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Commissioning Letter

Technopolis Limited
3 Pavillon Buildings,
Brighton,
UK,
BN1 1EE

Thursday 26th September 2019

Dear Sir/ Madam

**BIS Research and Evaluation Framework Agreement – Lot 3
Process, Impact and economic evaluation of the Hydrogen for Heat (Hy4Heat)
programme (originally known as Hydrogen Innovation Programme)
CR19059**

Thank you for your response to the Specification for the above commission by the Department for Business, Energy and Industrial Strategy (BEIS) (the Customer) through the BIS Research and Evaluation Framework dated 2 January 2016 between (1) Secretary of State for Business, Innovation and Skills; and (2) Technopolis Limited (the Framework Agreement).

- Annexes: A. Tender dated Thursday 9th August 2019
B. Specification for Process, Impact and economic evaluation of the Hydrogen for Heat (Hy4Heat) programme (originally known as Hydrogen Innovation Programme).

Appendix 1. GDPR

The Department for Business, Energy and Industrial Strategy (BEIS) accepts your Tender (Annex A), submitted in response to our Specification (Annex B).

The Call-Off Terms and Conditions for this Contract are those set out in Schedule 5 to the Framework and Appendix 1 of this commissioning letter.

The agreed total charges for this assignment are [REDACTED] exclusive of VAT which should be added at the prevailing rate in alignment with the price schedule below. The agreed invoice schedule is as follows;

Invoice Number	Approximate Date	Following deliverable signed-off by BEIS	Percentage of Total cost	Value
1	30th March 2020	March 2020 Quarterly update	[REDACTED]	£ [REDACTED]
2	31st August 2020	Interim Evaluation Report	[REDACTED]	£ [REDACTED]
3	30th March 2021	March 2021 Quarterly update	[REDACTED]	£ [REDACTED]

Polaris House, North Star Avenue, Swindon, Wiltshire, SN2 1FF www.ukpbs.co.uk FLALLSH APR 2015

UK Shared Business Services Ltd (UK SBS). Registered in England and Wales as a limited company.
Company Number 630888. Registered Office Polaris House, North Star Avenue, Swindon, Wiltshire SN2 1FF

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4	30th September 2021	Final Evaluation Report		
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AWS-2 Price Schedule

AWSCS REFERENCE:

ISSUE DATE:

ISSUE NAME:

ISSUE TYPE:

Please ensure that you DO NOT alter this spreadsheet.
Any alterations may result in your Contract being **Invalidated**.

UKSBS
Royal Air Force

Table 1: Total Project Costs (Summary)

Category	Number of Rows	Total Value (incl. Tax)	Quantity (incl. Tax)
1. Personnel	10	£1,000,000	10
2. Materials	10	£1,000,000	10
3. Services	10	£1,000,000	10
4. Other	10	£1,000,000	10
TOTAL	40	£4,000,000	40

Table 2: Total Project Costs (Detailed)

Item No.	Description	Quantity	Unit Price	Total Price	Notes
1	Personnel	10	100,000	1,000,000	
2	Materials	10	100,000	1,000,000	
3	Services	10	100,000	1,000,000	
4	Other	10	100,000	1,000,000	
...
40	TOTAL	40	100,000	4,000,000	

All invoices should be sent to finance@services.ukpbs.co.uk or Billingham (UKSBS, Queensway House, West Precinct, Billingham, TS23 2NF).

You are reminded that any Customer Intellectual Property Rights provided in order to perform the Services will remain the property of the Customer. The following deliverables have been agreed:

The Services Commencement Date is Friday 27th September 2019

The Completion date is Thursday 30th September 2021

The Contract may be terminated for convenience by giving 30 days' notice in accordance with clause 38 of the Call-off Terms and Conditions.

Your invoice(s) for this work must include the following information:
Commission number: FWRECR19059

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The Authorised Representative for this Commission will be [REDACTED] who can be contacted at [REDACTED] [REDACTED] [REDACTED]

Until the date of publication, findings from all Project outputs shall be treated as confidential. Findings shall not be released to the press or disseminated in any way or at any time prior to publication without approval of the Department.

This clause applies at all times prior to publication of the final report. Where the Contractor wishes to issue a Press Notice or other publicity material containing findings from the Project, notification of plans, including timing and drafts of planned releases shall be submitted by the Contractor to the Project Manager at least one week before the intended date of release and before any agreement is made with press or other external audiences, to allow the Department time to comment on factual accuracy. All Press Notices released by the Department or the Contractor shall state the full title of the research report, and include a hyperlink to the Department's research web pages, and any other web pages as relevant, to access the publication/s.

This clause applies at all times prior to publication of the final report and within one month from the date of publication. Where the Contractor wishes to present findings from the Project in the public domain, for example at conferences, seminars, or in journal articles, the Contractor shall notify the Project Manager before any agreement is made with external audiences, to allow the Department time to consider the request. The Contractor shall only present findings that will already be in the public domain at the time of presentation, unless otherwise agreed with the Department.

Congratulations on your success in being selected to undertake this Commission.

