Department for
Business, Energy
& Industrial Strategy

Enabling or requiring hydrogen-ready industrial boiler equipment: call for evidence

Summary of Responses

13 December 2022

December 2022

Any enquiries regarding this publication should be sent to us at: hydrogen.industry@beis.gov.uk

Contents

General information

Why we consulted

The call for evidence was an important opportunity to gather stakeholder views on the potential for 'hydrogen-ready' industrial boiler equipment to help industry decarbonise and kickstart the UK hydrogen economy.

Call for Evidence details

Issued: 20 December 2021

Closed: 14 March 2022

Response published: 13 December 2022

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Call for Evidence reference:

https://www.gov.uk/government/consultations/enabling-or-requiring-hydrogen-ready-industrial-boiler-equipment-call-for-evidence

Audiences:

We were keen to hear from a broad range of groups, including but not limited to: industrial sites, original equipment manufacturers for industrial boiler equipment, participants in the supply chain for industrial boiler equipment, Energy Service Companies with an interest in hydrogen, gas suppliers, non-governmental organisations, academics, and members of the public with an interest in this area.

Territorial extent:

UK

Confidentiality and data protection

Information you provided in response to this consultation, including personal information, may be disclosed in accordance with UK legislation (the Freedom of Information Act 2000, the Data Protection Act 2018 and the Environmental Information Regulations 2004).

We processed your personal data in accordance with all applicable data protection laws. See our privacy policy.

We will summarise all responses and publish this summary on GOV.UK.

Quality assurance

This call for evidence was carried out in accordance with the government's consultation principles.

If you have any complaints about the way this call for evidence was conducted, please email: beis.bru@beis.gov.uk.

Introduction

About the Call for Evidence

On 20 December 2021, the Department for Business, Energy and Industrial Strategy (BEIS) launched a Call for Evidence (CfE) on enabling or requiring hydrogen-ready industrial boiler equipment. The aim was to gather evidence from a broad range of UK manufacturers, industrial end-users, supply chain participants and other experts to enable the development of proposals. The CfE was open for 12 weeks, closing on 14 March 2022.

The CfE followed the publication of the UK Hydrogen Strategy on 17 August 2021. In the Strategy, government committed to run a CfE on hydrogen-ready industrial equipment by the end of 2022. The published CfE focussed on industrial boilers due to their widespread use, and because BEIS analysis indicates a significant proportion of the demand for hydrogen in industry will come from this equipment category. Furthermore, the technology required for hydrogen boilers is relatively advanced and more standardised than for other types of industrial equipment. For these reasons, industrial boiler equipment presents a good test case for hydrogen-ready industrial equipment more broadly.

The CfE contained the following three sections:

- The opportunity for hydrogen-ready industrial boilers
- The role for government to support hydrogen-ready industrial boiler equipment
- The role of the supply chain and economic opportunities for the UK

Respondents were asked to support their answers with evidence relating to their business, product or sector, published literature studies, or to their broader expertise. To raise awareness of the CfE, BEIS officials held two online webinars on 1 February 2022 and 3 February 2022. These were open to boiler manufacturers, industrial end-users, supply chain participants, trade associations, professional bodies, and any other person(s) with an interest in the area.

To build on evidence gathered through the CfE, BEIS commissioned an independent study from Arup and Kiwa Gastec to further examine whether government should enable or require hydrogen-ready industrial boiler equipment. This study investigated the following topics:

- definitions of hydrogen-readiness for industrial boilers
- comparisons of the cost and resource requirement to install and convert hydrogen-ready industrial boiler equipment
- industrial boiler supply chain capacity for conversion to hydrogen
- estimates of the UK industrial boiler population

The final report for this study has been published alongside the government response to the call for evidence. The conclusions and recommendations of that report do not necessarily represent the view of BEIS.

About the summary of responses

This document summarises the responses to the CfE. BEIS received 37 responses from a diverse stakeholder group, which is broken down in Figure 1.

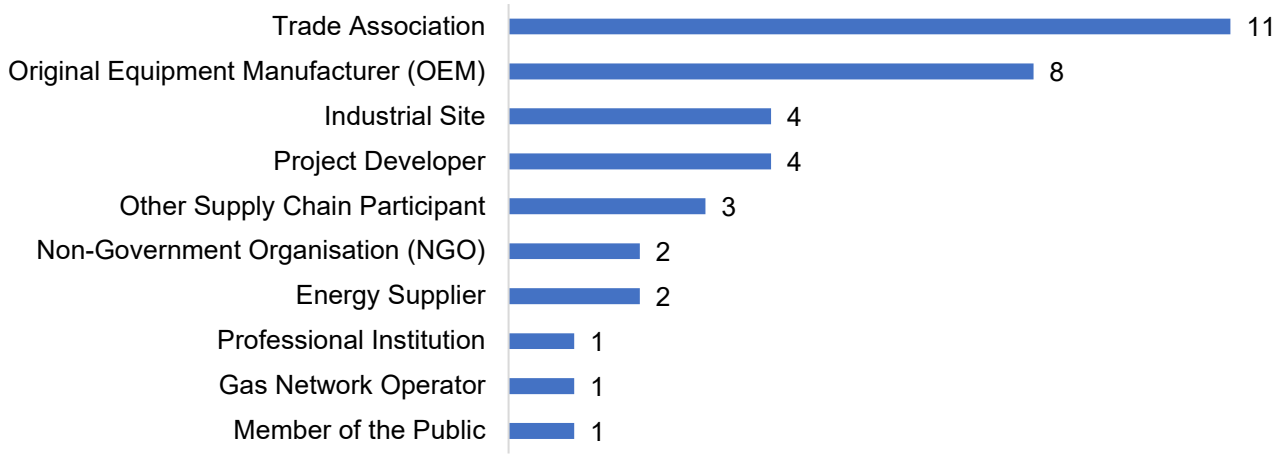

Figure 1: Respondents by type of organisation

This document provides a summary from the responses we received. While it is not practical to explain every viewpoint or piece of evidence we received in this document, all responses have been reviewed and will be used to inform policy proposals. The views expressed by respondents are not government policy, and we have not verified the information provided by respondents. BEIS thanks the respondents for sharing their expertise and feedback to the CfE.

Next steps

Decarbonising industrial processes is an important part of achieving our net zero ambitions, and industry is a likely early off-taker of low carbon hydrogen. We will take steps to ensure this can happen by phasing out unabated fossil fuel burning in industry and supporting possible replacements. Therefore, BEIS intends to sponsor the British Standards Institution (BSI) to ensure that hydrogen-ready industrial-sized boiler equipment is covered by a Publicly Available Specification (PAS). This standardisation document will aim to align with PAS 4444, developed for non-industrial hydrogen-fired gas appliances.[1]

We anticipate this PAS will develop a standardised definition for what constitutes a large 'hydrogen-ready' boiler to give confidence to end-users that this equipment can enable faster and cheaper fuel switching to hydrogen than would otherwise be the case. The PAS development process will engage a range of relevant stakeholders, with the aim to publish the PAS by early 2024.

BEIS will also continue to assess the merits of requiring large boilers to be hydrogen-ready including through product regulation, environmental permitting, or a combination of the two. The findings of this work may form the basis for further consultation on proposals for changes to policy for industrial boiler equipment.

[1] British Standards Institute, PAS 4444:2020 Hydrogen-fired gas appliances. Guide, https://knowledge.bsigroup.com/products/hydrogen-fired-gas-appliances-guide/standard, (accessed 22/11/2022).

Executive summary

Overall, the majority of respondents supported the idea of government enabling and requiring hydrogen-ready industrial boiler equipment. Many respondents commented that technical standards and certification routes would be important in enabling the supply chain to adapt and support the deployment of industrial boiler equipment. Many respondents commented that government should act as soon as it is practical and consider the impacts of proposed policies on other types of equipment used for industrial processes and building heat.

Defining ‘hydrogen-ready’ industrial boiler equipment

The majority of respondents indicated that hydrogen-ready should be defined as new boiler equipment that can fire natural gas at the point of installation but is designed to fire 100% hydrogen with the minimum number of component changes. Respondents also noted that boiler equipment should also be compliant with relevant environmental and air quality regulation before and after conversion to hydrogen.

The importance of a shared definition of hydrogen-ready was a common theme among respondents, with concerns that the term is currently being used in confusing or misleading ways for products that are only capable of operating on a blend of natural gas and hydrogen.

