Order Schedule 20 (Order Specification)

Date: **12/02/2025**

Department for Energy Security and Net Zero
3-8 Whitehall Place
London
SW1A 2EG

Section 1: Services Specification

Title of Request:	The provision of research into the competitiveness of domestic low carbon ammonia and methanol production versus imports
Duration of Contract:	8 weeks
Required Commencement Date:	**07th April 2025**
Budget (ex VAT) please specify if maximum or estimated	Max. £75,000 (excl. VAT)

1. **Introduction**
Low carbon ammonia and methanol, two derivatives of low carbon hydrogen, have the potential to play a role in reaching net zero. They can be used as a chemical feedstock, can be burned as a fuel in transport or power stations, and can be stored in large quantities. The Department for Transport's (DfT) 2019 Clean Maritime Plan sets out the significant role that low carbon ammonia and methanol may play in decarbonising the maritime sector. As derivatives of low carbon hydrogen, understanding whether low carbon ammonia and methanol will be produced in the UK or imported may also impact the design of the UK hydrogen system, as well as Government policies designed to build a low carbon hydrogen economy. The Department for Energy Security and Net Zero (DESNZ) is looking to improve its understanding of whether domestically produced low carbon ammonia and methanol, for use in sectors such as maritime, agriculture and chemicals, would be competitive. Specifically, this study will inform our understanding of the cost-competitiveness of producing low carbon ammonia and methanol in the UK versus importing them. It will look at the economics and relative commercial competitiveness of each option and provide a systematic review of the evidence. The outcomes of the study may be used by Government to understand whether and/or how low carbon ammonia and methanol production in the UK may impact the design of the UK hydrogen system and its policies.

2. Aims & Objectives

The aim of this study is to produce a primarily quantitative assessment of the relative cost-competitiveness of low carbon ammonia and methanol production in the UK versus low carbon ammonia and methanol imports. DESNZ and DfT propose the main sectors for the scope of this study to be maritime, agriculture and chemicals; however, this can be discussed with the supplier.

The overall objective of the study would be:

- To assess the forecasted cost-competitiveness of low carbon ammonia and methanol production in the UK in comparison to imported low carbon ammonia and methanol. Ideally the forecast would be in 5-year increments to 2050 (with the option to provide further granularity if possible), but it should at least cover 2030, 2035, 2040, and 2050.

This will include an assessment of the costs of producing low carbon ammonia and methanol from the requisite feedstocks in the UK, to be compared against forecasted costs of imported low carbon ammonia and methanol.

The expected outcome of the study is a primarily quantitative evaluation of the costs of UK production of low carbon ammonia and methanol compared to the cost of importing low carbon ammonia and methanol. This should take the form of forecasted ranges over 5-year increments, and in different scenarios that may influence costs/volumes/etc.

Further detail on the specific sub-questions that will need addressing are set out in Section 4 below.

3. Background to the Requirement

Hydrogen is an energy carrier with potential to support the UK's efforts to transform and decarbonise the energy system in line with our 2050 net zero target. Since publishing the UK Hydrogen Strategy (2021), Government and industry's understanding of the potential role of low carbon hydrogen in our future energy system has rapidly grown. This research will build on the work done by the Department for Energy Security and Net Zero's (DESNZ) Hydrogen Demand team on hydrogen use and demand as a feedstock and DfT's work on hydrogen as a feedstock for maritime fuels.

Following initial internal desktop research and engagement with stakeholders, DESNZ and DfT's understanding of the market is that there is currently no domestic production of low carbon ammonia or methanol for use in the UK, even though a significant increase in demand for both is expected in the coming years, especially in the 2030s onwards, and especially as a maritime fuel.

Though there are proposals for green fuel production assets to be developed in the UK, these kinds of facilities are likely to require government support through funding, or indirectly benefit from government supported infrastructure. Government providing this support could improve future energy security of supply in the UK, and bring economic benefits via developing these sectors domestically. However, achieving those benefits will require a value for money assessment, necessitating government to have an understanding of the costs of domestically producing these fuels relative to counterfactuals, including importing them instead.