Yours sincerely,

[REDACTED]
UK Shared Business Services Ltd

BY SIGNING AND RETURNING THIS COMMISSIONING LETTER THE SERVICE PROVIDER AGREES to enter a legally binding contract with the Customer to provide to the Customer the Services specified in this Commissioning Letter and Annexes incorporating the rights and obligations in the Call-off Terms and Conditions set out in the Framework Agreement.

Department for Business, Energy and Industrial Strategy (BEIS)

Name and Title	[REDACTED]
Signature	[REDACTED]
Date	30.9.19

Signed on behalf of Technopolis Limited

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Name and Title	[REDACTED]	
Signature	[REDACTED]	
Date	26 September 2019	

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Annex B – Specification for Process, Impact and economic evaluation of the Hydrogen for Heat (Hy4Heat) programme (originally known as Hydrogen Innovation Programme)

1. Background

Background to the programme

Hy4Heat is a programme commissioned by BEIS to explore whether replacing natural gas (methane) with hydrogen for domestic heating and cooking is feasible and could be part of a plausible potential pathway to help meet heat decarbonisation targets ([Hy4Heat website](#)). Currently, using hydrogen for heating represents just one potential option. However, there are necessary steps that must be overcome if hydrogen is to become a viable pathway for this. Some of these steps are addressed in the Hy4Heat programme, including demonstrating the safety case, developing a hydrogen quality standard, and developing and certifying hydrogen appliances.

The two primary objectives of Hy4Heat are:

1. to provide the technical, performance, usability and safety evidence needed to de-risk the use of hydrogen for heat in buildings
2. to stimulate industry to undertake a parallel programme of technical, performance and safety work on the distribution network, such as H21

The Hy4Heat programme has an announced budget of £25m and consists of 10 work packages (WPs):

1. Programme management
2. Definition of a hydrogen quality standards
3. Developing a hydrogen appliance certification
4. Development of domestic hydrogen appliances
5. Understanding commercial appliances and equipment
6. Understanding industrial appliances and equipment
7. Assessment of safety of using hydrogen in domestic properties and buildings
8. Demonstration trials of hydrogen appliances in unoccupied buildings
9. Preparations for future community (occupied) trials of hydrogen in homes
10. Development of hydrogen (fiscal) smart meters

The Arup+ team led by Arup, was appointed as Programme Management Contractor (PMC) to support BEIS in delivery of the Hy4Heat programme. They are responsible for delivering work packages 1 and 9 and elements of 7. Kiwa Gastec, Progressive Energy, Embers and YoEnergy are the other members of the Arup+ team. The other WPs are awarded through different procurement routes. So far, all WPs are underway with the exception of WP8.

More information about the Hy4Heat programme can be found at the following website: <https://www.hy4heat.info/>

An impact, process and economic evaluation of the Hy4Heat programme is now required to assess the Hy4Heat programme against what was agreed in the originally endorsed business case whilst acknowledging external factors which may have influenced the delivery of the programme since then.

2. Aims and Objectives of the Project

What is the proposed work and why is it required?

Hy4Heat is a relatively complex, novel and high spend integrated programme within the Department's Energy Innovation Portfolio. BEIS needs to account for its impact and learn lessons for future innovation delivery. The evaluation needs to go wider than the management information / Key Performance Indicators (KPIs) collected during the course of programme management, including identifying what impact the programme has had or is likely to have and whether the current delivery method represents the most effective and efficient use of resources. There is also a set of important learning, on how these impacts have been achieved and how similar innovation activities should be organised and procured in future.

An externally commissioned evaluation is required to provide additional assurance that the evaluation is carried out independently of the Hy4Heat programme itself, ensuring a robust, transparent and impartial evaluation.

What are the aims and objectives of the evaluation of Hy4Heat?

The overall aim of this research is to conduct a process, impact and economic evaluation of the Hy4Heat programme, specifically aiming to:

1. Identify the overall benefits and impacts of the programme, utilising a wide range of data sources
2. Assess the extent to which the programme has achieved its objectives, success criteria and KPIs for the programme. This will also include identifying whether the policy team client's needs have been met in the programme
3. Assess the cost effectiveness of the programme, understand issues associated with value for money and compare cost effectiveness to other similar programmes
4. Understand how effective and efficient programme implementation has been to inform the process evaluation. This will include assessing the effectiveness and efficiency of the contracted project management, procurement structures and internal governance and internal management structures.

What relevant work has already been conducted?

There has been work relevant to this evaluation that has either been completed or is currently ongoing. Arup+ are responsible for evaluating the WPs and there has been a Gateway Review. More details on these are included below. It is important to note that this evaluation will make sure of the information provided by these activities and will not duplicate them. The evaluation needs to tell us novel information that goes above and beyond what we already know about Hy4Heat. The evaluator should work with Arup to avoid duplication of work already being done.

Arup+ Evaluation Activities

Arup+ are already conducting evaluation activities of the individual WPs. These are more technically focused on the outputs and impacts of the individual WPs to feed into WP9 and to provide evidence to inform WP9

It will be essential that the evaluation contractor works with Arup+ to avoid duplication of efforts. Overall, Arup+ will be responsible for evaluating the technical outcomes of each WP and whether the WP objectives have been achieved, whereas this evaluation contract will be an evaluation of the programme as a whole, looking broadly at whether the Hy4Heat programme has met its objectives, how the process of the programme has worked, what BEIS has received for its £25m and what are the wider benefits of the Hy4Heat programme (unexpected or otherwise).