Respondents were in broad agreement that the definition of hydrogen-ready should account for the wide range of the subcomponents used in boilers in domestic, commercial, and industrial settings. Many respondents considered the aim for hydrogen-ready equipment should be to reduce the overall cost of converting equipment to operate on 100% hydrogen and a definition should not vary by sector or process for which the boiler is used. It was acknowledged, however, that a mechanism to capture setting-specific factors would be beneficial.

Cost of installation and conversion of ‘hydrogen-ready’ industrial boiler equipment

The majority of respondents agreed that the cost of installing hydrogen-ready industrial boiler equipment would likely be more expensive than conventional boiler equipment due to the need for design changes and further testing. Respondents provided a range of cost estimates listed at in Section 2.3. Respondents agreed that the cost of converting hydrogen-ready industrial boiler equipment to use hydrogen is likely to be cheaper than converting conventional boiler equipment to use hydrogen, however the cost differential would depend on the definition of hydrogen-ready and the size of the equipment.

Most respondents agreed that the time to install hydrogen-ready industrial boiler equipment would be similar to that the time required to install conventional equipment, and that this would also be dependent on the availability of trained installers. Respondents also broadly agreed that converting hydrogen-ready industrial boiler equipment to use hydrogen would be less time consuming and complex than converting conventional boiler equipment to use hydrogen.

The government's role to enable or require hydrogen-ready equipment

Most respondents considered a requirement for industrial boiler equipment to be hydrogen-ready would be beneficial because it would ensure equipment could be converted to hydrogen more quickly and at a lower cost than would be possible with conventional boiler equipment. Furthermore, respondents suggested regulation could stimulate the supply chain to develop hydrogen-ready equipment which could lead to a reduction in capital costs for equipment over time. Respondents broadly agreed that a combination of product standards and environmental permitting regime might be suitable. The Decarbonisation Readiness proposal for the power sector was noted as a potentially effective regulatory mechanism based on environmental permitting as it could allow for requirements to evolve over time.

A number of respondents commented that government should enable rather than require hydrogen-ready industrial boiler equipment. Respondents noted that action to enable, rather than to require, could prevent industrial sites from paying a premium on equipment which cannot be decarbonised if hydrogen does not become readily available. Respondents highlighted a definition for what is meant by hydrogen-ready and a technical standard for industry to follow as important enabling actions government could take. Rather than a requirement, some respondents suggested that education and financial incentives could be used to encourage sites to deploy hydrogen-ready equipment. Respondents commented that government could support the development of hydrogen-ready technologies by funding demonstration trials and sponsoring the development of technical standards to align the industrial boiler market.

The supply chain and economic opportunities for the UK

The majority of respondents agreed that the existing supply chain would be able to adapt to meet potential regulation for industrial boiler to be hydrogen-ready. Respondents noted that the development of standards for hydrogen-ready equipment would be important in giving confidence and clarity to the supply chain and that sufficient time should be allowed between the introduction of any potential regulation and its enforcement. Respondents highlighted that training and education will also be important in ensuring the supply chain is able to adapt successfully.

A number of respondents suggested that the UK should continue to work with the European Committee for Standardization and other international bodies to support the harmonisation of standards, help develop export opportunities for the UK and facilitate a global supply chain. Several respondents noted that hydrogen-ready industrial equipment could bring investment, growth, and the creation of jobs to the UK, whilst also improving the nation's energy security.

Summary of Responses

Section 1 - Introduction

Questions 1 and 2 do not form part of the summary of responses as they captured personal information.

Section 2 - The opportunity for hydrogen-ready industrial boilers

Section overview

This section described the potential for low carbon hydrogen to decarbonise industrial boilers and sought views on:

- other low carbon solutions to decarbonise industrial boiler equipment
- how hydrogen-ready should be defined
- the costs and complexity of installing hydrogen-ready industrial boiler equipment

Section 2.1 – Hydrogen fuel switching as a way to decarbonise industrial boilers

Question 3

What factors would impact the way an industrial site would decarbonise boiler processes?

Summary of responses:

There were 29 responses to this question.

Respondents highlighted the availability of low carbon fuels as an important factor in the way an industrial site would decarbonise boiler processes. Respondents noted the importance of having a secure low carbon fuel supply that is either continuously available through networks or can be stored safely and cost-effectively. Geographical location was also noted as being a significant factor in determining which low carbon fuels may be available to industrial sites, particularly sites that are dispersed and/or not connected to the natural gas grid.

Costs were noted as an important factor in the way an industrial site would decarbonise boiler processes. In particular, respondents highlighted the comparative operating costs of other low carbon technologies as well as the capital costs of purchasing new equipment or retrofitting existing equipment. Respondents also noted that certain technologies may impact explosive atmosphere safety requirements, which could result in further costs in addition to the boiler equipment itself.

Respondents indicated that the technical feasibility and safety requirements of operating a plant are important factors to consider. The importance of a suitably trained and skilled

workforce to ensure boiler equipment can be operated and maintained safely was highlighted. Respondents also suggested that access to 'decarbonisation-ready' equipment, which can be converted to use low carbon fuels, could be important in enabling a site to transition away from carbon intensive fuels.

Government policy was noted as an important factor to consider. Respondents emphasised that policies could act as incentives for sites to decarbonise, with increases to the UK Emissions Trading Scheme (ETS) credit prices, boiler scrappage schemes and capital tax relief schemes listed as potential options. Respondents noted that clear signals and/or regulation from government could influence the way an industrial site sought to decarbonise industrial boiler processes and could enable sites to invest with confidence in decarbonisation technologies.

Question 4

Do you think that low carbon hydrogen is a good way to decarbonise industrial boilers? Please give details to explain your view.

Summary of responses:

There were 28 responses to this question.

- Strongly agree = 12
- Agree = 13
- Neither agree nor disagree = 2
- Disagree = 0
- Strongly disagree = 1

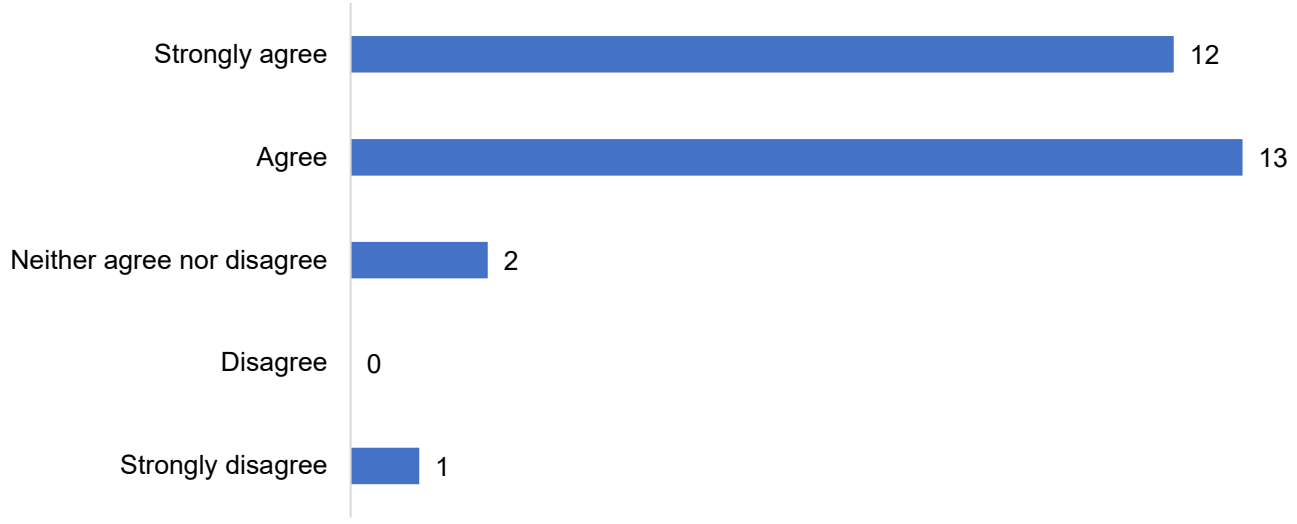

Figure 2 - Graphical representation Q4 responses.

The majority of respondents (25) either agreed or strongly agreed that low carbon hydrogen is a good way to decarbonise industrial boilers. The potential to retain and adapt existing natural gas infrastructure was noted as a positive, which respondents considered could reduce overall costs and prevent the need for extensive modifications to existing industrial sites. Linked to this, several respondents noted that existing industrial boiler operators and associated supply

chains already have expertise in combustion processes. This could help accelerate the deployment of boiler equipment that fires hydrogen and help ensure safe and efficient operation. A few respondents noted there are no clear alternative low carbon fuels or technologies that could readily produce high temperature heat and maintain product quality.

