRUCTURE | 5% |
| 5 | PROJECT TEAM – SKILLS AND KNOWLEDGE | 15% |
| 6 | METHOD, ABILITY AND TECHNICAL CAPACITY – 10% | 25% |
| 7 | UNDERSTANDING OF REQUIREMENTS | 5% |
| 8 | RISK AND CHALLENGES | 15% |
|  |  | 100% |

**Scoring Method**

Tenders will be scored against each of the criteria above, according to the extent to which they meet the requirements of the tender. The meaning of each score is outlined in the table below.

The total score will be calculated by applying the weighting set against each criterion, outlined above; the maximum number of marks possible will be 100. Should any contractor score 1 in any of the criteria, they will be excluded from the tender competition.

|  |  |
| --- | --- |
| **Score** | **Description** |
| 1 | Not Satisfactory: Proposal contains significant shortcomings and does not meet the required standard |
| 2 | Partially Satisfactory: Proposal partially meets the required standard, with one or more moderate weaknesses or gaps |
| 3 | Satisfactory: Proposal mostly meets the required standard, with one or more minor weaknesses or gaps. |
| 4 | Good: Proposal meets the required standard, with moderate levels of assurance |
| 5 | Excellent: Proposal fully meets the required standard with high levels of assurance |

**Scoring for Pricing Evaluation**

Price will be marked using proportionate pricing. Please see the example below.

Marking proportionate to the lowest price.

Price will be scored as set out below.

There will be a maximum of e.g. 20 marks

The lowest priced bid will receive the full 20 marks, all other bids will then be marked as set out below.

Proportionate Pricing scoring example

If 20% = 20 marks

|  |  |  |
| --- | --- | --- |
| Supplier | Price | Marks |
| 1 (lowest bid) | £50,000 | 20 |
| 2 | £60,000 | 50/60 \* 20 = 16.7 |
| 3 | £75,000 | 50/75 \* 20 = 13.3 |

**Structure of Tenders**

Contractors are strongly advised to structure their tender submissions to cover each of the criteria above and supply a price schedule specifying the daily rates (ex-VAT) you will charge for each level of your staff.

**Evaluation for Interviews, if held**

CCC reserves the right to award the contract based on applicants’ written evaluation only if one candidate emerges from the evaluation stage as significantly stronger than the others.

Should interviews go ahead, CCC will shortlist the top two or three suppliers with the highest marks from the written proposals. Interviews are provisionally expected to be held on 30/10/23. If this date changes, CCC will notify applicants.

The areas to be covered in the interview, and markings allocated to each topic area will be sent to the shortlisted supplier prior to interview.

Further details of interviews will be sent to successful applicants on selection.

**Feedback**

Feedback will be given in the unsuccessful letters or emails.

1. ‘Liquid’ refers to processes using an aqueous basic solution (such as potassium hydroxide) to capture CO2, ‘solid’ refers to processes using solid adsorbents to capture CO2. [↑](#footnote-ref-2)
2. <https://www.theccc.org.uk/wp-content/uploads/2020/04/CCC-%E2%80%93-Quality-Assurance-of-Evidence-and-Analysis.pdf> [↑](#footnote-ref-3)