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Infrastructure and Projects Authority (IPA) Gateway Review

An internal IPA Gateway 2 review¹ has already been conducted on the Hy4Heat Programme. As part of this review, many stakeholders involved in the project were interviewed. There is some overlap between these stakeholders and the ones relevant for this evaluation. Given that part of this assurance is benefits management, which links to evaluation, we will ensure that any relevant information gathered during the IPA Gateway 2 review will be made available to the contracted evaluators subject to Hy4Heat programme board approval.

What decisions/processes will it inform?

The proposed impact evaluation, alongside the work conducted by Arup+, will pull together key evidence, which will help inform continued debate on the utility of hydrogen for heat and future decisions on any potential roll out of hydrogen. This evaluation should also inform future policy and innovation programmes run by BEIS across different policy areas including hydrogen, electrification and heat pumps, including how best to procure innovation and projects to deliver innovation

What are the key research questions?

As part of creating an evaluation approach, BEIS has set out several high-level questions (HLQ) and hypotheses, which require evidence. These are the questions that we envisage being able to answer after this research. We expect these questions to be refined, expanded and finalised during the initial phase and as the work proceeds.

- **What impact has the programme had?**
 - To what extent were the objectives of the programme achieved? To what extent has the programme met its success criteria and KPIs?
 - Has the programme met the needs of the policy team clients (Low Carbon Gas Team and Hydrogen Economy Team)?
 - To what extent has the Hy4Heat programme contributed to an evidence base to assist decision-making about using hydrogen as a strategic option to decarbonise heat, including providing evidence to inform the next steps on the hydrogen pathway?
 - How do impacts differ for different types of stakeholders in different types of circumstances? (e.g. potential outcomes for consumers, supply chain, market, system and state)
 - Were there any unintended outcomes? For example:
 - Has Government activity crowded out any private sector work?
 - Has there been any duplication of international activities?
- **How has the programme achieved these impacts?**
 - How did the programme achieve its objectives? How did the WPs achieve their objectives? [Arup+ to address whether WPs achieved objectives, whereas this evaluation contract will focus on how. For example, by which mechanisms did Hy4Heat allow WPs to achieve their objectives (knowledge spill over, increased stakeholder input etc.)]
 - What is the contribution of Hy4Heat (relative to other programmes/factors) to

¹ Guidance on Infrastructure and Projects Authority (IPA) available at: <https://www.gov.uk/government/collections/infrastructure-and-projects-authority-assurance-review-toolkit>

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intended outcomes?

- **How effective and efficient has the delivery of the programme been?**
 - How effective has the organisation of a contracted project management and procurement structures been?
 - How effective and efficient have the internal (BEIS and Arup+) governance and internal management structures been?
 - How effective and efficient has the interaction with assurance review been?
 - Have the different approaches to commissioning WPs been effective at delivering innovation and standards (although this was not aim of commissioning strategies)?
- **What is the overall cost-effectiveness of the programme?**
 - What were the cost-benefits of the programme? At a basic level, how do the cost-benefits compare to other similar programmes?
 - Have the barriers in the economic case for completing the Hy4Heat programme been addressed?
 - To what extent has the programme contributed evidence to aid understanding about the potential savings if hydrogen were chosen as a strategic option to decarbonise heat? For example, by clarifying the costs of transitioning downstream of emergency control valve.
- **What is the wider learning from the evaluation for BEIS?**
 - How better can we use demonstration projects to stimulate industry and drive forward innovation?
 - What evidence/approach does industry need to be stimulated?
 - How best can we link the different stages of innovation to progress understanding and stimulate industry?

What are the hypotheses we are testing?

We have developed a number of hypotheses relating to the above research questions to be assessed in the evaluation.

What impact has the programme had?

- Programme activities contributed to the de-risking of a hydrogen transition resulting in hydrogen continuing to be considered a viable option for heat decarbonisation.
- The Hy4heat programme stimulated stakeholders to consider, prepare, research hydrogen.

How has the programme achieved these impacts?

- The programme advanced knowledge through an effective package of work which was managed by an external consortium
- That the Hy4Heat programme made an additional and significant contribution to a

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stakeholder set of activities, which would otherwise have been slower

How effective and efficient has the delivery of the programme been?

- Flexibility and variation in procurement and management routes has allowed the right fit of contractual and support arrangements to facilitate innovation and value for money.

What is the overall cost-effectiveness of the programme?

- NPV is positive and substantial assuming a hydrogen pathway

What is the wider learning from the evaluation for BEIS?

Hy4Heat has advanced knowledge of SICE and BEIS on how best to run and procure Innovation projects

3. Suggested Methodology

Overview

As part of developing this requirement, BEIS has considered a range of potential methods and the preferred method is described in this specification. The preferred approach involves an evaluation strategy led by theory-based approaches, specifically a contribution analysis with a CBA alongside this.

