Department for
Business, Energy
& Industrial Strategy

Consultation on a UK low carbon hydrogen certification scheme

Closing date: 28 April 2023

February 2023

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

Contents

General information

Why we are consulting

In the 2022 British Energy Security Strategy, we committed to setting up a certification scheme for low carbon hydrogen by 2025. The responses to this consultation will support the development of the scheme.

Consultation details

Issued: Thursday 9th February 2023

Respond by: 11.45pm, Friday 28th April 2023

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Consultation reference: Consultation on a UK low carbon hydrogen certification scheme

Audiences:

The consultation will be of particular interest to organisations involved in the production and distribution of hydrogen, as well as end users and those with an interest in wider energy system impacts and decarbonisation. It will also be of interest to stakeholders in the hydrogen industry, as well as those with a wider interest in the UK's net zero ambition.

Territorial extent:

The scope of this consultation is UK-wide. Our preferred approach is for hydrogen certification to be applicable on a UK-wide basis to support decarbonisation across the UK. Some of the proposals may fall within an area of devolved responsibility in Scotland, Wales and/or Northern Ireland. We will continue to work with the devolved administrations as we develop and finalise the certification scheme.

How to respond

Respond online at: https://beisgovuk.citizenspace.com/nzs/low-carbon-hydrogen-certification-scheme

or

Email to: HydrogenProduction@beis.gov.uk

When responding, please state whether you are responding as an individual or representing the views of an organisation.

Your response will be most useful if it is framed in direct response to the questions posed, though further comments and evidence are also welcome.

Confidentiality and data protection

Information you provide 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).

If you want the information that you provide to be treated as confidential please tell us, but be aware that we cannot guarantee confidentiality in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not be regarded by us as a confidentiality request.

We will process 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. The summary will include a list of names or organisations that responded, but not people's personal names, addresses or other contact details.

Quality assurance

This consultation has been carried out in accordance with the Government's consultation principles.

If you have any complaints about the way this consultation has been conducted, please email: beis.bru@beis.gov.uk.

Introduction

Hydrogen can support the decarbonisation of the UK economy, particularly in 'hard to electrify' industrial sectors, and provide greener, more flexible energy across power, transport and potentially heat. Hydrogen produced in the UK could also create thousands of jobs across the country, and provide greater domestic energy security, lowering our reliance on energy imports.

In the British Energy Security Strategy (BESS), the Government renewed its commitment to hydrogen by doubling its ambition to up to 10GW of new low carbon hydrogen production capacity by 2030[1], with at least half of this coming from electrolytic hydrogen production.

The BESS also committed to launching a hydrogen certification scheme by 2025 to demonstrate high-grade British hydrogen for export and ensure any imported hydrogen meets the same high standards that UK companies expect.

A low carbon hydrogen certification scheme could create benefits for the whole hydrogen value chain, including producers, off-takers and society as a whole, and support decarbonising the hydrogen economy. Certificates could help scheme participants to access new low carbon markets, report progress towards decarbonisation targets to corporate stakeholders, demonstrate eligibility and compliance for subsidy schemes, or be used to meet Government obligations and prove compliance with regulations.

Markets for hydrogen already exist, but because companies can enter them while making 'uncertified' claims, concerns about greenwashing can undermine consumers' and investors' confidence in them. Certificates, especially when backed by Government and a strong Chain of Custody, are a powerful way to demonstrate that emissions savings companies claim to have made, have indeed actually occurred. This can help to support Government's net zero and wider environmental goals.

Since publication of the UK Hydrogen Strategy in 2021, there has been a rapid increase in global interest and investment concerning the development of an international market for low carbon hydrogen. The UK is keen to play a leading role in developing the global market for low carbon hydrogen and we are focused on working with others to ensure it is underpinned by effective common standards, for example through continued engagement with international forums such as the International Partnership for Fuel Cells in the Economy (IPHE).