Two respondents neither agreed nor disagreed with the question, instead they noted that the optimal decarbonisation pathway will vary by site and depend on site-specific requirements. The uncertainty around hydrogen availability was noted as a significant barrier to identifying an optimal decarbonisation pathway for specific sites.

One respondent strongly disagreed that low carbon hydrogen is a good way to decarbonise industrial boilers. The response focussed on the production of hydrogen and suggested that 'blue' hydrogen, reliant on carbon capture and storage technology, had yet to be successfully deployed at scale. This respondent emphasised that hydrogen was also regarded as inefficient due to the energy losses associated with the conversion of renewable electricity. The respondent suggested that using renewable energy for direct heating would be a more efficient solution.

Question 5

Would other low carbon alternatives, including electrification, biofuels or CCUS, also offer a suitable way to decarbonise boiler processes? To what extent would changing energy prices influence your view?

Summary of responses:

There were 29 responses to this question.

There was broad agreement that electrification offers an alternative way to decarbonise industrial processes that use boilers. Electrification was regarded as an efficient option compared to alternative decarbonisation technologies. A number of respondents noted concerns that the current capacity of the electricity grid could be a constraint to widespread adoption. The ability of electric boiler systems to meet high levels of heat demand was also questioned. Some respondents noted that electric boilers require a much larger heat transfer surface than existing combustion systems and therefore the capital costs of the boiler itself and any associated on-site infrastructure could be significant. In addition, respondents noted existing sites may not have the space available to house a larger boiler and the associated infrastructure. Operating costs were highlighted as a barrier to electrification because the price of electricity could make operations commercially unviable. Hybrid hydrogen-electric systems, which can use electricity for load balancing, were highlighted as an alternative decarbonisation technology that could mitigate some of the concerns raised.

Carbon capture, usage and storage (CCUS) was highlighted by respondents, with agreement that it offers a viable decarbonisation pathway for sites close to an industrial cluster or CO_2 pipeline. The ability to retain existing boiler infrastructure and operator experience was noted as beneficial. However, respondents suggested that access to CCUS infrastructure is a limiting factor to widespread adoption, particular for dispersed sites that are not part of or close to an

industrial cluster. Some respondents also questioned the ability of CCUS technology to scale to smaller sites, as well as the costs of installing the technology. The lack of skilled operators with knowledge and experience of CCUS operations was highlighted as a concern.

Respondents mentioned bioenergy, with broad agreement that a range of biofuels can offer a viable decarbonisation pathway, particularly for off-grid sites. The ability to either retain or retrofit existing boiler infrastructure was noted as a benefit. The main concern raised by respondents was security of supply and whether the supply of biofuels could meet the demand from industry. The current price of biofuels was also noted as a potential barrier to widespread adoption. Nevertheless, several respondents suggested that biofuels will likely play a role in meeting industrial energy demands, albeit not a large proportion.

There was agreement from respondents that any changes in energy prices would be a significant factor in an industrial site's decision to adopt a particular decarbonisation technology.

Section 2.2 – Defining hydrogen-ready

Question 6

How should hydrogen-ready be defined for industrial boilers? Do you have any views on the ways we have described hydrogen-ready for industrial boilers?

Summary of responses:

There were 24 responses to this question.

The majority of respondents agreed that hydrogen-ready should be defined as new industrial boiler equipment that can fire natural gas at the point of installation but is designed to fire 100% hydrogen with the minimum number of component changes. In addition, one respondent suggested that a boiler's output rating should be based on hydrogen firing as it would likely be reduced compared to when operating on natural gas.

Respondents also suggested that hydrogen-ready boiler equipment should be compliant with relevant environmental and air quality regulation before and after conversion to hydrogen, and the Medium Combustion Plant (MCP) and Industrial Emissions (IE) regulation should contain specific pollutant limits for hydrogen combustion. Several respondents highlighted that any installations should be tested post-conversion by a competent engineer to ensure combustion temperatures are within an acceptable range.

A few respondents indicated that hydrogen-ready should be defined as new boiler equipment that can fire natural gas and 100% hydrogen at the point of installation with no modifications required. Designing a boiler with two burners, one for hydrogen and one for natural gas, was suggested as a possible way of achieving this. One respondent commented that hydrogen-ready boiler systems should have no emissions, such as Nitrogen Oxides (NOx), other than water vapour.

The importance of a shared definition of hydrogen-ready was a common theme among respondents, with concerns that the term is currently being used in confusing or misleading ways for products that are only capable of operating on a blend of natural gas and hydrogen.

Question 7

Do you agree it would be possible for equipment manufacturers to produce hydrogen-ready boiler equipment at scale and in the ways described above? Please give details to explain your view.

Summary of responses:

There were 20 responses to this question.

- Strongly agree = 12
- Agree = 5
- Neither agree nor disagree = 3
- Disagree = 0
- Strongly disagree = 0

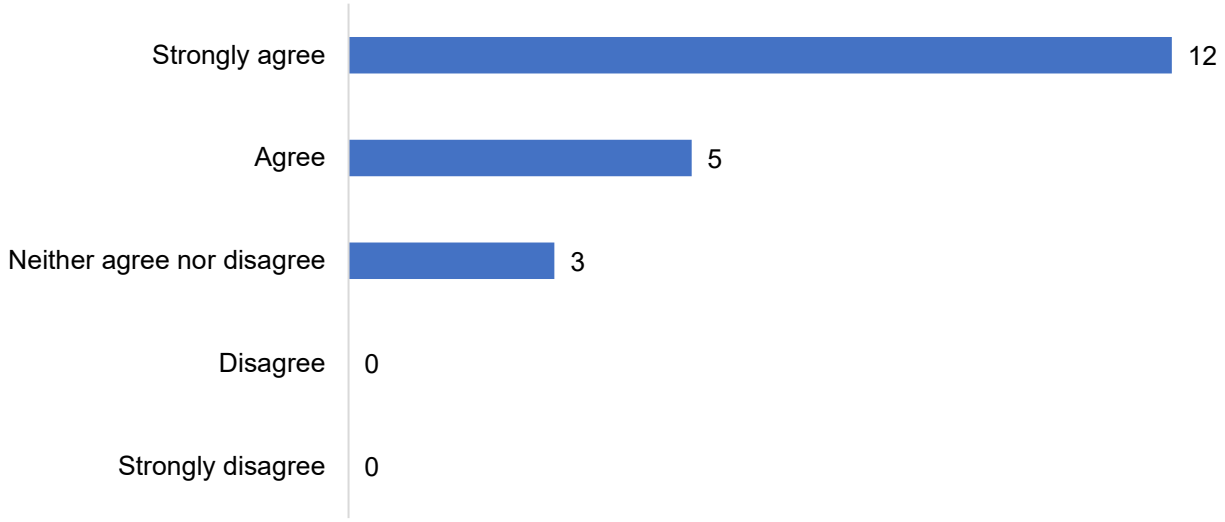

Figure 3 - Graphical representation of Q5 responses.

The majority of respondents (17) either agreed or strongly agreed that it would be possible for equipment manufacturers to produce hydrogen-ready industrial boiler equipment at scale. Respondents agreed that the production of hydrogen-ready industrial boiler equipment is technically feasible, but that further research and the development of technical standards would help manufacturers ensure their products operate safely and efficiently. Product certification was also highlighted as a way to provide industrial end-users with confidence when purchasing hydrogen-ready boiler equipment. Respondents noted that clear signals for how government might enable or require hydrogen-ready industrial equipment would help the supply chain invest with confidence and scale up production of these products, which in turn could help reduce overall equipment costs for industrial boiler operators.

Three respondents neither agreed nor disagreed that it would be possible for equipment manufacturers to produce hydrogen-ready industrial boiler equipment at scale. The development of hydrogen infrastructure and the availability of hydrogen was highlighted as a dependency for whether manufacturers would invest in at scale production of hydrogen-ready industrial equipment. Given the long lifespan of industrial boiler equipment, one respondent commented that retrofit solutions for existing boiler systems should be prioritised.

Question 8

Is the schematic of a typical industrial boiler system accurate? Are there additional subcomponents that should be considered?

Summary of responses:

There were 19 responses to this question.