Tenderers are asked to propose their alternative methodologies, as long as they are suitably credible and justified in the bid. However, each bidder must only submit one methodology, and must not submit a number of options. All bids must fit within our budget and timeline criteria, regardless of methodology proposed.

Methodological Stages

Stage One: Data mining, desk review and Theory of Change development:

Admin data

- **Purpose:** A thorough review of current programme documentation and evidence base developed to date by Arup+. This will allow the evaluation contractors to develop a comprehensive understanding of the Hy4Heat programme so far and assess where sufficient data already exists, avoiding a duplication of work.
- **Methodology:**
- Review the following documentation (plus any other relevant documentation identified):
 - Current log of success criteria collected across the WPs collected by Arup+
 - Current evaluation activities that Arup+ have already conducted/are already conducting
 - SICE KPIs that have been collected by Arup+ across the WPs
 - The benefits map, benefits management strategy and benefits realisation plan created by Arup+
 - Any / all work commissioned by the programme including the technical baselines for each WP outputs and reports, literature reviews, surveys and

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evidence to design studies so far.

- Assessing the documentation and recommendations made by the IPA as part of the Formal Gateway Review

Desk research

- **Literature review:**

- A literature review (including broader Departmental research) to understand the baseline/current state of industry and academic knowledge about using hydrogen for heat, to provide a baseline for understanding how the Hy4Heat programme has advanced current knowledge and to understand level of academic activity in this area. Whether this literature review is required will be assessed after the administration data has been reviewed.
- **Comparison to other programmes:** Review similar UK programmes, such as H21 or Mission Innovation Hydrogen Innovation Challenge (IC8), and how they monitor and evaluate the success of these programmes, with the aim to try to compare and combine learnings across the similar programmes.
- **Database analysis:** analysis of databases, such as Beauhurst, Crunchbase, Pitchbook and Prequin, to understand current funding levels into hydrogen innovation and funding trends. The contracted evaluator is required to provide their own access to the databases. Bidders should confirm that they will have access to these databases and apply any additional costs for this to their price schedule.
- **Patent analysis:** assessing the current patents on hydrogen technology and appliances relevant to the Hy4Heat programme. The contracted evaluator should suggest sources of patent information, such as patents in progress or number of patent applications.
- **Other:** assessing industry magazines, newsletters, social media to understand the level of activity surrounding hydrogen for heating activities.

Theory of Change development

- Approximately five 1-hour, face-to-face scoping interviews should be conducted to aid programme understanding, to create a definition of programme success and to understand any risks and assumptions about the programme.
- A Theory of Change should then be drafted and refined in a Theory of Change workshop with key stakeholders involved in the Hy4Heat programme.
- This Theory of Change should identify:
 - How the programme is expected to work and what evidence there is to support this thinking
 - The outputs, outcomes and impact, explicitly tracing causal links between them
 - Non-linearity in the design

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- The risks, uncertainties and assumptions that affect progression along the theory
- Prior to the next stage, and after Theory of Change development, the following steps should be conducted to ensure a strong theory-based evaluation:
 - Develop clear hypotheses about how we envisage the programme is having an impact, developed and agreed by the Hy4Heat programme board. We have outlined some basic draft hypotheses above, in Section 2: Aims and Objectives of the Project.
 - Outline the evidence we would expect to see to refute and strengthen the credibility of the hypotheses. This could involve developing alternative hypotheses. For example, unsuccessful WP bidders stating that the Hy4Heat programme has impacted the development of hydrogen appliances might constitute stronger evidence than a successful WP bidder making the same statement.
 - Map expected data onto the proposed Theory of Change and developing a clear data collection plan to ensure all questions are addressed and to systematically test the programme logic.
 - State the tests that will be used to scrutinise these causal claims and the quality of evidence you would expect to see
 - Identify areas where evidence already exists in admin or scheme data to avoid duplication of work with Arup+. This will also help to identify evidence gaps that will need to be addressed in the next stage.

Stage Two: data collection

Primary data collection will be used to address the evidence gaps identified in Stage One. It is envisaged that multiple stakeholders are to be interviewed. It is important to acknowledge that not all stakeholders will be interviewed for all aspects of the evaluation and for each Hy4Heat objective, therefore, the evaluation and objective are also listed below. A list of key stakeholders will be created during the initial stages of the evaluation.

Stakeholder	Number of individual face-to-face interviews	Evaluation	Objective
Work package contractors	16 (2 interviews per work package)	Process, impact	Objective One
Unsuccessful bidders for work package contracts	16 (2 Interviews per work package)	Impact	Objective One
Attendees of Hy4Heat events who did not bid for work package contracts	10	Impact	Objective Two
Industry stakeholders	20	Impact, economic	Objectives One and Two

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BEIS – Hy4Heat programme team	5	Process, impact, economic	Objectives One and Two
BEIS – Policy	6 x 2 = 12	Impact	Objectives One and Two
Arup+	6	Process, impact, economic	Objective One
Total	85		

Impact evaluation:

