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Open Letter to the Gas Distribution Networks regarding expectations for the Detailed Design Stage of the Hydrogen Village Trial

In the Ten Point Plan for a Green Industrial Revolution, the Government committed to support industry to deliver a 100% hydrogen heating neighbourhood trial by 2023 and a village trial by 2025. These trials will provide essential evidence to inform Government's strategic decisions in 2026 on the role of hydrogen for decarbonising heat in buildings.

In July 2021, Ofgem and the Department for Business, Energy and Industrial Strategy (BEIS) published a joint letter[1] inviting the Gas Distribution Network companies (GDNs) to prepare outline designs for the village trial (Stage 1) and to submit applications to Ofgem for funding to support the subsequent detailed design stage (Stage 2) by 17 December 2021[2].

On 6 May 2022 Ofgem published its decision on which Stage 2 detailed design studies to fund, following consultation with stakeholders and support from BEIS.[3]

We would like to congratulate Cadent and NGN on being selected to proceed to the next stage of the project. We believe that both proposals have the potential to generate diverse, quality evidence that will help the Government reach a decision on the role of hydrogen for decarbonising heat in buildings.

We would also like to thank SGN and WWU for their work in preparing their proposals. Both GDNs will continue to play an important role in development of the village trial, including through the collaborative industry projects outlined in the Annex submitted jointly by the GDNs. SGN will also continue to play a critical role in generating real-world evidence through the delivery of the neighbourhood trial in Fife, while WWU will support NGN's village trial proposal.

This letter builds on our joint letter of last July, which set out the objectives and benefits we are seeking to achieve through supporting the village trial. The guidance and annexes below set out our approach to managing Stage 2, and the expected requirements for GDN's applications in March 2023 for subsequent funding to build the infrastructure and operate a hydrogen village. These applications will be used by

[1] Available at: https://www.ofgem.gov.uk/publications/hydrogen-consumer-trial-open-letter-gdns
[2] Ofgem's funding for Stage 2 is under their RIIO-GD2 Net Zero Pre-Construction and Small Projects re-opener ('the NZASP re-opener').
[3] Available on Ofgem's website, alongside this Open Letter.

BEIS and Ofgem to select the location for the trial. The guidance and annexes should be considered jointly with the project directions published in Ofgem' NZASP decision.

We would like to thank all GDNs again for delivering high quality outline designs during the first stage of this project. We look forward to continuing to work closely with you to deliver a successful hydrogen village trial.

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Hydrogen heating village trial: detailed design – Guidance for GDNs

1. This document provides guidance to GDNs for the detailed design stage of the hydrogen village trial. The guidance on overall objectives and purpose and general eligibility principles set out in the joint letter of July 2021 still applies. Following the completion of Stage 1, future stages of the trial are summarised in the table below.

Table 1. Future Village Trial stages

Stages	**Description**	**Indicative Dates**
2. Detailed Design	Development of detailed plans to enable a go/no-go decision on whether to proceed with the procurement and engineering work required for a particular trial location and design, and investment decisions associated with this.	End 31 March 2023
3. Prepare and Build	By the end of Stage 3, project developers will need to demonstrate that they are ready to begin installation in consumer properties and the conversion to hydrogen.	Mid 2023 onwards
4. Go-live and Operate	Activities will include installation in consumer properties, conversion, system implementation (e.g. settlement/billing), operation of the trial, evidence collection and benefits realisation.	To begin 2025 at the latest. We anticipate this stage will last for at least two years
5. Trial exit	Activities will include either planning for the continuation of the project or decommissioning all necessary system engineering work and property installations, and data gathering and evidence analysis.	TBC

Governance and reporting arrangements

2. A flexible approach to governance will be required during Stage 2. Initially, we will adopt a similar approach to Stage 1, where the GDNs engage on a regular basis with Ofgem and BEIS on progress, risks and issues, and project timelines.

3. In parallel, we will work with stakeholders to agree an enduring, overarching governance framework for all the hydrogen heating trials. This overarching framework will bring together work on the neighbourhood trial as well as the village trial projects. The initial Stage 2 governance structures described below may need to be adapted to fit into this overarching framework.

4. We propose the following structures for Stage 2 for engaging and reporting to Ofgem, BEIS and others:

- Project Steering Groups: NGN and Cadent to each lead a group for their respective projects. They will use this forum to provide project updates and progress against project plan and deliverables, invite challenge, manage dependencies with the collaborative work and facilitate discussion of key risks and issues. The groups will meet every four weeks with the two GDNs proposing a list of attendees which should include BEIS, Ofgem and HSE when required. Progress reports will be presented to BEIS' Hydrogen Heating Programme Management Board (PMB) every 6 weeks and shared with Ofgem. The GDNs will provide information to BEIS who will coordinate reports for discussion.
- Hydrogen Village Trials Forum: BEIS to lead. This forum will be used to discuss common issues across both projects and to monitor and discuss progress on the collaborative workstream areas. It will meet every six weeks, with the four GDNs, National Grid, BEIS, Ofgem and HSE attending, and will report to PMB.
- Hydrogen Village Trial Working Group: GDNs to lead. This group will be used to monitor the delivery of all collaborative trials projects: this includes oversight of projects managed by the End User Safety Evidence Working Group that relate to trials. The group will meet fortnightly with the four GDNs, BEIS, Ofgem and HSE attending. It will report to PMB and will also provide detailed project scopes, project plans and update to risk registers to BEIS and Ofgem. We are proposing that this group also provides working level updates to the Village Trial Forum as requested by BEIS.

5. These groups do not preclude additional engagement that may be required, for instance on emerging issues, when GDNs need to provide evidence to the HSE Evidence Review Groups, or with other Government Departments if necessary (such as DLUHC on housing and local community issues).

Applications for funding for subsequent stages

6. The four GDNs should continue working together to manage and deliver the collaborative projects required to enable the trial. To enhance value for money and promote consistency, we expect them to continue to identify and work together on any further areas of common interest, such as consumer protection plans.

7. Applications for funding for Stages 3-5 must meet the requirements in Annex A and should be received by **31 March 2023.** BEIS and Ofgem will assess the applications and a decision will be made on the location of the village trial. We will confirm details of the exact form of the submission and the decision-making process in due course. We expect that the submission at the end of Stage 2 will be the final funding application required for the village trial, although release of any awarded funds is likely to be subject to further stage gates and conditions.