With the increase in international competition, we expect there to be opportunity for the UK to both import and export low carbon hydrogen, although this will depend on domestic demand. The certification scheme aims to enable both the hydrogen and the low carbon attributes of hydrogen to be exported, through compatibility with a range of international certification schemes, allowing exporters to demonstrate their emissions credentials internationally. Similarly, the certification scheme aims to provide the opportunity to certify the emissions of

[1] Subject to affordability and value for money.

imported hydrogen seeking to demonstrate its compliance with the Low Carbon Hydrogen Standard (LCHS).

The role of the low carbon hydrogen standard in certification

The LCHS, published in April 2022, sets an emissions threshold and methodology for calculating production emissions of hydrogen in eligible pathways. It was designed to ensure new hydrogen production contributes to our carbon emissions reduction target while also enabling a quick growth of the sector.

We envisage the certification scheme will use the methodology set out in the LCHS to calculate the embodied emissions in the hydrogen it certifies. The LCHS is intended to also be the basis for other elements of eligibility policy (such as eligible production pathways). This builds on the LCHS's current role as a condition for Government support through the Net Zero Hydrogen Fund (NZHF) and Hydrogen Production Business Model (HPBM), extending the reach to the wider UK market and to cover imports and exports.

Objective, design features and principles for the scheme

Low carbon hydrogen could enable savings of 41MtCO_2e between 2023 and 2032, or 9% of 2018 UK emissions. This emissions reduction would support the UK to meet our Net Zero Strategy[2] commitment to end the UK's domestic contribution to man-made climate change by 2050. Creating a trusted, transparent guarantee of origin will help to deliver these carbon reductions by boosting the growth of the low carbon hydrogen market, helping consumers choose low carbon hydrogen and moving towards the UK's net zero target. There are many potential benefits that a certification scheme for low carbon hydrogen could bring to the hydrogen economy, but to guide the development of the scheme we have set out our proposed priorities for what the main design features of the scheme should be.

The scheme's overall objective is to support the decarbonisation of the hydrogen economy. To this end, it should align with the UK's net zero objectives. It should also minimise any risk of greenwashing and encourage decarbonisation through compatibility with other domestic decarbonisation schemes to generate synergies. This is best achieved by making sure that there is a clear link between producers and end users of low carbon hydrogen.

With the aim to support this objective, the following priority design features have been set out in a hierarchical approach as, in some instances, design features may need to be traded against one another. For the scheme to be successful, there must be a high degree of confidence in the transparency and traceability of the hydrogen so that end users can be sure about the product they are consuming and demonstrate the associated emissions.

[2] Net Zero Strategy: Build Back Greener https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf

Primary priority design feature

- The scheme must connect producers and end users by providing a method of verifying and tracing the emissions of low carbon hydrogen use, so that end users can have confidence in the low carbon credentials of their hydrogen.

Secondary priority design features

- The scheme should stimulate market growth and incentivise the production of low carbon hydrogen. To this end, it should allow for wide participation across the hydrogen industry. It should also reflect market preferences for low carbon hydrogen as a distinct product through certificate transactions and pricing that allows producers and consumers in the market to capture the green premia of low carbon hydrogen. Supporting market growth also requires a user-friendly scheme with limited administrative burdens and participation costs for scheme participants.
- The scheme should facilitate cross-border trade in low carbon hydrogen. Its design should consider compatibility with international schemes of an appropriate standard, including those of likely hydrogen trade partners. It should also be predictable and provide a stable, long-term investment perspective to international markets so international players can easily forecast certification compliance.

In addition to the priority design features of the scheme, we have developed a set of principles to guide its development. These guiding principles reflect broader hydrogen policy and the direction we want to take.

The Low Carbon Hydrogen Certification Scheme should be:

1. Inclusive

- Open to the entire low carbon hydrogen market including import and export.
- Able to be used by different end users of hydrogen.
- Flexible and able to adapt as the LCHS evolves including the addition of new production pathways.