Respondents broadly agreed that the schematic represented an industrial boiler system but suggested additional components to improve its accuracy.

Several respondents suggested the inclusion of forced draught fans rather than induced draught fans. Boiler house safety equipment was noted as absent from the schematic, with respondents highlighting that hydrogen readiness would require need for gas detection equipment and suitable ventilation both before and after conversion to hydrogen. In addition, it was noted that the flue-gas stack requirements may need to be considered as a switch to hydrogen is likely to impact the dewpoint and temperature of the combustion equipment.

Respondents noted that economisers are widely used on industrial boilers to maximise efficiency and reduce fuel consumption and therefore should be added to the schematic as industrial sites will seek to utilise the latent heat in the exhaust gases. It was also noted that flue gas recirculation may not be required to bring NOx levels under control if improved burner technology is able to keep emissions within the legal limits.

It was suggested that the control and safety instrumentation relating to the fuel distribution system, burner and boiler could more accurately be separated out from their respective boxes on the schematic.

Question 9

Are the descriptions of how subcomponents would need to differ to fire hydrogen accurate?

Summary of responses:

There were 18 responses to this question.

Respondents noted that that several components in the gas train may need to be redesigned to fire hydrogen because they will have originally been designed for natural gas. These include safety valves, flame arresters and gas boosters. In addition, the diameter of the gas train may

need to be increased to allow for a higher flowrate of hydrogen to maintain equivalent energy volumes when compared to natural gas.

Respondents noted the potential for existing boiler systems to experience a derating when switching to hydrogen. A hydrogen flame is likely to be less radiant and this could lead to higher back-end temperatures and over-heating of components. Respondents also emphasised the need for boiler systems to be tested after conversion to ensure that combustion temperatures do not exceed the original design specifications.

It was noted that burner systems are likely to require new nozzle heads when converting to 100% hydrogen to maximise efficiency and reduce NOx emissions. In addition, flame detectors would potentially need to be replaced with ultra-violet (UV) detectors as hydrogen burns with a colourless flame. A few respondents noted that the burner system may need to be redesigned to account for possible flue gas recirculation in the future if the boiler system is unable to meet emissions limits without it.

Respondents noted that control systems may potentially need to be reconfigured to manage boiler processes when operating on 100% hydrogen. Additionally, electrical components may need to be changed to meet explosive safety requirements if they are impacted by the introduction of hydrogen. It was also noted that boiler house safety equipment such as leak detectors and fire detectors may need to be upgraded to ensure they are capable of detection when firing hydrogen.

Question 10

How would industrial boiler subcomponents need to be modified to be hydrogen-ready? Would this differ for the various types of industrial boilers, such as high pressure steam boilers, low pressure steam boilers, and hot water boilers?

Summary of responses:

There were 15 responses to this question.

A number of respondents referred to their response to question 9, as changes to enable a boiler to use hydrogen would also be relevant to make equipment hydrogen-ready. Respondents noted that the boiler system's instrumentation, safety devices and control systems would need to be compatible with natural gas, a blend of natural gas and hydrogen, and 100% hydrogen. The diameter and material of the gas train pipework would also need to be compatible with higher flowrates of hydrogen compared to natural gas.

The burner system would need to be designed to be converted to 100% hydrogen with minimal component changes or be capable of firing 100% hydrogen at the point of installation. Respondents noted this could be made possible by having two separate gas trains and two burner heads.

It was also noted that the boiler would need to be able to withstand increased surface temperatures when operating on 100% hydrogen. One respondent suggested that the boiler

system would need to be re-commissioned after any fuel-switch to natural gas/hydrogen or 100% hydrogen.

Respondents were in broad agreement that the relevant modifications would be broadly applicable to all types of industrial boilers, however it was acknowledged that hydrogen-ready designs for water-tube boilers are likely to be more complex than fire-tube boiler as the ratio of heat transferred in the guard bank, superheater and convective sections will change.

Question 11

Do you have any views on how a hydrogen-ready definition for industrial boilers should relate to definitions for other types of equipment, including for other industrial processes, domestic and commercial heating, or electricity generation?

Summary of responses:

There were 21 responses to this question.

Respondents were in broad agreement that the definition of hydrogen-ready should cover the range of end-use equipment in domestic, commercial, and industrial settings. Respondents suggested that the aim of installing hydrogen-ready equipment would be to reduce the overall cost of converting equipment to operate on 100% hydrogen and therefore a definition should not be equipment or sector specific. They acknowledged, however, that there should be a mechanism to capture setting-specific considerations where appropriate.

A number of respondents commented that a common hydrogen-ready definition shared across domestic, commercial, and industrial settings would help build awareness and confidence amongst consumers. Some respondents noted that the definition should not be solely focussed on hydrogen, but rather ‘renewable-ready’ so that end-users who cannot transition to hydrogen have a viable low carbon solution, such as liquid biofuels.

Several respondents noted that the definition should also include a mandatory commitment that manufacturers of hydrogen-ready equipment would perform the necessary conversions at a reasonable price and within a reasonable time-period once hydrogen becomes available.

Section 2.3 - The cost and conversion benefits of hydrogen-ready industrial boiler equipment

Question 12

Do you have views or evidence on what the costs of installing hydrogen-ready boiler equipment would be in contrast with equivalent costs for conventional equipment?

Summary of responses:

There were 19 responses to this question.

Respondents agreed that the cost of installing hydrogen-ready industrial boiler equipment is likely to be more expensive than conventional equipment due to the need for design changes and further testing. Respondents provided an estimated percentage increase for different subcomponents. For example, a hydrogen-ready industrial boiler shell was estimated to be between 10 – 20% more expensive than a conventional boiler shell due to potential differences in geometry needed to account for the flame characteristics hydrogen presents.

Preparatory steps to enable flue gas recirculation, such as a tee-flange added to the flue were estimated to increase the cost of the flue system by around 5%. Some respondents provided estimates for the burner system exclusively, calculating a 10 – 20% increase, while other respondents grouped the burner system and gas train together, with estimates ranging up to a 100% increase in costs compared to conventional natural gas equipment.

Respondents also noted that any changes to zoning requirements caused by the introduction of hydrogen could significantly increase costs as additional equipment would need to meet explosive safety requirements.

Question 13

Do you have views or evidence on what the costs of converting hydrogen-ready boiler equipment to use hydrogen would be in contrast with equivalent costs for converting conventional equipment?

Summary of responses:

There were 18 responses to this question.

Respondents agreed that the cost of converting hydrogen-ready industrial boiler equipment to use hydrogen is likely to be cheaper than converting conventional equipment, however the cost differential would depend on the definition of hydrogen-ready and the size of the equipment.

For a system that has been designed to require minimal component changes to run on hydrogen, respondents commented that the gas train, control system, burner heads and flue gas recirculation are aspects that would potentially require modification, in addition to meeting explosive safety requirements.

Respondents estimated that converting an existing natural gas burner could be between 20 – 200% more expensive than converting a hydrogen-ready burner. Several respondents highlighted that the cost to convert a hydrogen-ready industrial boiler to use hydrogen remains uncertain as it is a relatively new product area. Securing a hydrogen supply was noted as the biggest barrier to conducting trials to establish conversion costs and to better understand impact of conversion to hydrogen on NOx emissions.

Question 14

Do you have any views or evidence on the time and complexity of installing hydrogen-ready boiler equipment, when compared to installing conventional equipment?

Summary of responses:

There were 17 responses to this question.

Respondents broadly agreed that the time and complexity of installing hydrogen-ready industrial boiler equipment would be similar to that of installing conventional equipment.

Responses noted that the stringency of standards for equipment and installation of hydrogen-ready equipment compared to conventional equipment could have an impact. The stringency of checks or requirements for particular valves or gaskets were flagged as examples.

Respondents noted that site specific requirements such as plant safety, fuel supply and storage could impact the time and complexity of installation. The availability of competent installers was also noted as factors that could influence the time and complexity of installation.

Question 15

Do you have any views or evidence on the time and complexity of converting hydrogen-ready boiler equipment to use hydrogen, when compared to converting conventional equipment to use hydrogen?

Summary of responses:

There were 16 responses to this question.

Respondents broadly agreed that converting hydrogen-ready boiler equipment to use hydrogen would be less time consuming and complex than converting conventional equipment to use hydrogen.

Respondents noted that the ease of the conversion would be dependent on the agreed definition of what is considered hydrogen-ready. Several respondents noted the need for the conversion to be quick and convenient to ensure that site downtime is minimised.