Trial duration

8. We expect the trial to start in mid-2025 and to last a minimum of two years. This timing will maximise the likelihood that a robust and representative set of evidence

can be collected from the trial to inform strategic decisions on the role of hydrogen in heating in 2026. It should also allow sufficient time following strategic decisions to make considered decisions on the future of the trial and implement the appropriate exit or transition strategy in a carefully managed way.

Evidence framework

9. The Trials Evidence Framework developed by BEIS was reviewed at the end of Stage 1 and the *Trials Evidence Framework v4 April 2022* is shared in Annex B of this document. It is our expectation that, as work continues on the hydrogen village trial as well as on the neighbourhood trial and wider programme and new evidence gaps emerge, there will be a need for further iterations of the Framework. This will ensure that evidence asks for the village trial continue to reflect Government's needs for making strategic decisions on hydrogen heating in 2026. The change control process for iterating the Trials Evidence Framework will be discussed and agreed with the GDNs during Stage 2.

10. In due course BEIS will also share with the GDNs an Annex to the Framework which will provide advice on how evidence in the framework may be generated, how monitoring and evaluation can be embedded in the trial (including consumer research), and expectations on data sharing. It is anticipated that further discussions with Cadent and NGN will be required to build on this advice to help inform the development of detailed evidence plans.

Funding arrangements

11. We anticipate that BEIS and Ofgem will jointly support future stages of the trial, after Stage 2. We are working together to develop funding arrangements, mechanisms and processes and will share this with the GDNs at a later date.

12. We expect a proportionate private sector contribution to the costs of the village trial, reflective of the benefits that participating organisations receive or could receive in the future. GDNs should plan for an appropriate contribution and consider how to secure the same from their project partners.

Consumer protection

13. Consumer protection is vital, particularly considering the novel nature of the hydrogen heating grid conversion trial. The impact on consumers has been and will continue to be a key consideration in the development of the trial and ensuring consumer protection will be embedded in its delivery. When engaging with consumers, the GDNs should comply with the applicable regulations and demonstrate consideration of and adherence to the framework of consumer protections outlined in the response to the recent 'Hydrogen for heat: Facilitating a grid conversion hydrogen heating trial' consultation[4]. This framework includes principles which ensure transparency of information, appropriate oversight and redress, financial fair treatment, fair treatment for all, and quality of service. Ofgem

[4] https://www.gov.uk/government/consultations/hydrogen-for-heat-facilitating-a-grid-conversion-hydrogen-heating-trial

and BEIS will continue working with the GDNs and other stakeholders to ensure these principles are fully delivered in the village trial.

Developing the consumer offer

14. We look forward to working with the GDNs in developing their consumer offer. It is BEIS and Ofgem's expectation that the consumer offer will be fully aligned with the objectives of the trial and we expect to work with the GDNs to develop positions on key aspects (e.g. alternative offer, exit strategy, preventing any financial disadvantage, contractual arrangements with consumers) against agreed milestones throughout Stage 2.

Annex A: Detailed design – Requirements for Stage 3 to 5 funding applications

At the end of Stage 2, the GDNs should submit deliverables which include the following information (unless exceptions or amendments have been made by prior agreement with BEIS and Ofgem). BEIS and Ofgem will assess the applications for funding Stages 3 to 5 of the trial against these requirements.

Evidence Base

1. Detailed evidence generated during Stage 2, with information on how it has been assured, including:
    - Evidence generated against the Trials Evidence Framework (v4 April 2022), as well as any evidence generated additional to the Framework that could inform Stages 3-5 of the trial and the Government's view on the role of hydrogen in heating, including monitoring and evaluation evidence for consumer engagement. Please see the Trials Evidence Framework annex for further information on monitoring and evaluation.
    - Detailed survey data of type (e.g. building use, construction, type of tenure, leaseholder and freeholder arrangements) and number of properties included in the trial zone.
    - Detailed survey data on the range of consumer types likely to be included in the trial, including demographic data and protected characteristics (e.g. age, socio-economic classification, disability, race).

2. Detailed plan on how evidence will be generated in Stages 3-5, including:
    - List of all evidence expected to be generated during Stages 3 to 5 during the trial with reference to the Trials Evidence Framework, including anything additional to the Framework which could inform Government's understanding of the potential role of hydrogen for decarbonising heating. This should include a plan for how this evidence will be generated, including a high-level plan of the methodology, assurance processes and timing.
    - An initial monitoring and evaluation plan for the trial, including how consumer evidence (see requirement 18) and lessons learnt from delivery will be generated. Please see the Trials Evidence Framework annex for further information on monitoring and evaluation.
    - Plans on how GDNs will work with Ofgem and BEIS to identify and address any emerging evidence gaps that may inform the Government's understanding of the potential role of hydrogen for decarbonising heating.
    - Assessment of any substantial evidence gaps expected to remain after the completion of the trial and their implications.
    - Method of collecting, storing, measuring, and assuring evidence, including how the GDNs will work with Ofgem and BEIS to ensure data is shared in an interoperable format. This will involve contributing to the design of a possible Evidence Management System being considered by BEIS (please the Data Sharing section of the Trials Evidence Framework annex for further information).
    - Plans on how to share knowledge with other GDNs and interested parties, including plans on data sharing and collaboration.

3. Case for safety:

- Key conclusions of the safety evidence work so far, views from HSE (if applicable) and remaining key safety evidence gaps.
- Final detailed plan of the evidence the network intends to submit to HSE before the Trial, based on the HSE 'Safety considerations for a hydrogen trial' document and the 'Guidance on the development of safety evidence for a hydrogen conversion trial' (to be shared by HSE in Spring 2022), including content of the case for safety, timeline for delivery of each element of the case for safety and supporting evidence to HSE.

Planning and project delivery risk mitigation

4. Detailed plan, schedule and scope of work for stages 3-5, including:
    - Schedule of the deliverables and milestones to be met during Stages 3 to 5, including: detailed project programme for Stage 3 (Build and Prepare), plan and schedule for Stages 4 (Operational) and 5 (Exit). (See requirement 8 on Exit plan details). Scope of work, project deliverables and stage gates should be identified for each stage. The plan should also include a critical path analysis, including identifying long-lead time tasks and impacts of delays on project delivery.
    - An assessment of the key delivery risks to the project and how the schedule takes account of these e.g. provision of contingency time.
    - Contingency plans for any severe project delays that would put critical deliverables at risk.