2. Accessible

- Cost-effective, with appropriate and acceptable costs of compliance for operators and for the scheme administrator.
- Simple, user-friendly and adapted to business requirements.

3. Transparent

- Information is freely available about the approach and process for certifying low carbon hydrogen.

4. Compatible

- Can operate alongside UK schemes for other energy vectors (e.g. fuels, power); has the ability to convert certificates between vectors, and uses comparable Green House Gas emission metrics.

- Be flexible to facilitate appropriate harmonisation with a range of international hydrogen certification schemes, facilitating international trade.

5. Informative

- Should contain enough information to allow the user to understand key details on how hydrogen was produced.
- Information contained is sufficient to be compatible with down chain schemes such as product standards.

6. Robust

- Avoidance of fraud and misuse.
- Frequency of reporting and auditing is adapted to the complexity of supply chains and identified risk levels, implementing at least a “limited” assurance level.

7. Predictable

- Providing investment security for the industry, and the ability to reliably forecast compliance.

Structure of the consultation

This consultation sets out Government's 'minded to' positions on the design elements of a Low Carbon Hydrogen Certification Scheme. We are seeking views on these initial positions and intend to continue to engage with industry as we develop our thinking and finalise the scheme's design. This consultation is separated into sections covering the following areas:

- **Chapter 1 – Fundamental scheme design.** This chapter highlights the basic building blocks for the scheme. We propose that participation in the scheme should be voluntary, UK-wide, and that we expect the scheme to evolve over time following the LCHS. We also set out our 'minded to' position for the unit that certificates should be issued in, identify the need to consider how to issue certificates with an evolving standard, and set out how we expect the scheme to interact with the UK Emissions Trading Scheme.
- **Chapter 2 – Information disclosure.** This chapter discusses what information should be contained on a certificate. We set out the certificate design of some international schemes, and then set out our 'minded to' position that a certificate should include both factual information and a label to help interpret that information. Finally, we discuss how tiered labels could be introduced.
- **Chapter 3 – Chain of Custody.** This chapter sets out how certificates should allow hydrogen to be traced through the value chain. Here we set out our 'minded to' position that a Mass Balance system of Chain of Custody is most appropriate for this scheme.
- **Chapter 4 – Further design considerations.** This chapter sets out issues that are likely to require further consideration as we develop the scheme. These issues include how we could structure our consignment approach, how we can enable international trade of certificates, and challenges arising from the mid-stream.
- **Chapter 5 – Delivery and administration.** This chapter talks about how the scheme could be delivered including data reporting and frequency; alignment with other schemes, the transfer and retirement of certificates, and how the scheme could be delivered.

Chapter 1 – Fundamental scheme design

To begin designing a certification scheme for low carbon hydrogen, we must first establish the basics on which the more complex design elements can be built. We need to understand who should be able to participate in the scheme, what the scheme's geographical remit is, how the scheme could adapt to an evolving hydrogen market, and what unit certificates will be issued in.

Scheme participation

As set out in the introduction to this consultation, our intention is that the Low Carbon Hydrogen Standard (LCHS) forms the basis for the emissions methodology of the certification scheme, as well as other elements of eligibility policy. This means that the certification scheme would be open to any producers that are able to produce LCHS compliant hydrogen, and any end users that derive benefit from being able to prove the low carbon credentials of their hydrogen. The certification scheme should follow the evolution of the LCHS which is set to be reviewed as the sector develops. We will need to consider how the scheme treats producers who were previously able to certify their hydrogen but cannot comply with an updated version of the LCHS. This is discussed in more detail in the next section of this chapter.

We want the certification scheme to create benefits for producers, off-takers and society as a whole, supporting progress towards net zero. Wide participation in the scheme will be essential to delivering these benefits. We also want to build trust and confidence in certificates so that the scheme becomes the gold standard for verification of low carbon hydrogen. Through time, it may be this is best served by making participation in the scheme mandatory. However, we recognise that the UK hydrogen market is growing and that producers will have differing needs and priorities. For this reason, we are proposing that participation in the scheme be voluntary for producers to begin with. Whilst there will be no obligation to enrol, and we aim to design a scheme that has sufficient benefits, both financial and non-financial, to encourage hydrogen producers to join. We also aim to work with industry to identify how certification can support the widest range of end use cases.