If evidence suggests there is a case for actively supporting low carbon ammonia/methanol production in the UK, this could impact the design of policies to support the growth of the UK hydrogen system, such as production, transport and storage business models, as both fuels are low carbon hydrogen derivatives. The study itself will not require inclusion of policy advice.

Based on its own modelling, the Department for Transport will provide the Supplier with a range of illustrative fuel mix scenarios, which will include modelled volumes of ammonia and e-methanol for UK domestic and international maritime between 2025 and 2050, measured in tonnes or converted into TWh upon request.

DESNZ will provide the domestic low carbon hydrogen (as defined by the UK Low Carbon Hydrogen Standard) and electricity cost assumptions to be used in the analysis.

4. Scope

This research is being overseen by DESNZ Hydrogen Demand and Hydrogen Strategy teams, with input from the DESNZ Imports and Exports team, as well as the DfT Low Carbon Fuels, Maritime Environment and Decarbonisation, and Maritime Environmental Analysis teams.

The tender exercise is being undertaken to primarily answer the following questions:

Background (higher-level context)

- What are the current uses of ammonia and methanol in the UK and globally?
- What are the current forecasts of future use for ammonia and methanol in the UK and globally?
- Where is ammonia/methanol demand currently located in the UK?
- How is high carbon ammonia and methanol produced today and what is required to decarbonise its production?
- What is the status of high carbon ammonia/methanol trade globally in terms of where production and demand are primarily located and overall volumes currently traded?
- What is the status of low carbon ammonia/methanol trade globally in terms of where production and demand are primarily located and overall volumes currently traded, and how do we expect these markets to develop?

Production costs

- What are predicted production costs for low carbon ammonia and methanol in the UK, considering infrastructure, raw materials, energy, labour, technology and regulatory costs? How might these costs develop from 2025 to 2050, in 5-year increments? What may influence this? Please provide underlying assumptions for this, including on:
    - Efficiency = total energy in / total fuel energy out
    - Feedstock in / fuel out
        - electricity in / fuel out
        - hydrogen in / fuel out
        - nitrogen in / fuel out
        - carbon source in / fuel out
- What are predicted production costs for low carbon ammonia and methanol internationally, over the same timeframe?
- How does the cost of importing to the UK compare to the costs of domestic production? Is this dependent on end use sector?

Supply costs

- What are the costs of delivering low carbon ammonia/methanol to end users, considering storage, transport, refuelling and regulatory barriers? This should **include supply to the** maritime, chemicals and agriculture/fertiliser sectors, as the proposed main sectors forming the scope of the study.
- What is involved in the importation of low carbon ammonia/methanol in terms of processes, infrastructure and regulatory requirements, for each end use sector?

- What are these different sectors willing to pay for supply of low carbon ammonia and methanol for these applications?
- What infrastructure is currently in place at UK ports to facilitate the international trade of low carbon ammonia/methanol?

End use technology readiness and demand trends

- When, how much, and where might different UK sectors be able to use low carbon ammonia and methanol? Providing a low, medium and high scenario for demand trends.

Specific questions that could be explored for the maritime sector include:

- How is cost-competitiveness influenced by the location where refuelling takes place, e.g., whether this is in a UK port or an overseas port?
- Where are maritime vessels which call at UK ports refuelled?
- Does this vary depending on vessel types and fuel?
- Where is this fuel produced today?
- Who are the UK's key international competitors for maritime refuelling currently and what are the key determinants of this? How is this expected to change in future?
- What infrastructure currently exists in UK ports for low carbon ammonia/methanol refuelling? What infrastructure is expected/needed in future?

We expect the questions above to need answering to inform the overarching question of: What is the cost-competitiveness of producing low carbon ammonia and methanol in the UK rather than importing them?

However, some questions may be circumvented if addressed elsewhere in the research process.

Optional to include:

- What would actively supporting low carbon ammonia/methanol production in the UK involve?

5. Requirement

The aim of this contract is to procure technical advisors to conduct research and deliver a report outlining evidence on the competitiveness of domestic ammonia and methanol production in the UK vs imports. It will look at the economics and relative commercial competitiveness of each option and provide a systematic review of the evidence.