5. Costs and funding plans, including:
    - Comprehensive costs and profile of expenditure (capex and opex) over the lifetime of the project broken down by individual expenditure items by year, including commentary covering cost uncertainties and ranges.
    - Funding plan for the whole project including proposed contributions from the network, project partners, Government and through the RIIO price control mechanisms.
    - Firm cost estimates for Stages 3 and 4 and associated funding plans with contingency items clearly identified.
    - Expected costs for Stage 5 for the exit scenario(s) for the trial (See requirement 8 on Exit plan details) with associated funding plans.
    - Details of availability and costs of liability insurances for the complete project including both upstream and downstream components.

6. Organisation of responsibilities, including:
    - Structure of the project delivery team (organisational chart).
    - Detailed description of overall strategy for management of the project, management processes, governance structure, ownership of responsibilities and description of capabilities.
    - List of partners, contractors and suppliers, with firm agreements / arrangements in place where appropriate (including memorandums of understanding and letters of intent) detailing their responsibilities including for procurement, ownership and delivery of assets and services.

7. Evidence of satisfactory regulatory model, including:
    - Regulatory barriers identified and a description of the agreed solution(s) with relevant parties to resolve these (such as licences granted and exemptions sought). This should include, but is not limited to, regulatory issues associated with:
        - Production / storage / distribution of hydrogen or at any other point during the supply chain.
        - Alternative options given to consumers.
        - The approach to metering, for all meter types (including PPM customers) and supply-point types (1-4) in the trial area.
        - The approach to billing, including solutions to the charging of VAT at a different rate to natural gas.
        - Consumers in the trial areas switching between energy suppliers.
        - How property prices, mortgage and insurance policies will be affected in the trial areas, including implications on energy performance certificates (EPCs).
        - Planning and permitting, including at a property level, spatial planning and wider implications (roadworks etc.), as well as any other permissions needed at a local authority level.
        - Building Regulations.
        - Different tenure types, including the rights and responsibilities of different groups, such as domestic and non-domestic landlords, tenants, sub-tenants and owner-occupiers, as well as leaseholders and freeholders.
        - Interaction with any relevant government renewable, energy efficiency and fuel poverty schemes and policies.
        - Any further regulatory frameworks that may require amendment or derogation to facilitate the trial which were not identified in Stage 1, including industry codes and licences, and primary and secondary legislation.
    - Where an issue has not yet been fully resolved, a viable solution should be proposed, with a clear indicator of what the network considers should constitute evidence of resolution and estimated date of resolution.

8. Development of the exit plan:
    - The network must set out the plan for reverting to natural gas.
    - If the network chooses, they may also explore possible electrification and / or continuation of providing hydrogen.
    - For each option, work should include:
        - identification of necessary infrastructure works.
        - cost estimates and funding routes.
        - strategy for handling consumers' appliances and installations.
        - identification of necessary long-term market and regulatory changes to enable the option (if temporary exemptions were granted during the trial).

    - evidence that consumers are aware of any long-term opportunities and risks associated with all potential exit plans.
- The network could either select a preferred scenario or set out enabling conditions associated with each scenario and a decision process designed to narrow options to one single scenario.

9. Risk register:
    - Updated project risk register, including evidence of mitigation against the risks identified during Stage 1, and identification of any further risks and evidence of plans to mitigate these.

Infrastructure and Delivery

10. Plan to provide resilient hydrogen supply, including:
    - Detailed plan for hydrogen production including location and design of facilities, list of required equipment, and where possible, a preliminary Reliability, Availability and Maintainability (RAM) study, evidence of offtake agreements signed with producers, evidence of FIDs taken by producers, evidence of access agreements / permits if relevant.
    - Detail on greenhouse gas emissions associated with hydrogen production using the methodology set out in the Low Carbon Hydrogen Standard guidance[5] and, where appropriate, evidence that the Low Carbon Hydrogen Standard has been met in order to be able to seek financial support through relevant government funds (Net Zero Hydrogen Fund, Hydrogen Business Model).
    - Detailed plan for storage and other strategies for supply resilience such as back up sources, including evidence of agreement signed with partners and evidence of access agreements if relevant.
    - Detail on readiness of new technological solutions and how risks associated with these will be managed.
    - Where the commercial approach involves procurement, demonstration of readiness to procure including evidence of market engagement (including quotations where relevant), confirmation of internal approvals, and preparation of invitation to tender materials.

11. Plan to provide alternative solutions to consumers, including:
    - Indication of likely numbers of domestic and non-domestic consumers who will require an alternative solution and plan for approach where non-hydrogen solutions need to be implemented (including the main technology option, how it will be funded and any additional arrangements required to make it a viable solution for the consumer, such as the need for insulation,).
    - Evaluation of impact of non-hydrogen options, including issues such as the impact of electric solutions on electricity network capacity and extent of

[5] https://www.gov.uk/government/publications/uk-low-carbon-hydrogen-standard-emissions-reporting-and-sustainability-criteria

reinforcement work required, or in the case of bottled gas, how it will be supplied.

- Evidence of engagement or agreements with relevant third parties who will act as partners for this element.
- Where the commercial approach involves procurement, demonstration of readiness to procure including evidence of market engagement (including quotations where relevant), confirmation of internal approvals, and preparation of invitation to tender materials.
- Contingency plan in case new consumers (consumers or business) choose to opt-in at a later date during the trial, including those with potentially complex safety cases.

12. Design and plan for grid conversion, including:
    - Detailed design and plan for grid conversion across the trial zone, setting out the reasons for the chosen approach (overall disruption, time off gas for consumers, cost, environmental impact); the timeline (for procurement, conversion); measures in place to ensure isolation from natural gas infrastructures. As well as plans and designs for new infrastructure and modifications of existing infrastructure, this should include proposals for ongoing operation (including operating parameters such as pressures and velocities, and approach to maintenance).
    - Where the commercial approach involves procurement, demonstration of readiness to procure including evidence of market engagement (including quotations where relevant), confirmation of internal approvals, and preparation of invitation to tender materials.
    - Plan for “de-conversion” to return to natural gas (as part of the exit plan).