Evolution of certification

It is our ambition that production of low carbon hydrogen in the UK will grow to 2GW in construction or operation by 2025, and to up to 10GW by 2030. Alongside this growth in production, it is also anticipated that the ways in which we use hydrogen to decarbonise our economy will develop significantly over this period. In order to reflect these changes in the hydrogen market, we expect that the certification scheme will need to evolve over its lifetime too. It is our intention that the scheme will run in continuous operation, however there may be events or circumstances that require us to pause or suspend the scheme.

The certification scheme is expected to follow the evolution of the LCHS which is set to be reviewed as the sector develops. These updates could involve lowering the threshold or including additional emissions sources to the methodology. Projects benefiting from Government schemes such as the Hydrogen Production Business Model and the Net Zero Hydrogen Fund will have to comply with a specific version of the LCHS, with the current intention being that this would be grandfathered within their agreements. BEIS is still considering whether any exclusions to the 'grandfathering' provisions should apply.

The grandfathered LCHS is a minimum requirement for producers eligible to receive HPBM and NZHF support. Producers can voluntarily lower their emissions beyond the threshold, however, some may not be able to do so. This means there may be a discrepancy for those producers who were previously able to certify their hydrogen but can no longer comply with the certification scheme due to an updated version of the LCHS.

We are considering options for the treatment of this issue whilst balancing the integrity of the certification scheme with the need to manage investment risk for hydrogen producers. This includes potentially offering ‘legacy’ certificates for those that were previously compliant with the certification scheme, noting that in all instances the producer must remain compliant with the grandfathered LCHS scheme. Or we could provide certificates only for hydrogen meeting the most up to date standard. When deciding on our approach, we will balance our ambition for a growing hydrogen economy with the integrity of the scheme.

Geographical scope

We propose that the scheme would be of greatest benefit if offered UK-wide, to support decarbonisation across the UK. There will also be great benefit to producers based in devolved regions in partaking in a single certification scheme due to the opportunities for low carbon hydrogen production in these areas. Any potential implications for international trade will be assessed as details of the scheme are developed, including consideration of the Northern Ireland Protocol. We are working with devolved administrations on how a UK-wide scheme might be implemented should areas of devolved responsibility be engaged.

Additionally, one of the design features of the certification scheme is to better facilitate international trade. While we propose that the geographical scope of the scheme will be limited to the UK, we intend to design the scheme to eventually be interoperable with comparable international schemes.

Certificate units

For certificates to be useful, it is important that they are issued based on a unit that is both easily understandable but also aligned with standard metering and reporting of hydrogen. We considered different categories of units including energy-based, mass-based, volume-based, and time-based. Our ‘minded to’ position is that energy-based units (MWh) for hydrogen certificates would be most useful as;

- After adjusting for temperature and pressure, each certificate will represent the same amount of hydrogen as any other certificate. This is not true for a mass or volume-based approach because different masses or volumes of hydrogen may have different energy content. Similarly, on a time-based approach, the rate of production may vary.
- Gas is usually priced on an energy basis, and metered on a volume basis, before being converted to energy for charging. Aligning the certificates with this approach will make it simpler to tie the sale of hydrogen and a certificate together.
- Other emerging international schemes such as CertifHy and TÜV SÜD are being developed with energy-based units (MWh). Using a similar approach is likely to make future harmonisation more straightforward.
- This approach is well recognised in the energy industry as the LCHS operates in MJ LHV, electricity is metered and sold in kWh, and Renewable Energy Guarantees of Origins (REGOs) operate in MWh.