Objective One: advance of technical innovations

- Stakeholder interviews with WP contractors (n = 16, 2 per work package) to understand the advance of technical innovations during the Hy4Heat programme, how knowledge and skills have been advanced in their company and what work in this area they will continue to do after the Hy4Heat programme has finished. Arup+ are responsible for evaluating the technical impacts of each WP and so their evaluation activities will inform the technical impact that these companies have achieved. The evaluation contractor will be responsible for evaluating the *how and why* such impacts have been achieved.
- Stakeholder interviews should also be conducted with those who applied to complete the work packages but were not successful (n = 16, 2 per work package, where possible and accessible). The purpose of this is to understand what work surrounding using hydrogen for heat they are doing outside of Government-funded initiatives. This will also include an understanding of the impact of other related programmes of work. If they did not continue with hydrogen-related activities, the interview will aim to understand the barriers for not continuing with this.
- Quantitative data to inform the understanding of whether there has been technical advancement could also involve assessing the following aspects, amongst others:
 - Number of patents for relevant technologies
 - Number of relevant published articles on hydrogen
 - Changes in technology efficiency or Technology Readiness Level (TRL)
- Other sources of quantitative data could include the KPI data collected by Arup+ and data gathered from relevant academic journals, industry press, social media and patent databases. Other sources of relevant quantitative data could be assessed in stage one of the evaluations.

Objective two: stimulate industry

- 20 face-to-face 1-hour interviews with key industry/sector stakeholders
 - It is envisaged that these interviews could include the following stakeholders: HSE, Ofgem, standards bodies, DNOs, trade associations, manufacturers, academics and Committee on Climate Change.
 - The evaluation contractor should work with policy colleagues and Arup+ to identify key industry stakeholders who are either pro-hydrogen or anti-hydrogen or ambivalent/hesitant about it to get a balanced view and to further the understanding of who the key stakeholders in this space are.

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- **These interviews should cover topics such as whether this programme has encouraged the private sector to conduct Research and Development (R&D) into using hydrogen for heat and to create plans and processes for if this is adopted in the UK.**
- **These interviews should assess not only the impact of the reports delivered from the Hy4Heat programme on industry but also the impact of events such as the announcement of the Hy4Heat programme. These interviews should also assess barriers and drivers for using hydrogen that industry currently see and what evidence they would need to overcome this.**
- **6 Interviews with policy colleagues in BEIS x 2**
 - **To understand whether, and how, the Hy4Heat programme has advanced policy thinking surrounding using hydrogen for heat in the future in the UK, what evidence gaps there are, whether Hy4Heat has added to the wider BEIS hydrogen approach/thinking and whether their needs have been met with the programme. These interviews should be conducted at the start of the evaluation and towards the end to understand whether the Hy4Heat programme has met policy objectives. Therefore, there should be a total of 12 interviews.**
- **10 face-to-face 1-hour interviews with individuals from companies who attended relevant Hy4Heat events, such as the launch event.**
 - **This will be to understand what relevant R&D they are doing and what the influence of the event was on these activities. This should also include an understanding of the impact of other related programmes of work and the input these have had on their work. The most appropriate companies to interview will be decided in stage one of the evaluations.**
- **In addition to the qualitative interviews, quantitative data could be gathered, including the following:**
 - **Amount of private investment in hydrogen**
 - **Number of new companies formed**
 - **Number of jobs supported**
 - **Number of new collaborations made**
 - **Amount of private follow-on funding**
- **One source of quantitative data could be from the KPI data collection process specifically the following KPIs that Arup+ are tracking:**
 - **KPI 3: Number (and size) of Organisations supported to deliver project (Lead Partner and Other Organisations as named on grant offer/ contract)**
 - **KPI 4: Number of active Business Relationships and Collaborations supported (Formal and Informal, Overall and New)**

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- KPI 6i: Initial Financial Leverage from the private sector to deliver project
 - KPI 8i: Follow-on Funding to take project further forward
 - KPI 9: reduction in carbon emissions
- Additional sources of quantitative data could be gathered from database analysis, such as Beauhurst, Pitchbook etc, social media analysis and analysis of industry materials, such as magazines and newsletters.

Process evaluation

- The same interviews with BEIS Hy4Heat (n=5) and Arup+ (n=6), plus the work package contractors (n=16) described above should also include process evaluation questions. These interviews should cover what has worked well and not so well in the delivery of the Hy4Heat programme, in addition to what learnings we can take from the contracted project management and novel approach to procuring the work packages.
- This aspect of the evaluation should help to provide insights into how best to manage and procure innovation programmes, how to manage the different types of procurement and to understand any learnings about barriers to evaluation that we can understand and apply to other innovation programmes.

Economic evaluation

- A modest economic evaluation should also be conducted that focuses on the two key aspects described below. BEIS has included detail on this aspect of the evaluation in the specification to allow bidders to suggest an appropriate methodology. However, it is important to note that the focus of this evaluation will largely be on process and impact aspects. We expect that up to 10% of the budget will be allocated to the economic evaluation.