13. Detailed procedures for end-users’ conversion, including:
    - List of building/premises likely to participate, including details of gas consumption and usage.
    - Process by which engineers/installers will confirm suitability for conversion, undertake risk assessments and confirm safety mitigations to be applied – with reference to relevant standards.
    - Assessment (based on surveys and other safety evidence) of the safety mitigations and any other adaptations likely to be necessary in participating premises, including to pipework, building fabric (e.g. new vents) and meter location.
    - Identification of premises which will require an individual risk assessment/management plan, the reasons why a bespoke approach is required (e.g. presence of boosters, risers etc.), and a detailed outline of the approach to be taken.
    - Full details of the types and quantities of all hydrogen appliances required, and assessment of confidence in availability, supported by evidence.
    - Detailed procurement strategy (including commercial assumptions made, risks and mitigations) for all conversion work, including appliances, ancillary devices and all necessary components. This should include agreements already

reached with manufacturers to supply these elements and approach to ensuring adequate reliability.
- Detailed costs and impact assessment of all end user conversion work, including the estimated duration and disruption to end users of all conversion activities.

14. Workforce and training
    - Detailed plan on recruitment and training to ensure both upstream and downstream, workforce capacity and capability throughout Stage 3 to 5, including evidence of contingency plans to mitigate workforce attrition during the Trial.
    - Evidence of GDNO training standards (including competency assessments) and courses developed.
    - Evidence of draft agreement with downstream gas safe registered engineering companies for work to be carried out in consumers' houses.

Public and Local Engagement

15. Comms and Stakeholder Engagement, including:
    - Outputs and outcomes of all public and consumer engagement activities conducted in Stage 2, including surveys of consumers and visits to premises. This should include information and evidence of meaningful engagement and local support for the project. GDNs should give evidence that indicates likely trial uptake and an assessment of any key risks/issues associated with consumer participation based on engagement so far.
    - Outputs and outcomes of engagement with local partners, local representatives, consumer groups and other interested parties, including stakeholders that support consumers with additional needs and consumers in vulnerable situations.
    - Detailed comms and consumer engagement plans (covering pre, during, and post-trial). This should include:
        - Detail of proposed comms and engagement activities, with consideration of the engagement needs of different consumer groups, including vulnerable consumers, tenure types (including freeholders and leaseholders) and demographic groups. This should outline the aim of the engagement and the rationale for the approach / methods / activities proposed. Appointments with installation / maintenance engineers and consideration of the role of landlords / tenants should also be incorporated. This should also cover who would need to give final permissions e.g. for what appliances are in installed and how the GDNs will manage conflicts between different groups (e.g. tenant and landlord or freeholder/ leaseholder).
        - Detail of the customer journey and what will be required from consumers at each point.

- Details of how the risks and opportunities of the trial are communicated clearly to consumers, so they can form specific, fully formed and timebound consent.
- Detail on proposed governance structures for seeking views from key stakeholders.
- A detailed media comms plan.

16. Consumer Offer, including:

- Overarching consumer strategy for both domestic and non-domestic consumers (including those who are vulnerable), informed by consumer engagement. This should include details of the proposed contractual arrangement with participating consumers:
  - The finalised consumer 'offer', including proposed options for consumers/businesses who do not wish to or cannot participate and how this can be funded. This should also include how the offer will be presented to different stakeholders who are affected (such as leaseholders, freeholders, occupiers and landlords).
  - Proposed billing strategy for hydrogen supply, including billing rates and charges and an assessment of the impacts to consumers.
  - Terms and conditions with respect to consumers being able to change their mind and their rights to do so, including timelines and any other stipulations. These should be agreed by working with other GDNs.
  - Customer service arrangements.
  - Provisional contractual arrangements between consumers and the GDN with respect to installation and maintenance of equipment (and ancillary work), including a clear strategy for managing changes of ownership during the trial period.
  - Detail on what costs will be included by the GDNs in the consumer offer and what is expected to be covered by consumers, including ancillary works, and how the GDNs will support consumers to manage unforeseeable costs.
  - Provisional contractual arrangements between different stakeholders (including occupiers, landlords and freeholders/leaseholders) in compensation for disruption.
  - Post-trial arrangements, including the exit plan, and options provided to consumers then, and an assessment of the impacts to consumers, e.g. on choice and disruption.
  - Evidence that an equality impact assessment was carried out when developing the consumer offer.
  - Provision of plans to manage any issues regarding heating quality or cost. For example, in the event of high cost of energy, appropriate measures to ensure consumers are not financially worse off and, in the case of poor quality heating for non-hydrogen users (e.g. due to lack of insulation), appropriate measures so that quality of heating is maintained.
- Details of intended messaging around the consumer offer:

- Details of how key consumer benefits to the Trial will be communicated with consumers and considered within the Trial design.
- Details of how options for alternatives will be presented, including how the option of hydrogen will be encouraged whilst maintaining choice and aligning with consumer principles on cost parity.
- Details of how social research undertaken has informed this planned messaging.

17. Consumer protection plan, including:
    - Detail on demographics of consumers within the Trial area, including number of consumers on the Priority Services Register. The definition of a 'vulnerable consumer' in the specific context of a Trial should be agreed between GDNs, BEIS, and Ofgem and be consistent with existing policy.
    - Plan for delivery (including options and contingencies as necessary) and ongoing monitoring of the consumer protection framework set out in the government response to the BEIS consultation 'Hydrogen for heat: facilitating a 'grid conversion' hydrogen heating trial'. This should include identifying areas for further improvement.
    - Finalised strategies for different consumer groups, including vulnerable consumers, informed by consumer engagement. The offer should ensure that all engagement and materials are inclusive. For materials, this may include using accessibility guidelines and standards where they are available and cognitive testing to inform the design.
    - An outline and assessment of other consumer issues, such as impact of the trial on the property market (e.g. property transactions, mortgages and insurance), and strategies to address these to minimise impact on consumers.
    - Contingency plans for changes to consumers' situation during the Trial such as change of ownership/tenancy of properties or business closures.
    - Outline of roles and responsibilities of different organisations involved in the consumer protections regime, including local authority, local support groups etc.
    - Assessment of any safety, cost or housing quality risks, with appropriate mitigation plans. For example, in the event of loss of property value due to any perceived safety risk, plans for compensating consumers.

18. Consumer Evidence:
    - Consumer evidence should be seen as part of the overall monitoring and evaluation of the trial. Plans for how the consumer evidence in the Trials Evidence Framework (strands 1-41) will be generated should be included in the initial monitoring and evaluation plan (See requirement 2).