It was also noted that further testing would be required to determine the scope of changes needed to convert either hydrogen-ready or conventional equipment to use hydrogen

Question 16

How might the risk of not accessing hydrogen impact whether an industrial site decides to deploy hydrogen-ready boiler equipment?

Summary of responses:

There were 25 responses to this question.

Most respondents noted that the future availability of hydrogen would be a significant factor in whether an industrial site chooses to deploy hydrogen-ready industrial boiler equipment. Without a clear signal from government on the future availability of hydrogen, some respondents explained it would be difficult for industrial sites to develop an investment case for more expensive equipment or commit to a specific decarbonisation pathway.

In particular, some respondents noted that the risk of investment would be dependent on the price differential between hydrogen-ready and conventional equipment, the future price of hydrogen compared to natural gas, the associated maintenance costs of hydrogen-ready equipment and the level of achievable plant efficiency both before and after conversion.

Question 17

Are there any other commercial, operational, or environmental factors that might affect whether a site deploys hydrogen-ready boiler equipment?

Summary of responses:

There were 25 responses to this question.

Respondents highlighted a range of other factors, in addition to the future availability of hydrogen that would influence a site's decision to deploy hydrogen-ready industrial boiler equipment. The importance of having a secure low carbon fuel supply that is either continuously available through networks or can be stored safely and cost-effectively would be a significant factor for industrial sites. Respondents noted that the capital and operating costs, of alternative low carbon technologies would also be an important factor for industrial sites looking to decarbonise, as well as the average lifecycle of different types of equipment.

Physical space requirements, both before and after conversion to hydrogen, were highlighted as an important consideration as it was noted that some sites may not have sufficient space to install hydrogen-ready boiler equipment. In addition, respondents noted that the storage of hydrogen could impact a site's classification under the Control of Major Accident Hazards (COMAH) Regulations (2015) and therefore would need to be considered.

The method to produce hydrogen was also raised, and some respondents suggested that some industrial operators may opt exclusively for electrolytic hydrogen due to environmental concerns relating to hydrogen produced with CCUS. A company's environmental targets and strategy was also noted as a factor that could influence its decision on whether to deploy hydrogen-ready boiler equipment.

Question 18

Overall, do you agree it could be beneficial for industrial sites to deploy new boiler equipment that is hydrogen-ready? Please give details to explain your view.

Summary of responses:

There were 27 responses to this question.

- Strongly agree = 11
- Agree = 13
- Neither agree nor disagree = 1
- Disagree = 1
- Strongly disagree = 1

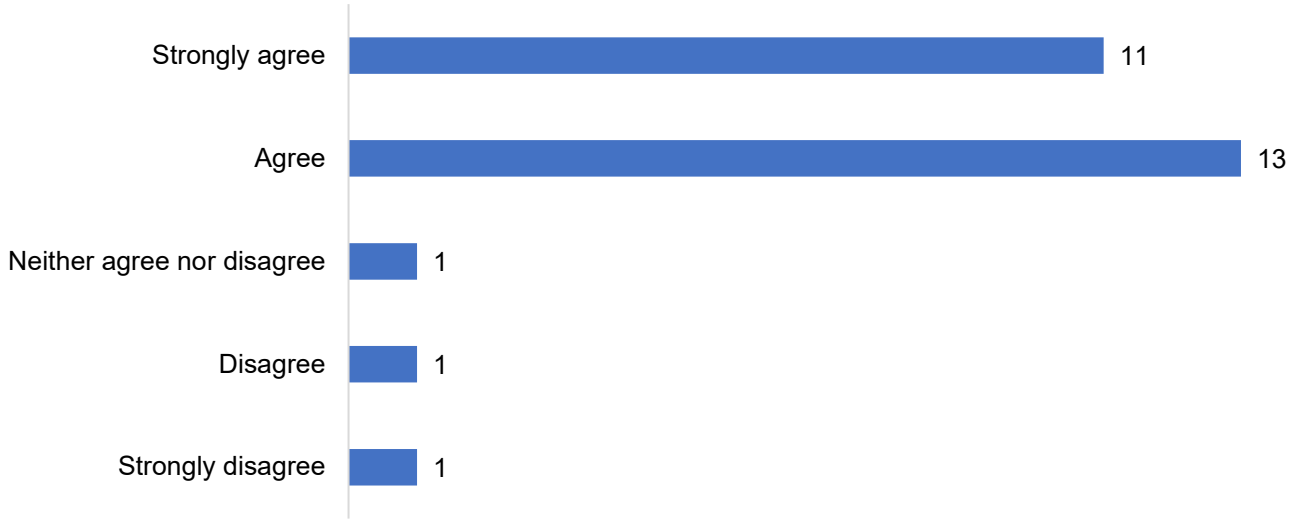

Figure 4 - Graphical representation of Q18 responses.

The majority of respondents (24) either agreed or strongly agreed that it would be beneficial for industrial sites to deploy new boiler equipment that is hydrogen-ready. Respondents noted that this decision would depend on the capital and operating costs to use industrial boilers that are hydrogen-ready compared to other options decarbonise boiler processes. The ability to futureproof industrial boiler equipment and minimise site downtime during conversion were noted as benefits. In addition, some respondents highlighted that it would be beneficial for the boiler equipment to be dual fuel, capable of operating on either natural gas or hydrogen, to protect sites against risks associated with the supply or price of hydrogen.

One respondent neither agreed nor disagreed that it would be beneficial for industrial sites to deploy new boiler equipment that is hydrogen-ready. The respondent noted that uncertainty around the future availability of hydrogen could mean that sites may never benefit from their capital investment in hydrogen-ready industrial equipment. The respondent noted that it may be more economically attractive for and industrial site to delay installing hydrogen-ready boiler equipment until the future availability of hydrogen becomes clearer and capital costs fall.

Two respondents either disagreed or strongly disagreed that it would be beneficial for industrial sites to deploy new boiler equipment that is hydrogen-ready. One respondent considered electrolytic hydrogen to be inefficient compared to using renewable electricity directly for heat processes. The other respondent believed that it may be beneficial for sites situated close to industrial clusters to deploy hydrogen-ready equipment but that it is too early to say for dispersed sites due to the uncertainty around the future availability of hydrogen. The respondent noted that in addition to potential increases in capital investment, deploying

hydrogen-ready equipment could lock an industrial site into burning natural gas for longer if a hydrogen supply does not become readily available.

Section 3 - The role for government to support hydrogen-ready industrial boiler equipment

Section overview

This section explored the potential benefits and risks of government encouraging the adoption of hydrogen-ready industrial boiler equipment and sought views on:

- whether government should encourage hydrogen-ready industrial boiler equipment
- the possible mechanisms and timescales of any government intervention
- the criteria to assess the merits of a regulatory approach

Section 3.1 - Enabling or requiring hydrogen-ready boiler equipment

Question 19

Considering the possible levers available, do you have any views on whether government should enable and/or require industrial boiler equipment to be hydrogen-ready?

Summary of responses:

There were 29 responses to this question.

A number of respondents considered that a requirement for equipment to be hydrogen-ready would be beneficial because it would ensure industrial boiler equipment could be converted to hydrogen more quickly and at a lower cost than would be possible with conventional equipment.

Some respondents suggested regulation would stimulate the supply chain to develop hydrogen-ready industrial equipment which could lead to a reduction in capital costs for equipment over time. Respondents also noted that regulation could help avoid a scenario where many conventional boilers require extensive retrofits or replacement altogether if hydrogen became available. Some respondents indicated that alongside regulatory requirements, financial support should be available to end-users to install hydrogen-ready equipment to mitigate the risk that they may not receive hydrogen within the boiler lifetime.

A number of respondents commented that government should enable rather than require hydrogen-ready industrial boiler equipment. An agreed definition of what constitutes a hydrogen-ready boiler, along with technical standards for industry to follow were the main enablers noted by respondents. Rather than a requirement, respondents suggested that education and financial incentives should be used to encourage industrial sites to deploy hydrogen-ready equipment. Respondents indicated this would mitigate the risk of sites incurring higher costs by installing hydrogen-ready equipment and then not being able to readily access hydrogen.

One respondent noted that an industrial boiler may be one of a number of process plant types a site may have that uses natural gas. It was noted that a requirement for industrial boiler equipment to be hydrogen-ready could make it more complex to manage onsite fuel infrastructure if a site has not yet decided how to decarbonise the other types of process equipment.