Interaction with the UK Emissions Trading Scheme

Our intention is for each certificate to state the hydrogen's embodied emissions from the production of hydrogen. When hydrogen is burned, regardless of the production method, there are no greenhouse gas emissions. Therefore, certificates will not provide evidence for reduced UK Emissions Trading Scheme (ETS) bills based on hydrogen usage; ETS will continue to monitor actual emissions from fuel usage and charge accordingly. Hydrogen certificates can however be used to demonstrate scope 2 or 3 emissions associated with the use or combustion of hydrogen[3].

Questions

1. **Do you agree with the design features set out in the introduction?**
    a. **Please explain your answer and suggest any alternative or additional features and how they should be prioritised.**
2. **Do you agree with the principles set out in the introduction?**
    a. **Please explain your answer and suggest any alternative or additional principles for the development of the scheme.**
3. **Do you agree that there should be a single certification scheme covering the UK?**
    a. **Please explain your answer.**

[3] Emissions scopes can be found in Annex A

4. **Do you agree that participation in the scheme should be voluntary initially?**

    a. **Please explain your answer.**

5. **If LCHS changes through time, do you think the certification scheme should offer 'legacy' certificates based on compliance with previous versions of the LCHS?**

6. **How do you think 'legacy' certificates would impact the certification scheme and the market for certified hydrogen?**

7. **Do you agree that certificates should be issued based on MWhs of hydrogen?**

    a. **If you answered "no" to question 7, please state your concerns and suggest your preferred alternative.**

Chapter 2 – Information disclosure

The certificates issued as part of the low carbon hydrogen certification scheme will need to contain enough information to support informed purchasing decisions and allow end users to demonstrate how the hydrogen they are using was produced. Certificates in comparable international schemes often carry two kinds of information: factual disclosure and a label. The first describes the properties of the hydrogen and the second gives information about what standards those properties meet. For example, the factual disclosure might report the time at which the hydrogen was produced, the production pathway used, and, most importantly, the emissions intensity of this production. The label might report whether this qualifies the hydrogen as low carbon, or precisely which standards it meets in a more complex rating system. This chapter discusses our approach to disclosure and labelling, as well as what kind of information a certificate may display.

Certificate designs in international schemes

Hydrogen certificates already in use or development, in schemes around the world, vary in detail, but always involve one or both of the two basic elements of disclosure and labelling.

- Australia hydrogen guarantee of origin: the scheme discloses information but has no label.
- France hydrogen guarantee of origin: the scheme certifies hydrogen with all levels of emissions and has three labels: ‘renewable hydrogen’ for renewable-based pathways, ‘low-carbon hydrogen’ for non-renewable but low-carbon pathways, and ‘fossil hydrogen’ for all other hydrogen. There is no public information available on the specific information disclosure fields under the scheme.
- China Hydrogen Alliance Standard: the standard has three different labels and only certifies hydrogen below a certain emissions threshold: ‘low carbon hydrogen’ (14.51kgCO_2e/kgH_2 threshold), ‘clean hydrogen’ (4.9kgCO_2e/kgH_2), and ‘renewable hydrogen’ (4.9kgCO_2e/kgH_2 and produced from renewable hydrogen pathways). There is no public information available on the specific information disclosure fields under the scheme.
- CertifHy: the scheme only certifies hydrogen with emissions below the equivalent of a 60% reduction from a grey hydrogen baseline of 91gCO_2e/MJ (i.e., the hydrogen has emissions of c.36.4gCO_2e/MJ and below) as being ‘low-carbon’. It has two labels: ‘low-carbon hydrogen’ for hydrogen produced from non-renewable sources and a ‘green hydrogen’ label for renewable hydrogen. It contains both basic facts about the producer and hydrogen, as well as the sustainability properties (emissions intensity and fuel inputs) and support received.
- TÜV SÜD CMS 70: this scheme only certifies hydrogen that is produced with a renewable energy source (it does not include hydrogen made from fossil-based inputs

or non-renewable electricity sources) and that is below a certain emissions threshold (which varies according to production pathway). It has two labels: ‘green hydrogen’ and ‘green hydrogen+’. The two labels vary on a range of characteristics, including Chain of Custody, system boundary, point of issuance, and energy input requirements. There is no public information available on the specific information disclosure fields under the scheme.