1. How Hy4Heat has addressed the barriers in the economic case

- A key aim of the economic evaluation should be to understand to what extent and how the Hy4Heat programme has addressed the barriers and market failures that prompted the need for the Hy4Heat programme.
- Barriers and evidence gap that should be considered include regulatory barriers, high-upfront capital costs and uncertain consumer demand.
- Key market failures to consider include:
 - Imperfect information – firms are unsure about the safety and feasibility of hydrogen
 - Co-ordination failure – there is a significant coordination challenge given the fragmented gas industry
 - Unpriced negative externalities – the costs incurred to society as a result of continuing to burn fossil fuels to provide our energy
 - Unvalued benefits of knowledge spill overs – undervalued RD&D knowledge spill overs

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- **The Hy4Heat programme aims to correct some of these market failures and barriers by:**
 - **Demonstrating and providing evidence that hydrogen can be used safely for space and water heating and cooking**
 - **Developing tools and generating knowledge that can be utilised in other applications besides the original project**
 - **Equipping the government with some of the information it requires to make a strategic direction on heat decarbonisation.**
 - **Gathering evidence to understand whether these barriers and failures have been overcome, as the Hy4Heat programme intended will be done mostly through gathering of views across the programme of in-depth interviews as well as a review of market information. This should consider the extent to which the Theory of Change has been realised, which would involve both considering whether Hy4Heat has been successful in the wider context, and whether it has had a perceivable impact on the wider industry.**
 - **Once the evaluation contractor is in place, we will share the Economic Case, which provides further detail on the above proposed market failures and barriers.**
- 2. Cost-benefit analysis**
- **A proportionate cost-benefit analysis should be conducted to understand whether the programme represented value-for-money, attributing a monetary value on the impact and cost of the Hy4Heat programme. These should be monetised as far as possible but for impacts that can't be readily monetised then qualitative approaches will be taken. Only those costs and benefits that can be quantified will be included in the cost-benefit analysis. We don't envisage any new data collection for the economic evaluation, it should use existing data and data collected through the other workstreams.**
 - **The NAO² approach of the 3Es (economy, efficiency and effectiveness) should be used as an overarching framework for the cost-benefit analysis:**
 - **Economy: minimising the cost of resources used or required.**
 - **Efficiency: the relationship between the output from goods or services and the resources to produce them.**
 - **Effectiveness: the relationship between the intended and actual results of public spending.**
 - **Predicted benefits are:**
 - **Technology efficiency gains – monetised**
 - **Technology cost reductions - monetised**
 - **GVA – monetised**

² NAO guidance found here: <https://www.nao.org.uk/successful-commissioning/general-principles/value-for-money/assessing-value-for-money/>

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- Increase in jobs – monetised but not included in cost-benefit analysis as per HMT Green Book guidelines
- Increased knowledge – qualitative unquantifiable benefit
- Bringing a decision about hydrogen forward - qualitative unquantifiable benefit
- Spill overs: qualitative unquantifiable benefits
 - Stimulate investment in other areas of the UK gas sector
 - Stimulate further research in this area – R&D spending
- Wider benefits include:
 - Investment in R&D in hydrogen networks and in adapting commercial and domestic appliances - monetised
 - Developing UK export markets in the longer-term - qualitative unquantifiable benefit
- Predicted costs include:
 - BEIS input, both financially and in terms of admin input- monetised
 - Cost of WP contracting processes (including to unsuccessful tenderers)- monetised
 - Cost of PMC- monetised
 - Resource commitment from contractors - monetised
- Quantitative data to inform the cost-benefit analysis could be collected from:
 - KPI data specifically KPIs 5 (Advancement of Low Carbon Solutions- Technology Readiness Levels), KPI 6 (Initial funding) and KPI 6ii (follow-on funding to take the project further).
 - WP outputs, specifically about the cost of developing domestic commercial and industrial hydrogen appliances (WPs 4, 5 and 6, respectively).
- Further qualitative information to inform the cost-benefit analysis should be collected in the above stakeholder interviews with BEIS Hy4Heat team, Arup+ and industry/sector stakeholders.
- It is expected that this analysis should be conducted at the latter stages of the evaluation, conducted by an economist. A benefit to cost ratio should be developed that is based on a comparison of the resource costs and the benefits involved with the programme. This should align with the principles of the HM Treasury Green and Magenta books. Outputs will be a cost-benefit analysis, spreadsheet and write up.

Stage Three: synthesis and Theory of Change review

Given the collection of data across several interviews and across the two objectives, a

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synthesis stage is likely needed to collate the data and understand the overarching story and impact of the Hy4Heat programme.

It will be at this stage that the Contribution Analysis will be conducted. The evaluators should go back to the original Theory of Change and understand whether the evidence collected fits with the framework, and revise and strengthen this if necessary. This should involve assembling and assessing the contribution story and assessing the evidence collected against the causal statements made in the scoping stage to make a judgement about causal claims. This should also include a comparison of the results to the wider BEIS hydrogen programmes to provide an understanding of how the Hy4Heat programme has added to the wider BEIS hydrogen approach. The contractor should also propose a method to assess the robustness of the data. The robustness of the evidence should be considered in the syntheses.