A few respondents noted that enabling or requiring hydrogen-ready industrial boilers may not be suitable for off-grid sites, with suggestions that a 'renewable-ready' approach that encompassed other decarbonisation technologies, such as biofuels, may be more effective.

Question 20

How do you think the market for hydrogen-ready boiler equipment would develop without regulation?

Summary of responses:

There were 24 responses to this question.

Respondents broadly agreed that the market for hydrogen-ready industrial boiler equipment would still develop without regulation, albeit at a slower pace. Without regulation, respondents noted that boiler manufactures are unlikely to develop hydrogen-ready equipment at scale due to more limited demand from industry. Respondents suggested demand would be reduced because of the anticipated increase in capital costs of hydrogen-ready equipment and the uncertainty around the future availability and price of hydrogen.

Several respondents considered that regulation could provide confidence to the supply chain to develop hydrogen-ready industrial equipment at scale, which could lower costs. It was also noted that without regulation, adoption of hydrogen-ready equipment is likely to be more sporadic, and that regulation would support wider adoption that could help individual sites and local areas convert to hydrogen more easily and quickly if and when hydrogen became available.

Some respondents noted that without regulation, the costs of converting hydrogen-ready equipment to 100% hydrogen could vary substantially depending on how the equipment manufacturer defined hydrogen-ready. Respondents noted that this could result in end-users facing significant, unforeseen costs to successfully fuel switch to hydrogen.

Question 21

Do you agree with the benefits and risks presented of requiring boiler equipment to be hydrogen-ready? Are there any other factors to consider?

Summary of responses:

There were 24 responses to this question.

Respondents broadly agreed with the benefits presented in the call for evidence, highlighting that a requirement for industrial boiler equipment to be hydrogen-ready would send a clear signal to the supply chain and provide confidence for investment in hydrogen-ready products. In addition, one respondent noted that requiring boiler equipment to be hydrogen-ready could have indirect benefits for the electricity system as it could help reduce the burden on the electricity grid capacity and diversify energy demand.

Respondents broadly agreed with the risks presented, although a few commented some risks may be slightly overstated. For example, one respondent noted that if hydrogen became available to a site it is unlikely that site operators would opt not to convert hydrogen-ready equipment. Respondents commented that the most significant risk is the uncertainty around hydrogen availability and the additional costs associated with hydrogen-ready equipment, without receiving any immediate decarbonisation benefits. The possibility of NOx limits being amended in the future and the ability of hydrogen-ready equipment to meet the limits was also highlighted as a risk.

Question 22

Overall, do you agree that it would be beneficial for government to require boiler equipment to be hydrogen-ready?

Summary of responses:

There were 26 responses to this question.

- Strongly agree = 10
- Agree = 11
- Neither agree nor disagree = 1
- Disagree = 3
- Strongly disagree = 1

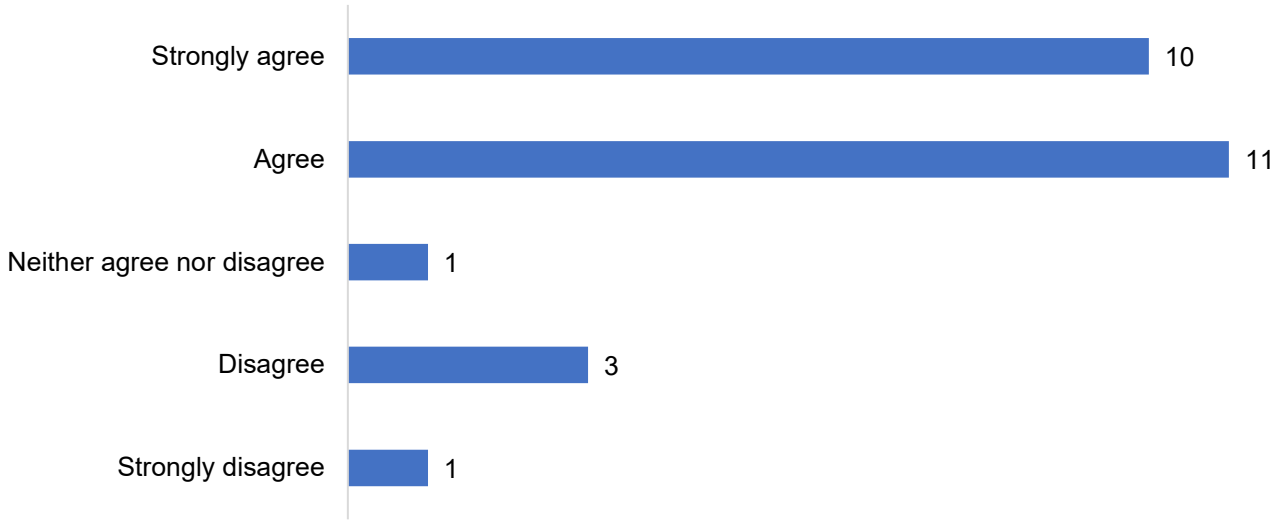

Figure 5 - Graphical representation of Q22 responses.

The majority of respondents (21) either agreed or strongly agreed that it would be beneficial for government to require boiler equipment to be hydrogen-ready. Respondents commented that sites are not likely to invest in decarbonisation technologies without regulation and guidance from government. Respondents noted that regulation would stimulate the supply chain for industrial boilers to produce hydrogen-ready boiler equipment at scale and avoid the need for conventional equipment to be retrofitted, which may be more expensive and delay the speed at which industrial sites can fuel switch to hydrogen.

One respondent neither agreed nor disagreed that it would be beneficial for government to require boiler equipment to be hydrogen-ready. The respondent noted that there should be a requirement to decarbonise, but it should not mandate the installation of a hydrogen-ready equipment.

Four respondents either disagreed or strongly disagreed that it would be beneficial for government to require boiler equipment to be hydrogen-ready. Several of these respondents commented that government should support the deployment of hydrogen-ready industrial equipment rather than require it. Respondents noted that enabling rather than requiring would reduce the likelihood of dispersed sites from paying a premium on equipment which cannot be decarbonised if hydrogen does not become readily available. One respondent acknowledged that as the future availability of hydrogen becomes more certain, a requirement covering areas likely to receive hydrogen could be beneficial.

Question 23

If government required industrial boilers to be hydrogen-ready, what would be the implications for other types of equipment used for combustion of fossil fuels? (e.g. domestic and commercial boilers, industrial kilns, furnaces, ovens, dryers, and electricity generating equipment.)

Summary of responses:

There were 27 responses to this question.

Respondents noted that a requirement to install hydrogen-ready industrial boilers could encourage hydrogen production, supporting other hydrogen end-users too. Several respondents noted that certain principles of hydrogen-ready industrial boiler design may be easily transferable to other types of combustion equipment, though suitable hydrogen-ready standards would still be required. Respondents commented it may not be practical or feasible to make all types of industrial equipment hydrogen-ready and that different types should be considered on a case-by-case basis, with standards being introduced in a staggered fashion.

Some respondents noted that industrial boilers are often not the only pieces of combustion equipment on an industrial site, and this could add complexity and cost if multiple fuel supplies are required. In addition, respondents noted that a requirement for boiler equipment to be hydrogen-ready could impact combined assets such as Combined Heat and Power (CHP), and that decarbonising these assets should be considered as a whole system.

Section 3.2 - How hydrogen-ready regulation could work in practice

Question 24

Do you have any views on what kind of regulatory approach might be suitable for requiring the deployment of hydrogen-ready industrial boiler equipment?

Summary of responses:

There were 21 responses to this question.

Respondents gave a range of views for how hydrogen-ready regulation for industrial boilers could work in practice. Several respondents agreed that requirements based on a combination of product standards and the environmental permitting regime would be most effective. Several respondents also commented that the environmental permitting regime, as a mandatory requirement, would be more impactful, however that a voluntary product standard could help ensure industry is aligned. Proposals described in BEIS' call for evidence on Decarbonisation Readiness permitting requirements for the power sector were highlighted as a potentially effective regulatory mechanism that could allow for requirements to evolve over time.[2]

A few respondents commented that product standards would be too complex to be effective, as many sub-components used for industrial boilers are currently imported from overseas and a significant amount of work would need to be undertaken to develop such standards. In contrast, one respondent highlighted that it is likely that plant operators would prefer the use of product regulation rather than environmental permitting. The respondent commented that it would be more efficient to regulate a small number of OEMs rather than for a large number of boiler operators to have to adhere to requirements.