Annex B: BEIS Trials Evidence Framework v4 April 2022

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
Consumer	**Consumer attitudes & perception**	1. Social acceptance data in and outside trial areas to evaluate changes in domestic consumers' understanding of hydrogen heating compared to other energy sources (e.g. natural gas, electrification) before, during and post-trial.	**Stage 1 – 5**
		2. Social acceptance data in and outside trial areas to of hydrogen use in commercial and industrial settings to evaluate changes before, during and post-trial	**Stage 1 – 5**
		3. Consumer attitudes and familiarisation time to using hydrogen only meters and converted natural gas meters (H2 ready meters) compared to natural gas meters.	**Stage 4**
		4. Consumer attitudes to the cost of hydrogen before, during and post-trial. Including: a. New pricing / billing system b. Cost of new appliances c. Cost of modification needed to the property d. Any other associated cost resulting from converting to hydrogen (*cost will be mitigated in the trial, however we can still collect evidence on consumers' attitude and perception to hydrogens affordability and whether they see it as 'worth-it' post-trial)	**Stage 1 – 5**
		5. Consumer attitudes to preparatory engagement, including on: a. Consumer understanding of trial purpose and practicalities b. Gaining local support c. Maximising consumer sign up to trial d. News coverage to facilitate consumer understanding (HHIC) e. Engagement on future environmental impact of the switch from natural gas to hydrogen gas (BSI) f. Different communication and engagement methods in the preparation of trials (e.g. postal, one-to-one, community event, online, app-based, or different combinations of these) g. Different communication methods used to engage commercial and industrial users	**Stage 1 – 2**
		6. Consumer perception of the frequency of engagement, communications and updates throughout the preparation and operation of the trial (e.g. at certain intervals, at critical project 'milestones', etc)	**Stage 4**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		7. Consumer perception and attitudes to different communication means and mechanisms for contacting the trial operators, (e.g. phone line, dedicated community contact, online FAQ page, chatbot, etc.) during and post-trials and data on which communication method is most used.	**Stage 2 - 4**
		8. Perception and attitudes to different communication means and mechanisms for vulnerable consumers and consumers who have accessibility requirements, including but not limited to - braille - British Sign Language - visually / sensorily / hearing impaired consumers - digitally excluded - consumers who speak/read/write English as an additional language	**Stage 2 - 4**
		9. Data on effectiveness of activities pre-trial on consumer acceptance and attitudes of hydrogen system (e.g. does it make a difference if they visited a showhouse, read a brochure, read information on previous trials, etc.)	**Stage 1 – 2**
		10. Data on consumers use of the communication channels provided by the trial operator, including: - confidence in the process of reporting hydrogen appliances faults - confidence in the process of reporting hydrogen leaks compared to natural gas leaks - confidence in the process for billing and payment queries - using the communication mechanisms when necessary and at appropriate times - perception of their queries being addressed appropriately and in a timely manner	**Stage 4**
		11. Consumer perception of and confidence in different stakeholders involved in trials delivery and the different sources of information on hydrogen (e.g. would consumers value information with HSE approval, from university studies, Government messaging to support information etc).	**Stage 1 - 4**
		12. Consumer attitude to additional energy-related support (not directly by the duty-holder) as part of the conversion process, including support to consumers such as: - conversations about energy use, - energy-related advice - impartial, independent review of the energy efficiency of consumer homes, - energy efficiency advice. - Redress routes and use of energy ombudsman	**Stage 4**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		13. Consumer attitudes towards installing energy efficiency measures at the same time as other changes made to convert to hydrogen, e.g: - Would they be willing to have additional works to install energy efficiency measures at the same time? - Would they be willing to pay for this work? - What information would be needed at what times in the process to encourage uptake of energy efficiency measures?	**Stage 2**
		14. Consumer perception on consumer protections in place, such as: -How well informed are they about protections in place? Do they know the routes to redress? -Did they feel the routes to redress were sufficient? -Do they understand how they are protected in the marketplace? -Do they believe there is a difference between being protected when using natural gas vs. hydrogen	**Stage 4**
		15. Consumer attitudes on perception of hydrogen safety prior to and during the trial, including on: a. General perception of safety and preparedness for trial b. Plans/instructions to maintain safety throughout trial, i.e. not blocking vents etc. c. Plans/instructions for any hydrogen incidents, i.e. being confident in what to do d. Safety perception of hydrogen vs natural gas e. Effectiveness of risk communications on consumers' attitudes and perception f. Commercial / industrial consumers' concerns about safety in the workplace g. the impact of any negative news / media coverage on the safety or other concerns around hydrogen on consumer support'	**Stage 1 - 4**
		16. Consumer attitudes to disruption related to their change from natural gas to hydrogen regarding intrusive works inside the property, such as: a. switching appliances and meters b. repositioning appliances and meters c. increasing ventilation to meet required standards (part F standards) d. boiler placement and subsequent re-routing of pipes & flues e. in-home pipework reparation and replacements f. in-home disruptions from switching back to natural gas from hydrogen at the close of the trial. g. electrical assessment (check earth wires are fitted, fit RCD spur units for boiler connects, etc.)	**Stage 3 – 4**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		h. Any other works or alternations resulting from the outcomes of a risk assessment for the installations of hydrogen in the property.	
		17. Consumer attitudes to disruption related to their change from natural gas to hydrogen regarding intrusive works outside properties, such as: - street works - repositioning meters - electrical assessments -Any other works or alteration needed	**Stage 3 - 4**
		18. Consumer reaction to time off gas (the length of time during the switch that properties are not connected to the gas grid) during conversion process. (*expecting time off gas to be longer for grid-conversion trials). Including on: - What is considered to be an acceptance / unacceptable time off gas - Specific concerns they have during this period - Concerns of commercial/industrial consumers during this period - What mitigations could be in place to make the time off gas more acceptable	**Stage 3 - 4**
		19. Consumer reaction to secondary heating appliances required during time off gas	**Stage 4**
		20. Consumer attitudes and experience of using hydrogen appliances (e.g. hydrogen cookers) for cooking over the course of the trial, including: -different flame behaviour flame colour and visibility speed of cooking increased moisture levels in the room - Familiarisation time with new appliances - Different noise levels of appliances	**Stage 4**
		21. Consumer attitudes and reactions to food cooked by hydrogen appliances commercially and domestically – does the food have the same quality of characteristics and produced with the same ease as natural gas	**Stage 4**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		22. Consumer attitudes and reaction to the models, size and colours of hydrogen appliances on offer and the impact this has on their willingness to participate in the trial.	**Stage 3 - 4**
		23. Consumer attitudes and experience of using hydrogen appliances (e.g. hydrogen boilers and gas fires) for heating over the course of the trial, including how effective hydrogen is at heating all rooms of the property, the familiarisation time and noise levels of the appliances.	**Stage 4**
		24. Consumer attitudes (i.e. level of acceptance/resistance) in trial area to proposition of, or being compelled to in the case of grid conversion trials, going off natural gas to hydrogen or an alternative energy supply	**Stage 2 - 3**
		25. Changes in risk perception for consumers in trial area over the course of the trial. Including perception of risks around a. safety b. economic cost (in terms of bills as well as property value) c. flexibility in heating options.	**Stage 4**
	Consumer behaviour	26. Consumer attitudes and knowledge of carbon credentials of hydrogen versus alternatives, such as natural gas and electrification	**Stage 4**
		27. Data on the cooking appliances that consumers opt for (gas vs electric), including comparisons with the appliance they used before (e.g. does hydrogen have an impact on people wanting to use gas cookers)	**Stage 4**
		28. Data on the number of consumers who opt for the alternative offer to hydrogen and the reasons for that choice.	**Stage 4**