Key methodological considerations

Decision points for the evaluation

It is important that an as near to real-time evaluation as possible occurs alongside the delivery of the Hy4Heat programme and so there will be quarterly updates to the Hy4Heat Programme Board; contractors should ensure that they allocate enough time to prepare updates for the Board and attend the board quarterly. Where there are issues or findings from the evaluation that have decision-making implications, this will be fed back immediately to the Project Manager who will then decide on whether escalation to the Hy4Heat

programme board is needed. Evaluation contractors should be aware of the need to feedback important information to BEIS regularly and to engage in weekly calls to ensure real-time learning can occur.

Methodological considerations

Length of Interviews

- Interviews will be up to 1 hour in length.
- Interview lengths will vary depending on whether the interviewee is answering questions related to the impact, process and/or economic evaluation and both objectives.

Sampling

- Our envisaged participants are those who are involved in delivering the WPs, who were unsuccessful in the tender process for the WPs, who have attended Hy4Heat events and industry stakeholders.
- BEIS have contact details for these envisaged participants. All individuals will be contacted and asked to participate in the evaluation by the Evaluation Contractor. The sample sizes described above reflect actual conducted interviews, not the number of individuals approached to participate.
- Given that the programme is currently being run, BEIS anticipates no problems with engagement from BEIS stakeholders, Arup+ and WP contractors.
- For unsuccessful WP bidders, there were between several separate bidders. BEIS anticipates that the evaluation contractor should be able to achieve two interviews per WP, but it will be important that all unsuccessful bidders are contacted to take part. It is envisaged that BEIS will notify these of the evaluation and ask them if they would like to be involved. Participation will be framed around giving the company an opportunity

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to show what work they have completed that is relevant to Hy4Heat and provide their input and ideas. Evaluation contractors should suggest alternative ways to encourage participation in stage one of this project.

- BEIS suggests that the evaluation contractor speak to 20 industry stakeholders. The Hy4Heat team have a stakeholder database of 300+ individuals. BEIS do not envisage any issues with accessing these respondents due to them having already keen interest in the Hy4Heat programme. It is envisaged that BEIS will contact relevant stakeholders to inform them of the evaluation and ask them if they would like to be involved.

Addressing bias

- This approach makes most use of qualitative data and therefore it will be important for the evaluation contractor to address potential issues around bias and to ensure the evaluation stands up to scrutiny.

Timings

- The Hy4Heat programme is due to complete in March 2021. The evaluation will then continue for 6 months after project completion.
- The majority of the evaluation will aim to be conducted during the programme, but it is likely that the economic evaluation analysis will be conducted after the programme has finished to allow for a complete picture of the programme. An interim impact evaluation will be conducted during the programme to allow for changes to be made and then the full impact evaluation will be conducted in the 6 months after the programme has ended.
- BEIS requires that evaluation contractors should ensure access to data for all participants for at least 3-5 years after programme closes and that BEIS/evaluation contractor can contact the participants for further information, if necessary.

Key considerations for bidders to note

Database Access Costs

As can be seen in Stage One, we have requested that the evaluation contractor provides access to databases relevant for this project. In your bid documentation, please include the database access as a separate line in the pricing schedule.

Structure of the bids

The maximum page limit for tenders is 18 (excluding declarations, pricing schedule and CVs).

Working with stakeholders

It is essential that the evaluation contractor includes enough time for working with key stakeholders in the evaluation. There will need to be sufficient time for working and meeting with Arup+ as the PMC and a key stakeholder to ensuring the success of this evaluation.

Conflict of Interest

For research and analysis, conflict of interest is defined the presence of an interest or involvement of the contractor, subcontractor (or consortium member) which could affect the actual or perceived impartiality of the research or analysis.

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This evaluation must be independent from perceived and actual conflict of interest as it is essential that this work is robust, credible and free from bias.

Please note that the appointed supplier for this requirement will undertake evaluation of the Hy4Heat programme including all work packages delivered under the programme. BEIS therefore considers that there is potential for an actual or perceived conflict of interest if companies who have delivered work packages to date under the Hy4Heat programme were to bid for this work. In their tender response, all tenderers (regardless of prior involvement of the Hy4Heat programme or not) are required to ensure that any actual or perceived conflict is declared and satisfactorily mitigated. BEIS reserves the right to exclude any proposals where the bidder has an actual conflict of interest that cannot be mitigated to the satisfaction of BEIS.

Working Arrangements

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

The successful bidder will be expected to work closely with the BEIS policy and analytical teams, draw on BEIS' expertise knowledge and align with on-going analytical projects to ensure appropriate research design and learning outputs.

The project will start with an inception meeting with key policy and analytical teams in attendance.

Bidders should assume that engagement with BEIS will include weekly project management phone calls, weekly progress update reports, steering group meetings (frequency to be confirmed), and face to face meetings as required to design, and deliver the chosen methods. Throughout the research, BEIS will be required to review and sign off all final data collection instruments, analytical approaches (including key assumptions) and outputs.

BEIS also expects that bidders will establish suitable internal working arrangements and channels of communication. As the research will involve multiple work strands feeding into various research activities, it is important that people assigned to different tasks regularly communicate, feedback and understand what else is happening. It will be the responsibility of the bidder's project manager to ensure that this occurs.