The report will cover the questions set out above in Section 5 (Scope). This will be a quantitative assessment of the relative competitiveness of low carbon ammonia and methanol production in the UK versus low carbon ammonia and methanol imports, focused on modelling and desktop research. Qualitative interview data can be included if appropriate but should not form the basis of the study, as the purpose of the report is not to understand individual challenges of offtakers, but the wider economic angle of low carbon ammonia and methanol production.

The report is to be presented in a form that could be published and so must be submitted electronically in both MS Word and Adobe PDF form. Both files must meet the latest government minimum accessibility standards set out by the Public Sector Bodies Accessibility Regulations 2018. This is currently set at Web Content Accessibility Guidelines 2.1 level AA (WCAG 2.1). Guidance on GOV.UK for making document accessible is to be used in addition to WCAG 2.1. The length of the report can be determined by the supplier, dependent on the amount of data there is to analyse. The report should be concise, favouring quality over quantity, and with minimal repetition.

We envisage regular catchups between the supplier and the DESNZ Hydrogen Demand and Hydrogen Strategy teams (estimated every 1-2 weeks, to be conducted virtually via Microsoft Teams) to ensure research remains focused on the main objectives as it progresses. Presentations to a wider stakeholder audience (e.g. wider DESNZ and DfT teams) on a less frequent basis may also be

required to inform on progress. A final presentation of the findings should be provided along with the written report.

Quality Assurance (QA):

- All models and modelling must be quality assured and documented.
- Contractors should include a QA plan that they will apply to all research tasks and modelling. This QA plan should be no longer than 2 sides of A4 paper. It should include the delivery of a DESNZ pattern QA Log.
- This link contains an externally accessible version of the Department's Modelling QA guidance, and the QA log: The QA log should be filled in during the project and submitted at project completion as a deliverable to demonstrate the QA undertaken.
- When models are submitted to the Department, during the project or at completion, they should be accompanied by confirmation by a senior (partner or equivalent) of the contracting organisation, that the assurance has taken place in accordance with approaches outlined in the QA plan agreed with the Department. Evidence of testing through development provided in support of the QA Log ratings greatly improves the level of confidence in it.
- Suppliers must supply quality assurance evidence for any existing models they wish to submit to the Department. This must be:
    - to a standard that is at least the equivalent of the Department's internal standard, available at this link
    - accepted as suitable by the Department

Assumptions:

1. The period of the requirement will be approximately 8 weeks.
2. The timeline and outputs of the project have been outlined in an indicative weekly breakdown (in Section 7, below) to provide a rough idea of requirements. This will be discussed with the supplier at the start of the project and is subject to change.
3. The supplier shall be required to attend regular progress meetings.
4. All progress meetings shall be conducted via MS Teams.
5. DESNZ shall provide DfT modelling and cost assumptions to support the research. To be provided: DESNZ hydrogen and electricity cost assumptions, DfT ammonia and methanol volume assumptions, and possibly CO2 and nitrogen cost assumptions. Any data not listed as being provided by DESNZ or DfT, will need to be provided by the chosen supplier. This includes data on international imported costs and domestic costs forecasted out to 2050. Production cost template will be provided by DESNZ, but any forecast modelling will be expected from the supplier.
6. The supplier must use the data sources provided by DESNZ and use their own calculations of import costs etc (rather than externally sourced calculations) to base the research on, unless otherwise agreed in writing beforehand.
7. The supplier must provide a copy of the quantitative analysis undertaken to produce the report, preferably in MS Excel spreadsheet form.
8. The scope of the research will include the main end use sectors of ammonia and methanol that would be impacted by cost-competitiveness of production location. The scope is expected to cover (but is not limited to) the maritime, agriculture, and chemicals sectors as a minimum.
9. The report should begin with an Executive Summary of 2-5 pages in length. This should be suitable for use as a stand-alone summary of the research findings. It should clearly identify the main points arising of policy relevance.