Disclosure and labelling

The factual disclosure and label parts of a certificate serve different purposes and may be useful to different users. At the most basic level, there is a choice between only including one of the two elements, or both.

If a certificate offers only factual disclosure, it provides participants in the market with information, but leaves them to make their decisions about what this information means in terms of environmental standards. Knowledgeable players should be able to assess the quality of the product in terms of emissions goals from the factual data, but non-experts may need additional guidance on how to interpret the information.

A label is clear and simple but lacks the detail that might be required for some end use cases such as compliance with Government schemes. Additionally, some users might wish to hold themselves to a higher standard than the requirements of the scheme at large and choose only products with the very lowest emissions intensity. For this, they would need the actual data on emissions intensity that would be included in factual disclosure but not on a label.

Certificates that include both disclosure and a label aim to cover the needs of all consumers. The label provides the quick assessment of whether a product is “good enough”; the disclosure gives the richer detail that lets users make more finely tuned judgements. The option of including both disclosure and a label has been chosen in France and China, and for CertifHy and TÜV SÜD.

Our ‘minded to’ position is to include both factual disclosure and a label, to cater to the needs of all consumers. Some factual fields would be mandatory, while others would be voluntary to allow harmonisation with requirements of other schemes (international and domestic). When designing the required fields for a certificate, our ‘minded to’ position is to require minimal mandatory disclosure whilst providing opportunity for much wider voluntary disclosure.

The exact disclosure fields required for the certificate will need to be considered fully in the subsequent design stages of the scheme, but indicatively, mandatory fields could include:

- Actual emissions associated with the production of hydrogen calculated according to the low carbon hydrogen standard methodology
- Compliance with input and electricity sustainability criteria
- The method, including feedstocks, used to produce the hydrogen

- Whether production is supported by Government - this is could allow us to better trace Government supported hydrogen and gain insights into how it is used
- Other fields to enhance traceability, including production facility, location, time and date of production.

Other voluntary disclosure fields could also be included, to allow producers seeking to export to international markets, or to participate in other domestic schemes to harmonise their certificates with the data reporting requirements of those markets or schemes.

Labelling approach

The label on a certificate is intended to provide an easy to interpret assessment of the information disclosed on the certificate. As we intend to base our certification scheme on the LCHS, the simplest choice is a single label that states that the certified hydrogen meets the scheme's standard for emissions intensity, simply saying this MWh of hydrogen is compliant with the LCHS. This approach is easy to understand and would highlight that Government considers the hydrogen to be low carbon.

Using a label stating the production method was considered (e.g., fossil reformation with CCUS, electrolytic), but as emissions can vary within production methods, we are not minded to pursue this option. The Government is supportive of bringing forward a range of production methods, as long as they are able to meet emissions and environmental requirements, and an approach to labelling based on emissions intensity rather than production method supports this.

A different approach adds more detail by creating a tiered series of labels for emissions intensity falling in ranges. The following tiers illustrate a potential approach:

- Tier 1 (15–20g CO_2e / MJ LHV H_2)
- Tier 2 (10–15g CO_2e / MJ LHV H_2)
- Tier 3 (5–10g CO_2e / MJ LHV H_2)
- Tier 4 (0–5g CO_2e / MJ LHV H_2)

This approach could help differentiate between hydrogen only just meeting the LCHS, and hydrogen that is significantly lower carbon. We also note that other countries have considered tiered labels, with the China Hydrogen Alliance's Standard offering a "Low carbon H_2" label that must meet a 14.51kgCO_2e/kgH_2 threshold, a "Clean H_2" label that must meet a 4.9kg$CO_2$2e/kgH_2 threshold and a "Renewable H_2" label that must meet a 4.9kgCO_2e/kgH_2 threshold and be produced from renewable H_2 pathways.