One respondent noted that government could explore options to set requirements based on geographical areas linked to hydrogen availability, with the option to expand these as hydrogen becomes more readily available. Several respondents commented that any regulation should be accompanied by capital support for the deployment of hydrogen-ready industrial equipment.

Question 25

Do you have any views on whether we should consider the potential for regulating hydrogen-ready industrial boiler equipment separately from hydrogen-ready requirements for power generation?

Summary of responses:

There were 17 responses to this question.

Respondents generally agreed that it would be beneficial to align environmental regulation between industrial and power generation sectors. However, respondents noted that there are

[2] HM Government, Decarbonisation Readiness: Call for evidence on the expansion of the 2009 Carbon Capture Readiness requirements, 2021

significant technical and commercial differences between the design of industrial plants and power plants, therefore tailored requirements for specific pieces of equipment would be needed to account for this. For example, respondents noted that hydrogen-ready industrial boilers could be deployed in the near future whereas hydrogen-ready combined cycle gas turbines are more complex and therefore are likely to take longer to develop. There was broad agreement from respondents that any aligned regulation should consider a range of factors including, technology readiness, safety requirements and the availability of space.

Question 26

Do you have any views on the possible exemptions presented? Are there other factors that should be considered when assessing potential exemptions?

Summary of responses:

There were 10 responses to this question.

Respondents broadly agreed that the possible exemptions presented in the call for evidence were comprehensive. Geographical based exemptions were supported by a number of respondents in particular. One respondent suggested two additional exemptions, first to cover equipment with lower thermal capacities and second to consider the proportion of emissions from boiler processes in relation to emissions from the whole site.

Several respondents highlighted that fewer exemptions would be required if off-grid sites were appropriately considered in the design of any regulation, rather than requirements focussing on industrial sites connected to the natural gas grid. One respondent noted that a large number of sites may need to be exempt due to the number of back-up boiler systems deployed in in the UK, a lack of certainty around future availability of hydrogen, and if other decarbonisation pathways, such as CCUS, are better suited.

Question 27

Do you have any views on the potential timing for introducing any regulation requiring industrial boiler equipment to be hydrogen-ready?

Summary of responses:

There were 24 responses to this question.

Respondents agreed that there should be adequate time between the announcement of any regulation and its enforcement since the replacement of industrial boiler equipment can be a complex project and can take several years to plan and secure investment. Several respondents commented that regulation should be announced as soon as possible as this would send a clear signal to OEMs and end-users, providing them with confidence to invest in hydrogen-ready industrial boiler equipment.

Some respondents commented that hydrogen-ready equipment should be brought to market as soon as possible, however regulation should only be introduced once there is clarity on

where hydrogen would be available to allow sites to make an informed decision. One respondent noted that due to the significant lifespan of industrial boiler equipment, it is essential that equipment being sold today is at least capable of operating on a 20% hydrogen blend should gas grid supply such a blend in the future.

Question 28

Do you have any views on how potential requirements for boiler equipment might need to evolve, as options for industrial sites to decarbonise change over time?

Summary of responses:

There were 15 responses to this question.

Respondents broadly agreed that any requirements for industrial boiler equipment to be hydrogen-ready should be reviewed frequently to account for any evolution in technology. Respondents commented that there may need to be requirements around dual-fuel equipment to ensure resilience whilst energy sources transition from natural gas to hydrogen. One respondent noted that once hydrogen becomes widely available end-users would no longer install hydrogen-ready equipment, but hydrogen equipment instead.

One respondent noted that to mitigate the risk that end-users might install conventional equipment sooner than might otherwise of have happened as a way to avoid having to comply with regulation, government could introduce a date by which all existing equipment needs to be retrofitted to become hydrogen-ready.

Section 3.3 – Criteria to evaluate whether to take a regulatory approach

Question 29

Do you think these three criteria provide the right framework to assess the merits of hydrogen-ready regulation?

- *Fast and cost-effective emissions abatement*
- *Technical viability*
- *Deliverability*

Summary of responses:

There were 22 responses to this question.

- Strongly agree = 3
- Agree = 16
- Neither agree nor disagree = 1
- Disagree = 2
- Strongly disagree = 0

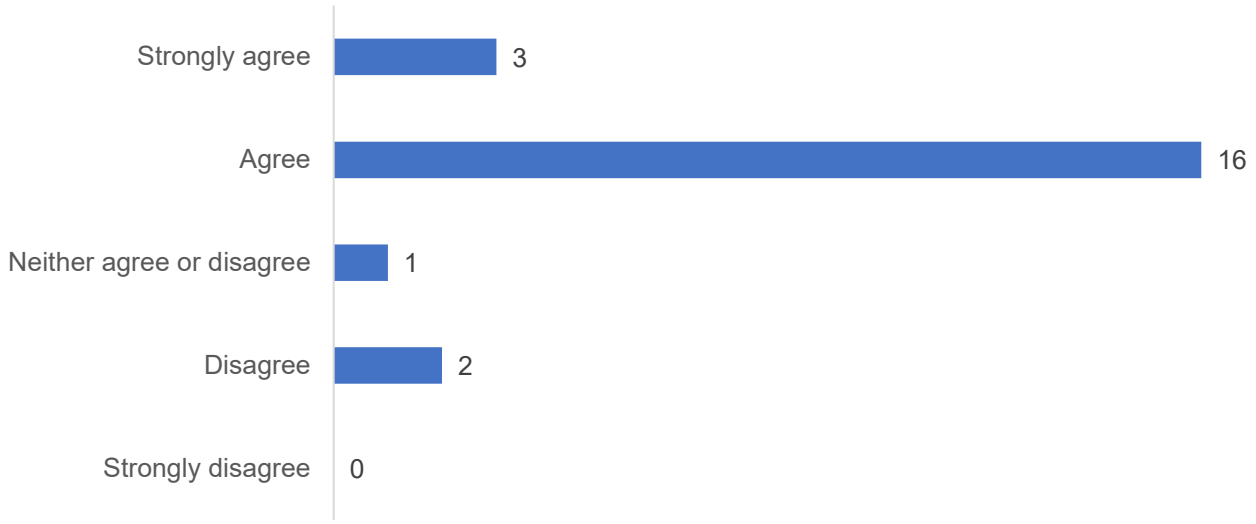

Figure 6 – Graphical representation of Q29 responses.

The majority of respondents (19) either agreed or strongly agreed that the three criteria outlined in the call for evidence provide the right framework to assess the merits of hydrogen-ready regulation. Respondents highlighted the need for a balance between the criteria which allows for effective emissions abatement whilst not overly disrupting day-to-day operations at a site. Respondents also noted that the deliverability criteria would be substantially influenced by supply chain readiness and the importance of engaging with OEMs, maintenance, and training providers was highlighted. One respondent suggested an additional criterion to help ensure that regulation enables other technologies to decarbonise industrial boilers to compete on a level playing field.

One respondent neither agreed nor disagreed and two respondents disagreed with the criteria presented in the call for evidence, they did not provide reasoning for their response.

Question 30

Are there other factors or criteria that should be accounted for?

Summary of responses:

There were 15 responses to this question.

Several respondents commented that fuel availability should be a criterion, as some sites may never receive hydrogen and therefore risk paying an upfront premium for equipment that they cannot decarbonise.

Two respondents commented that the criteria should have a level of flexibility to allow industrial sites to choose how to best decarbonise their boiler equipment. Other respondents noted that any criteria should account for environmental factors, hydrogen-electric hybrid technologies and whether hydrogen is blended with natural gas or 100% hydrogen gas.

Section 4 – The role of the supply chain and economic opportunities for the UK

Section overview

This section examined the roles that relevant supply chain participants would play in supporting the deployment of hydrogen-ready industrial boiler equipment and sought views on:

- how the supply chain may need to support industry to develop hydrogen-ready equipment
- the wider economic implications of hydrogen-ready equipment

Section 4.1 - The role for supply chains in enabling deployment of hydrogen-ready boiler equipment

Question 31

Are the listed services the supply chain provides for the industrial boiler market accurate?

- *Manufacturing*
- *Installation*
- *Finance and insurance*
- *Operation*
- *Inspection, maintenance, and modification*
- *Decommissioning, disposal, and resale*

Summary of responses:

There were 16 responses to this question.

Respondents agreed that the services listed reflect the industrial boiler market. Several respondents noted that design consultancy services should be included as industrial boiler projects are likely to involve design engineers.