		29. Consumer behaviour during the conversion process, for instance: - Do consumers respect the agreed appointments for pipework inspection, getting boilers installed, etc. - Are consumers willing to prepare for the appointment, such as postpone any ongoing works (e.g. remodelling or decorators) -Do commercial/industrial consumers behave any differently to domestic consumers? -Are commercial/industrial users willing to close their business to meet an appointment / have preparatory works done on the property?	**Stage 3 - 4**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		30. Consumer behaviour change, for different consumer types, in domestic and non-domestic settings, over the course of the trial in comparison to pre-hydrogen conversion use, for instance: - Do consumers keep the windows open more often for ventilation? - Do consumers use heating/cooking more-or-less often than before and why? - How do consumer respond to leaks (does the odorant work as expected, do they cut of gas / close ECV, do they shut doors, how quickly do they make calls to report it, how do people with anosmia respond to gas alarms etc.) - Do consumers alter ventilation either deliberately (i.e block vents) or accidentally (install carpets and block door undercuts)? - Do consumers follow the safety plan instructions/guidance (as in strand 4.)? - Do the above consumer behaviours change over time?	**Stage 4**
		31. [TBC depending on exit strategy] Retention of trial-participants who remain on hydrogen versus those leaving trial to switch back to natural gas (if possible, e.g. in H100) or alternatives (e.g. electrification)	**Stage 5**
	Consumer expectations	32. Consumer expectations of the benefits and responsibilities for different groups, such as tenants compared to landlords, freeholders and leaseholders	**Stage 1 – 2**
		33. Consumer expectations of compensation for disruption and taking part in the trial including: a. The level of compensation expected b. Their expectations of how they should be compensated (cheque, credit on bill, gift cards) c. Their expectation around how the compensation would be delivered (i.e. would they have to initial the claim or would it be automatic) d. Do commercial/industrial users have different expectations around incentives e. Expectations from freeholders and leaseholders	**Stage 1 – 2**
		34. Consumer expectations of outcomes and benefits of the trial	**Stage 1 – 2**
		35. Consumer expectations of hydrogen appliances that are offered as replacements for their natural gas appliances. Do they expect the same variety, spec, size of their natural gas appliances	**Stage 2 – 3**
		36. Consumer expectations of post-trial care, e.g. how long the post-trial care should last and what this should include (such as appliance servicing or access to expert advice) or	**Stage 2 – 3**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		whether their old appliances will be re-installed or exchanged for new ones.	
	Impact and experience on premise-type and demographic	37. Impact and experience of preparatory trial activities (including conversion process and time-off gas) a for different domestic consumer-types, such as: -Did appointments disrupt their work? (e.g. by having to take time off work or disrupting their working from home set up) -How did time off gas affect their day to day lives? -What impact did the mitigation needed have on their home? E.g. did it affect the décor of the house, did they have to rearrange rooms -What were the specific impacts and experiences on vulnerable consumers? -Measuring increased road congestion as a result of trial activities The outcomes should also be captured with respect to the characteristics of the premise, including e.g. - Building type e. g. detached house, terraced house, flats, etc. (that remain within TBC scope) - Tenure type (owner occupied, rented) - Nondomestic buildings - Number of storeys (that remain within TBC scope) - Level of insulation (do more insulated houses find hydrogen more acceptable?) - Building condition and age - Building size - Building material (brick, timber etc.) - End user (internal) pipework - Existing gas meter location, meter type and supply point type - Boilers controls interface - Type of ventilation used in building - Type of thermostat - Type of heating system (i.e. radiators or warm air heating, underfloor heating etc.)	**Stage 3 - 4**
		38. Impact and experience of trial from go live, regular use of hydrogen, to end of use, for different domestic consumer-types, such as: -Familiarisation times with new appliances -Impact of increased ventilation on the homes The outcomes should also be captured with respect to the characteristics of the premise (see line 36)	**Stage 4**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		39. Impact and experience of preparatory trial activities (including conversion process and time-off gas) for commercial and industrial consumers, such as: -Impact of appointments on business -Loss of business occurred during time off gas -Impact of mitigation measures on how their business functions The outcomes should also be captured with respect to the characteristics of the premise (see line 36)	**Stage 3 - 4**
		40. Impact and experience of trial activities, from go live to regular use and end of use, of using hydrogen for commercial and industrial consumers. Such as: -Familiarisation time of using new appliances -Impacts of maintenance of new appliances The outcomes should also be captured with respect to the characteristics of the premise (see line 36)	**Stage 4**
		41. The impact of trial activities (from initial conversion/set-up to regular use over the trial) on the energy efficiency of the property (e.g. if increased ventilation undermines air tightness this could impact the energy efficiency rating. The outcomes should also be captured with respect to the characteristics of the premise (see line 36)	**Stage 4 – 5**
		42. The impact on the property market in the trial area, including on: - Property prices - Mortgages (existing and new) - Saleability of properties - Building insurance costs and coverage - Rental market	**Stage 3 – 4**
Safety	**Pre-trial safety outputs**	43. Data on the ability to meet the different trial-safety requirements set out by the HSE in the Safety Evidence Needs Assessment (in annex) for the safety case across the following sub-headings; - System architecture (T1 – T7) - System suitability (materials and components, e.g. service pipe size suitability) (T8 – T16) - Risk Assessment (T17 – T31) - Controls (T32 – T37) - Capability and training (T38 – T40) - Standards and procedures (T41 – 57) This evidence will be submitted through the safety case for the hydrogen village trial	**Stage 2 - 3**
		44. Assessment of impact and effectiveness of communication of safety plans, drills and procedures for hydrogen incidents, including plans to interact with emergency services, ahead of the trial.	**Stage 2 – 3**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		45. Information on the mitigation measures the trial operator will use to deploy hydrogen safely in different building types, including an assessment per property of the mitigation measures likely to be used (meters moved, vents installed, pipework replaced etc.) and the expected time required to complete work on the property	**Stage 2 – 3**
	Live trials	46. Effectiveness of specific training and competency assessment plan to ensure the safe installation & operation of appliances and meters for the duration of the trial	**Stage 4**
		47. Consumer insights on practical impacts of the safety mitigations from the QRA (Quantitative Risk Assessment) for the conversion and operation of hydrogen in properties over the course of the trial, such as: - Meter location, e.g. moving meters outside - Installing safety devices such as Excess Flow Valves (EFV) and assessing the flow it is set at - Adding extra ventilation to properties	**Stage 2 - 4**
		48. A record of the safety measures and mitigations used per property in the trial area, including: -What type mitigation measure was used (meter moved, vents installed, pipework replaced) -What impact did this mitigation measure have on the property -Length of time to complete the work on the property -How many visits were needed per property	**Stage 4**
		49. Frequency of the activation of mitigations required for the conversion and operation of hydrogen in homes over the course of the trial (e.g. how often the EFV needs to be manually re-set, how many times hydrogen alarms are set off)	**Stage 4**
		50. Impact and effectiveness of communication of safety plans, drills and procedures for hydrogen incidents, including plans to interact with emergency services, for the duration of the trial	**Stage 4**
		51. Understand how to undertake an effective check to determine the safe installation of any new components or appliances	**Stage 3**
		52. Further development of IGEM/H2/ and IGEM/1/3 and associated training standards through understanding the maintenance regime that needs to be in place to ensure the effectiveness of the mitigation measures (downstream of ECV) throughout the trial: -How many times a year do they need to inspect ventilation, ECVs -How long to the checks take? -What is the cost of the checks? -What are the types of failure they discover?	**Stage 4**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		53. Evidence around testing and refining the further development of safety operating standards and procedures (upstream of the ECV)	**Stage 3**
		54. Data on NOX emissions, hydrogen leaks and water vapour at a property level (on a subset of properties) and if possibly in the local area before, during and after the trial.	**Stage 3 – 5**
Delivery and learning for town/roll-out	**Time and Cost**	55. Detailed data from building surveys, including - Building type e. g. detached house, terraced house, flats, etc. (that remain within TBC scope) - Tenure type (owner occupied, rented) - Nondomestic buildings - end use - Number of storeys (that remain within TBC scope) - Level of insulation - Building condition and age - Building size - Building material (brick, timber etc.) - End user (internal) pipework - Existing gas meter location, meter type and supply point type - Boilers controls interface - Type of ventilation used in building - Type of thermostat - Type of heating system (i.e. radiators or warm air heating, underfloor heating etc.) - Other critical building features	**Stage 2**