The quality assurance within BEIS requires external peer review of all evaluation reports. BEIS will appoint an external peer reviewer and the successful bidder will be expected to engage and work with this person to maximise the robustness and utility of the research.

Required Skills

BEIS would like you to demonstrate that you can apply your organisations expertise, capabilities and skills to undertake the project. Your tender response should include a how your team will apply their skills and expertise to the following and how this will enable the successful delivery of the project.

The following elements are considered particularly important for this work:

- Application of the understanding to the Innovation and UK energy policy landscape;**
- Application of specialist knowledge and expertise to the sector;**
- Designing, undertaking, project managing and reporting large-scale process, economic and impact policy evaluations, including primary and secondary data collection and research;**
- Application of theory-based evaluations in a policy evaluation context, specifically creating and using Theory of Change and ideally knowledge and skills to contribution analysis;**
- Ability to engage private sector;**

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- Collaborative working with policy and analyst teams to understand the Hy4Heat policy aims to support the evaluation;
- Ability to deliver robust and high-quality analytical work;

Data Protection

All collection, processing and storage of personal data must be compliant with GDPR. Contractor must provide evidence to BEIS that practices are compliant with GDPR

Deliverables

The primary outputs will be:

- Interim evaluation report to provide a summary of progress and findings at an interim stage to be delivered at an appropriate point in the contract, likely during 2020. We expect the interim report to be approximately 30 pages in length.
- Final evaluation report providing a full, independent evaluation of Hy4Heat to be delivered in Q3 2021. We expect the final report to be approximately 50 pages in length.
- Full technical evaluation report containing all the technical details of the research undertaken as part of the evaluation to be delivered in Q3 2021.

Additional outputs include a slide-pack and presentation for each the interim and final report. We expect each of the presentations to last approximately 45 minutes, and slide-packs to contain an appropriate level of detail for this length of presentation. Quarterly updates to the Hy4Heat board will also be required in the form of short notes and/or brief PowerPoint presentations.

In line with GSR publications guidance we would expect that the evaluation reports will be published to support policy consultations/strategy documents and for transparency. All quantitative raw data should be sent to BEIS. We intend to publicly archive our data; however, the feasibility of doing so will be addressed during the project.

Quality Assurance

Bidders must set out their approach to quality assurance in their proposal. Bidders must:

- Ensure that quality assurance is done by individuals who were not directly involved in the research; analysis or model development
- Specify who will be responsible for quality assurance before it comes to BEIS

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. BEIS reserves the right to refuse to sign off outputs which do not meet the required standard specified in this Invitation to Tender. The Contractor must state how all work on the project will be quality assured within the proposal.

The Contractor will be expected to produce high quality reports that meet the following criteria:

General:

- Answer the research questions clearly, in plain English
- Clearly structured so that information presented in each section of each report is clear
- Connections between sections are clear

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- **Executive summaries of no more than two sides that set out the findings clearly and their relevance to BEIS policies**
- **All sections have clear introductions and conclusions (including findings being written concisely upfront)**
- **Methodology clearly explained so others could repeat the work in future.**

Use of good quality English:

- **Thoroughly proof-read and peer reviewed for writing quality**
- **No jargon is used, and all terms are defined and referenced clearly**
- **All acronyms are written out in full the first time that they are mentioned in each section of each report**
- **No grammar and phrasing errors**
- **No typos / typographical errors present**
- **Concise and non-wordy sentences and paragraphs**
- **Concise reports that are not too long and do not have vast annexes**

Visualisations:

- **All visualisations are labelled**
- **All axes are labelled, including with appropriate units**
- **Clear and appropriate use of visualisations (large enough size, data can be read clearly without reference to the raw data, and there are not too many visualisations presented at once)**
- **All visualisations are clearly explained and discussed**
- **A range of different types of visualisations are used to provide more interesting and innovative ways of presenting the results**

Where complex or innovative methods are proposed, bidders should specify how additional quality assurance will be provided. Where necessary, this should include the use of external expertises.

Outputs will be subject to BEIS internal approvals, the more substantive the output the longer the approval time required. Both published and other reports will require three rounds of comments, which should be factored into the timelines. BEIS may wish to appoint an external peer reviewer to provide a high-level peer review.

The successful bidder will be responsible for any work supplied by sub-contractors.

BEIS reserves the right to request an audit of projects against the BEIS Code of Practice for Research and the commitments made in the tender documents and subsequent contract.

For primary research, contractors should be willing to facilitate BEIS research staff to attend interviews or listen in to telephone surveys as part of the quality assurance process.

Other useful sources of guidance and advice that will help bids and the resulting work be of the highest quality include:

- **The Government Social Research Code, in particular those that relate to GSR Products:**
- **UK Statistics Authority Code of Practice or an equivalent standard.**
- **The Magenta Book, Government guidance on policy evaluation and analysis.**
- **Supplementary Guidance on the Quality in Policy Impact Evaluations**
- **Quality in Qualitative Evaluation: A Framework for assessing research evidence provides a Framework for appraising the quality of qualitative**

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evaluations.
The Green Book: appraisal and evaluation in central government.