Whilst this may help the interpretation of emissions data, we would need to carefully consider how we structure the tiers to avoid unintended consequences (e.g., production 'bunching' at the top of a label's compliance range), as well as further understanding the impact such a

tiering system would have on different production methods. Feedback from this consultation will guide our future position on this issue.

Questions

8. **Do you agree with our indicative list of mandatory disclosure fields?**
    a. **Please explain your answer and suggest any additional mandatory disclosure fields.**
9. **Do you have any suggestions for potential voluntary fields that may be of use?**
10. **What markets or schemes would you like to use the voluntary disclosure field to demonstrate compliance with?**
11. **Would you prefer a single label, or multiple tiers?**
    a. **Please explain your answer.**
12. **If stating a preference for multiple tiers to question 11, do you have any suggestions on how tiers should be structured?**

Chapter 3 – Chain of Custody

Chain of Custody refers to how hydrogen will be traced throughout the value chain. In any certification scheme, certified products must be tracked throughout the supply chain so that valid claims can be made about their sustainability properties when they are consumed. This tracking can be more or less strict depending on the selected Chain of Custody. Which traceability system the scheme uses will lead to different outcomes for the hydrogen market and contribute by varying degrees to its policy objectives.

Approaches to Chain of Custody

The four main approaches to the Chain of Custody of the certification scheme are:

- **Identity-Preserved** - meaning certified hydrogen from a specific production plant is kept separate from all other hydrogen, even if it comes from other plants that meet the certification requirements. This is the strictest form of traceability.
- **Segregation -** meaning that certified hydrogen from different production plants can be mixed in a single supply chain, so long as they all comply with the certification requirements. Non-certified hydrogen cannot be mixed into the segregated chain.
- **Mass Balance** - which allows certified and non-certified hydrogen to be mixed along the supply chain. However, the certificate that verifies the low carbon status of a batch of hydrogen entering the system is passed along the supply chain until the point that a consumer requiring certified hydrogen takes it out of the system. The certificate is 'bundled' with the sale of hydrogen at each link in the supply chain.
- **Book and Claim** – which doesn't keep any physical link between the production and consumption of hydrogen. A certified producer 'books' the sustainability attributes embedded in its hydrogen and at the other end of the value chain, buyers 'claim' a contribution to the production of an equivalent volume of compliant products.

These options were explored in the LCHS consultation, with respondents split between Mass Balance and Book and Claim. We have considered further and think that Identity-Preserved and Segregation are unworkable options. Whilst they both offer extremely strict traceability, they are unlikely to be workable in the real world as keeping consignments of hydrogen from a different producer or with different emissions profiles separate as they pass through the distribution chain will almost certainly lead to significantly increased costs, rendering the scheme undesirable. We also considered some hybrid options, details of which can be found in Annex B, however none of these offered sufficient benefits to warrant further consideration.

Assessment of Chain of Custody approaches against scheme objectives

Criteria for assessment

As set out at the beginning of this consultation, the primary objective for this scheme is to facilitate the decarbonisation of the hydrogen economy, supported by our priority design features. Currently, there is demand for low carbon hydrogen but no systematic way for users to verify that the hydrogen they are purchasing was made with a certain level of carbon emissions. To give them confidence, the scheme needs to be accurate and minimise uncertainty around GHG emissions estimates and be robust to avoid fraud or double counting. Finally, the scheme should be transparent and ensure that information is freely available to market participants. In assessing the options for the Chain of Custody approach, the design feature of giving end users confidence was held above others.

As secondary design features, we identified market growth and the facilitation of international trade. These design features were discussed in more detail in the introduction to the consultation.

On top of these scheme-specific features, consistency with broader Government objectives of cost-effectiveness and ease of execution was explored. Further analysis on costs to business can be found in our accompanying de-minimis assessment.