		56. Costs (including unit costs and availability of assets) and time involved in pre-conversion activities before the trial goes live, downstream of the ECV. Including, but not limited to: -Provision of adequate ventilation -Relocation of boilers and ancillaries, including meters -Installing hydrogen appliances or converting H2 ready appliances (boilers, cookers, fires) -Installing hydrogen meters or converting H2 ready meters -House surveys -Testing the downstream gas distribution pipework and addressing faults/leaks	**Stage 2 - 3**
		57. Costs (including unit costs and availability of assets) and time taken for pre-conversion activities to the existing gas network upstream of the ECV to hydrogen. Including, but not limited to: - pipe inspection - pipe laying/replacement - modification or replacement of pressure control equipment - updating of instrumentation e.g. pressure transducers, temperature management and other control systems - scope for conversion guidance/code of practice, including specification of suitable components and equipment	**Stage 2 - 3**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		-Sectorisation planning -Sector proving -Sector purging procedures (no emissions)	
		58. The impact of different building characteristics on the time and cost of different processes downstream of the ECV, including: - Building type e. g. detached house, terraced house, flats, etc. (that remain within TBC scope) - Tenure type (owner occupied, rented) -Details of end user gas installations (i.e. pipework / joints being converted) - Number of storeys (that remain within TBC scope) - Building condition and age - Building size - Building material (brick, timber etc) - Level of insulation/ventilation - Commercial versus domestic use - Other critical building features	**Stage 3**
		59. Costs and time for different trial activities downstream of the EVC, during conversion: including, but not limited to: - Isolating properties at the ECV -Purging gas pipework within the property -Convert all appliances to run on H2 -Pressuring testing gas installation -Carrying out safety checks -Complete certification	**Stage 2 - 3**
		60. Costs and time for different trial activities, upstream of the ECV, during conversion. Including but not limited to: -Isolating sectors at natural gas boundary and implementing purging procedures -Monitoring networks pressures and leakages across the boundary	**Stage 3**
		61. Data on extent of coordination required by network and trial-delivery stakeholders for sectorisation/switching to hydrogen	**Stage 1 – 3**
		62. Costs and time associated with all risk-reduction measures, such as: - moving meters outside - making a property compliant with appropriate standards in terms of ventilation, etc. - new Installation pipework - repurposed gas pipework that may need replacing, resizing	**Stage 3**
		63. Costs and time involved in maintenance and repair of the pipes / hydrogen system and maintenance of pressure control equipment and instrumentation over the course of the trial, including data on the frequency and impact of leaks both upstream and downstream of the ECV.	**Stage 4**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		64. Costs and time involved in maintenance and repair of the appliances over the course of the trial, including data on the prevalence of failures during the trial period.	**Stage 4**
		65. Impacts of seasonal changes on the cost and time estimates for all activities related to the trial.	**Stage 4**
		66. Data on the tripping of the excess flow valve (EFV) during commissioning purging operations and the false tripping of the EFV, and subsequent time and cost of re-setting the EFV* *The EFV is tamper proof & Only engineers/professionals can re-set the EFV in the smart meter	**Stage 4**
		67. Cost and time for any activities undertaken to link the trial area to the hydrogen production source (estimates during Stage 2).	**Stage 2 – 3**
	Design, Maintenance and Repair	68. Data on supplementary design and installation considerations needed for the network in a hydrogen system in addition to the current natural gas system (e.g. the design and installation of burners, ventilation requirements, size of pipework, leak detection etc) both upstream and downstream of the ECV	**Stage 3**
		69. Maintenance and repair schedules needed for the gas network in a hydrogen system, compared to the current natural gas system, including pipes, gas grid equipment, and excess flow valves.	**Stage 4**
		70. Maintenance needed for a hydrogen system compared to the current natural gas requirements on hydrogen appliances and meters	**Stage 4**
		71. Repair regime, maintenance needed and durability/longevity of hydrogen appliances and meters for a hydrogen system compared to the current natural gas requirement	**Stage 4**
	Conversion & viability	72. Processes required for conversion of the grid network on a sectorisation basis, such as management of purge and re-fill	**Stage 1 – 3**
		73. Reliability of existing property surveys and modelling to accurately assess and predict the amount of work needed to convert premises to hydrogen	**Stage 3**
		74. Validating and demonstrating which factors would preclude the ability for a premise to be converted to hydrogen heating/cooking relating to building regulations, including, but not limited to: - Factors impacting level of ventilation needed - Any critical building features that impact converting premises	**Stage 2**
		75. Extent to which the existing network can be repurposed to carry hydrogen. Including any parts that need complete replacement (valves, pipes, springs, filters etc.)	**Stage 3**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		and the time and procedures for removal of materials that are unsuitable for hydrogen.	
		76. Operational evidence on injecting and using hydrogen in the existing grid infrastructure, including evidence on: - Flow rates and pressure drops - Leaks - Ways of identifying and isolating leaks (e.g. hydrogen sniffers) - Velocities - Dust - Erosion and embrittlement / fatigue - Noise - Functionalities of downstream of Emergency Control Valves (ECV) - Jointing techniques of pipework - Pressure absorption - Leakage rates - Water vapor in open flues of hydrogen appliances and in rooms containing un-flued hydrogen appliances; - Increased pluming from hydrogen appliance terminals; - Purging parameters requirements for hydrogen and direct purging approach that could be developed for domestic installations	**Stage 4**
		77. Data on impact of H2 purity on appliances and meters as it picks up debris / contaminates in existing piping. Including data on: - Impacts on emissions - Impact on reliability - Impact on efficiency	**Stage 4**
		78. Data on hydrogen leakage rates and trends over the course of the trial in different seasons and weather, throughout the hydrogen system to end-use.	**Stage 4**
		79. Carbon reduction data informing the carbon reduction options assessment for hydrogen, including the impact of leaks from the hydrogen system	**Stage 4**
		80. Carbon reduction data and carbon credentials of products, services and projects to inform standards for manufacturers and installers	**Stage 4**
		81. Carbon reduction data informing the development of carbon intensity assessment methodologies for hydrogen pathways, hydrogen technologies and technology systems	**Stage 4**
		82. Trials evidence informing upstream procedures for the potential hydrogen conversion roll-out, including: - Operating procedures for personnel - Operational procedures for sector proving - Procedures governing how networks are purged and vented	**Stage 3**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		- The way that gas engineers disconnect and reconnect the network - Operational grid procedures, e.g. test of control systems, operational let-down between pressure tiers, hydraulic balancing	
		83. Trials evidence informing downstream procedures for the potential hydrogen conversion roll-out, including: - Operating procedures for personnel - The way that consumers are instructed and educated in the safe use of appliances as part of the benchmark process - Reviewing and tailoring benchmark processes to include learnings on the safe use of appliances	**Stage 3**
		84. Data on staff experience when undertaking activities within properties. Including: - Incident reports where staff have faced abuse within a property - Safeguarding reports where staff have witnessed an issue within a property	**Stage 3 - 4**
Commercial and Regulatory	**Commercial, regulatory and billing**	85. Supply chain capability of delivering: a. The material aspects needed for the trial (such as appliances and equipment) on time, to the required specifications and in the quantity required. b. the services needed for the trial on time and to the required standard (such as storage infrastructure, distribution methods, hydrogen production)	**Stage 1 -2**
		86. Feasibility, effectiveness and accuracy of metering methods and meter types for hydrogen in both domestic and non-domestic premises	**Stage 1 - 3**
		87. Regulatory changes required (billing, consumer protection principles, access to properties) for the trial	**Stage 1 - 3**
		88. Feasibility of the current regulatory tools in the delivery of trials wider roll-out (e.g. Major Hazard Regulatory Model)	**Stage 3**
		89. Legislative changes required for the trial	**Stage 1 -3**
		90. Policy changes required for large-scale grid conversion for the trial	**Stage 1 - 3**
		91. Assessment of current standards provision and potential standardization gaps relating to regulation and legislation (including formal, industry-driven, supranational, international, standards from other jurisdictions	**Stage 1 - 2**
		92. Feasibility and effectiveness of new billing methodologies for hydrogen	**Stage 2 - 3**
		93. Data on skilled workforce requirements, for upstream work e.g. number of engineers and installers	**Stage 2 - 3**
		94. Data on skilled workforce requirements, for downstream work e.g. number of engineers and installers	**Stage 2 - 3**