Question 32

Do you agree that the existing supply chain would be able to adapt to meet potential regulation requiring industrial boiler equipment to be hydrogen-ready? Please explain your answer.

Summary of responses:

There were 23 responses to this question.

- Strongly agree = 4
- Agree = 14
- Neither agree nor disagree = 4
- Disagree = 1
- Strongly disagree = 0

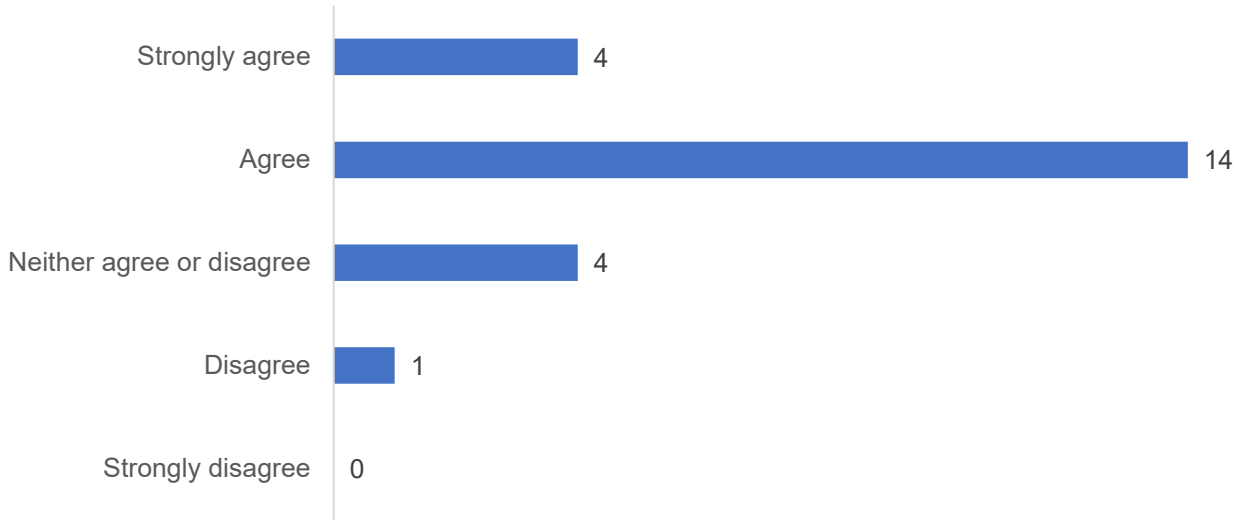

Figure 7 – Graphical representation of Q32 responses.

The majority of respondents (18) either agreed or strongly agreed that the existing supply chain would be able to adapt to meet potential regulation. Respondents noted that the availability of standards would be critical to give confidence to the market and that sufficient time should be allowed between the introduction of any potential regulation and its enforcement. Respondents highlighted that training and education would also be important in ensuring the supply chain is able to adapt successfully.

Four respondents neither agreed nor disagreed, they noted that many manufacturers of industrial boilers would already have products that are either partially capable or fully capable of operating on hydrogen. Respondents also noted that the ability for the supply chain to adapt would be dependent on funding support to run trials and testing.

One respondent disagreed that the existing supply chain would be able to adapt to meet potential regulation. The respondent suggested hydrogen may not be the most efficient decarbonisation option in all situations, for instance where sites have access to CCUS. The respondent noted that government support for hydrogen-ready equipment could improve the investment case for this technology, when compared to other ways to decarbonise.

Question 33

How could the government help supply chain participants to support the deployment of hydrogen-ready boiler equipment?

Summary of responses:

There were 19 responses to this question.

Respondents noted that government could support the development of hydrogen-ready products by sponsoring technical standards to help align the industrial boiler market. Linked to this, respondents highlighted the importance of innovation and demonstration trials and commented that government could support the funding of these. Respondents also noted the

importance of education and ensuring training programmes account for the use of hydrogen as a fuel.

Respondents highlighted that hydrogen-ready industrial boiler equipment is likely to cost more than conventional equipment and therefore suggested government could set up a capital grant scheme to support end-users to purchase hydrogen-ready equipment.

More information about the future availability of hydrogen was also mentioned by respondents as a way in which government could help the supply chain to deploy hydrogen-ready boiler equipment in industry.

Question 34

How much time would be needed between the details of regulation being provided and any new requirements coming into effect?

Summary of responses:

There were 16 responses to this question.

Respondents broadly agreed that a period of 2-3 years would be an appropriate timeframe between the details of any regulation being provided and any new requirements coming into effect. Some respondents also suggested a timescale of 1 year, whilst others suggested up to 5 years. Respondents noted that a period of 2-3 years would allow OEMs to adapt their production lines and carry out necessary testing. Respondents also noted that it would allow end-users to account for the change of regulation in their boiler maintenance and replacement programmes.

Question 35

By what date could supply chains enable industrial sites to meet potential new requirements for boiler equipment to be hydrogen-ready? Please give details for your views.

Summary of responses:

There were 19 responses to this question.

Several respondents mentioned that a number of OEMs are capable of producing hydrogen-ready industrial boiler equipment today, however the availability of technical standards and certification would help the whole supply chain to develop. Several respondents mentioned the year 2025 as the date by which supply chains could enable industrial sites to meet potential new requirements for boiler equipment to be hydrogen-ready.

Section 4.2 - The role for supply chains in enabling deployment of hydrogen-ready boiler equipment

Question 36

How could hydrogen-ready requirements for industrial boiler equipment support the following objectives and maximise benefits to the UK economy:

- *Jobs and investment*
- *Export opportunities*
- *Innovation, knowledge, and technology transfer*
- *Leadership for standards and regulation*

Summary of responses:

There were 19 responses to this question.

There was broad agreement from respondents that requirements for industrial boiler equipment could benefit all the areas listed. Respondents noted that regulation could help keep the UK at the forefront of the global hydrogen economy, noting that UK hydrogen standards are currently being used as the basis for standards around the world.

Several respondents noted benefits to the UK economy including investment, growth and the creation of jobs in the hydrogen sector, whilst also improving the UK's energy security. Some of the respondents highlighted that the cost regulation might impose should not be so high that it discourages investment and threatens the economic viability of businesses.

Question 37

Do you have any views or evidence regarding work to develop standards or regulation in other countries which would be relevant if the UK were to require industrial boiler equipment to be hydrogen-ready?

Summary of responses:

There were 14 responses to this question.

Respondents broadly agreed that the UK should continue to work with international bodies, for example the European Committee for Standardization (CEN). Respondents noted this would help support the harmonisation of standards, export opportunities and facilitate a global supply chain

Several respondents noted that standards produced by the British Standards Institute and the Institution of Gas Engineers and Managers (IGEM) would need to be amended to account for the use of hydrogen.

One respondent commented that the British Standards Institute provides a forum to engage with stakeholders contributing standards related to hydrogen developed by CEN and the International Standardization Organization (ISO). Another respondent suggested that PAS

4444 for non-industrial hydrogen-fired gas appliances has been referenced in the development of other international standards on hydrogen.

Question 38

Are there any other final comments you wish to make regarding this call for evidence?

Summary of responses:

There were 9 responses to this question.

Several respondents conveyed their support for government to require hydrogen-ready industrial boiler equipment in their final comments. A respondent noted that a separate CfE should be conducted to cover other types of industrial equipment as there is significant differences in design. Another respondent commented that focus should be on the retrofit of existing equipment, given the long lifespan of an industrial boiler. One respondent highlighted that hydrogen training and education programmes, along with new digital technologies would be needed to facilitate a transition to hydrogen.

Acronyms

Acronym	Definition
BEIS	Department for Business Energy and Industrial Strategy
BSI	British Standards Institution
CCUS	Carbon Capture, Usage and Storage
CEN	European Committee for Standardization
CfE	Call for Evidence
CHP	Combined Heat and Power
COMAH	Control of Major Accident and Hazards (regulation)
IE	Industrial Emissions (regulation)
IGEM	Institute of Gas Engineers and Managers
ISO	International Standardization Organization
MCP	Medium Combustion Plant (regulation)
NOx	Nitrous Oxides
PAS	Publicly Available Specification
UK ETS	UK Emissions Trading Scheme
UV	Ultraviolet

This consultation is available from: https://www.gov.uk/government/consultations/enabling-or-requiring-hydrogen-ready-industrial-boiler-equipment-call-for-evidence

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