Exclusions:

1. Any changes of scope/additional work shall be agreed on a 'case by case' basis, and any additional/reduction in costs as a result shall be agreed prior to work commencing.

6. Timetable

Deliverable: A final report outlining evidence on competitiveness of low carbon ammonia and methanol production in the UK vs imports. The report should be submitted electronically as a Microsoft Word document, featuring an executive summary and quantitative analysis. An interim report of early findings and/or initial modelling will also be required by the end of March. Timeframe: Approximately 8 weeks from contract placement. Delivery of initial modelling and/or early research findings will be required before the end of the 2024-25 financial year, with the final product delivered following review of this. Indicative weekly breakdown: Week 1 – Initial meeting, scoping and detailed plan. Agreement of approach with DESNZ. Week 2/3 – Data gathering and modelling. Share early findings with DESNZ. Week 4 – Mid project check in. Week 5 – Provide early draft to DESNZ for first review. Week 6 – Revise report. Week 7 – Final review DESNZ. Week 8 – Finish up and send final report.

Additional Guidance Notes:

Service Conditions and Environmental Factors
If the environment in which the required supplies or services will operate or be located is likely to impact on outcome, design or performance, the specification must explain those factors. If there are constraints imposed by users, the Specification must also explain the nature of these limitations e.g. site access time / dates to site for deliveries.
Environmental factors may include:

- Operating and storage conditions
- Availability of energy and other services
- Intended use of products and ergonomic requirements
- Personal safety considerations
- Servicing or maintenance requirements or limitations
- Organisational policy (current / future required accreditation)
- Environmental certification requirements (Incl. 3rd party)
- Sustainability requirements e.g. compliance with regulations (WEEE directives)

Section 2: Supplies Specification

Item Description	
Introduction & Key Features & Capabilities (I.e. Max footprint requirements for Capacity, Dimensions, Throughput, Parameters, Hardware, Software, QA, whole life support etc.)	
Installation	[details to be provided in relation to the installation, such as date and location]
Software	[details to be provided in relation to software related to the item. This may for example include annual corrective upgrades]
Training	[details to be provided on the level of user training required, this may include number of people to be trained, location of training, onsite/offsite]
Service Maintenance and Support (including whole life support)	[details to be provided on the required service maintenance and support including SLA's, full lifecycle costs should be taken into consideration]

User and Service Manuals	[details to be provided on whether user or service manuals are required and if so in what format and volume]
Service Spare Parts	[are any service spare parts required]
Power Requirements	[details on power requirements to be provided]
Operational Requirements	[details to be provided on the operational requirements, such as how many hours and days per annum the supplies should operate for]
Relevant Standards	[details to be provided on any applicable relevant standards]
Warranty	[details to be provided on warranty requirements]
Delivery location and date	[details to be provided on delivery location and latest delivery date / time]
OEM	If applicable, utilise the following: If the vendor is not the Original Equipment Manufacturer (OEM) the vendor MUST provide, in writing a recently dated (i.e., within the past year) and signed letter from the OEM recognizing them as the fully authorized and qualified vendor of the products and accessories

Quality Assurance Requirements

The Specification may request or detail appropriate quality assurance processes to be undertaken by the Provider. This will significantly reduce the Contracting Authority's need to test or inspect the supplies and/or services provided.
You are more likely to receive supplies of an appropriate standard if the quality requirements are stated clearly and refer to recognised product standards.

Whole Life Support

Reliability, Availability and Maintainability
This section should state:

- The requirements regarding maintenance, modifications, or upgrades to the supplies
- Any additional or enhanced capability that will, or may be, required
- The required level of reliability
- The required level of availability
- Accessibility of the site
- Times available to maintain or provide the supplies and or services
- Details of refresh / refurbishment programmes
- Environmental disposal (Incl. 3rd party)

Training
Should training or skills transfer be required, remember to specify:

- What is required e.g. in the installation, operation, or maintenance of a product, or in the use of a service
- The level of any training / skills transfer required
- The timescale for completion of the training or skills transfer
- Proposed venue(s) or location(s) (as applicable)
- Environmental certification requirements (Incl. 3rd party)