Evidence grouping	Evidence subset	Evidence strand	Trial Stage
		95. Data on the extent to which skill gaps may exist in the market and on what basis they should be addressed	**Stage 4**
	Training and skills	96. Data feeding into refinement of the hydrogen heating training scheme, sufficiency of standards and guidance for workforce, and manufacturers product training	**Stage 3**
		97. Understanding capability and agility of new workforce (i.e. will the same engineers expected to do a wide range of tasks relating to conversion) and how does this impact the time taken to convert premises	**Stage 3**
		98. Data on internal competences and training that commercial and industrial consumer may need	**Stage 2 - 3**
		99. Workforce attitudes and behaviours on a hydrogen system in comparison to the natural gas system, including: - Type of work required - Level of repairs, maintenance, and servicing needed	**Stage 4**
		100. Information on the type and number of necessary certifications and training for skilled professionals and the workforce, as required by Government regulation, training laws, and by organisation/s such as the Existing Gas Safe Register	**Stage 3**
		101. Demonstrate that installers follow training requirements relating to the design of natural gas services installations in domestic and commercial properties i.e. Gas safety regulation by HSE GS(UI)R	**Stage 4**
	Risks and mitigations	102. Lessons learned on effectiveness of mitigations proposed for known risks to refine risk assessments. Including: Safety risks -Supply chain risks -Appliance development risks -Procurement risks -Any other risks identified	**Stage 4**
		103. Mapping unknown risks that emerge within hydrogen heating trials into risk register	**Stage 4**
		104. Lessons learned on effectiveness of mitigations for emerging new risks to refine risk assessments	**Stage 4**