Scenarios

We recognise that the policy landscape and market for hydrogen is likely to change over the coming years. To allow for these changes, we considered two scenarios to assess the Chain of Custody options. These scenarios reflect different time horizons and shifting patterns in the hydrogen market. Given the inherent uncertainty in how the market will evolve, considering different scenarios makes the analysis more robust to plausible future configurations of the market.

- **Baseline scenario:** the hydrogen market configuration is similar to today: no grid blending, limited international trade, and an absence of large-scale storage and hydrogen-to-power.
- **Complex future scenario:** market developments have led to a more complex hydrogen market characterised by grid blending, extensive international trade and large-scale storage, and hydrogen-to-power. Without judging what the most likely scenario is for the future, this option reflects one of the most complex plausible outcomes.

Options assessment

After removing Identity-Preserved, Segregated, and the hybrid variations we have two options – Mass Balance, and Book and Claim.

In the baseline scenario, a Mass Balance Chain of Custody would likely provide the most confidence, as due to the strict relationship between the certificate and hydrogen, low carbon credentials can only be claimed where hydrogen has been used. This could help it to support the most decarbonisation as it comes with the lowest risk of greenwashing, as well as potentially being compatible with other schemes such as the Renewable Transport Fuel Obligation[4] (RTFO). However, Book and Claim may provide more market growth by allowing the greatest commoditisation of certificates by allowing them to be sold to whoever is willing to pay the highest price. It would also be the simplest to execute as there are fewer checks required. Nonetheless we think Mass Balance performs better overall in this scenario as we are prioritising confidence in the scheme and protecting against greenwashing over market growth through commercialisation of certificates.

Mass Balance systems continue to perform better against our policy objectives in a complex future scenario. As we introduce international trade, under a Book and Claim system, the possibility of international greenwashing and impact on UK decarbonisation objectives emerges. For example, if UK hydrogen off-takers buy certificates from other countries but consume physical grey hydrogen produced in the UK, this appears as greenwashing to final consumers and doesn't reduce the UK's emissions. Additionally, large-scale storage reduces temporal correlation and thus transparency if hydrogen is consumed at a later point but its sustainability properties are already claimed today.

A Mass Balance Chain of Custody enables a level of confidence in a future blended hydrogen pipeline. An off-taker would agree with a producer to take a specified energy content of hydrogen via a system that they are both physically connected to. The producer would then ensure the correct energy content was injected into the system and the off-taker could extract the same energy content and receive the certificates. Although the specific molecules of hydrogen cannot be traced, the Chain of Custody is maintained by being physically connected to the same system and ensuring the energy content matches. Note that consideration is being given as to how market and trading arrangements may need to adapt to facilitate blending, including which players purchase the blended hydrogen, for example networks, shippers etc, who may not be the end consumers or user. Additional information on our assessment of Chain of Custody options is available in Annex B.

Due to its closer alignment with the priority design features of the scheme, it is our 'minded to' position to use a Mass Balance system of Chain of Custody.

Questions

13. Do you agree with a Mass Balance system of Chain of Custody?

[4] Under the RTFO, suppliers of relevant transport fuel in the UK must be able to show that a percentage of the fuel they supply comes from renewable and sustainable sources.

a. **Please explain your answer and suggest the alternative you'd recommend if you disagree.**

14. **Do you agree that a Mass Balance system of Chain of Custody would provide the most consumer confidence over the credentials of the hydrogen?**

    a. **Please explain your answer.**

Chapter 4 – Further design considerations

The positions so far set out in this consultation form the fundamentals, but we will need to continue to develop more detail of how the scheme will operate over the coming months before the scheme can launch. We will need to work out our approach to consignments, how best we can facilitate international trade of certified hydrogen, and how to resolve any issues arising from the mid-stream. The following sections set out these issues, and our thinking so far.

Consignment approach

A hydrogen production facility can have different inputs (e.g. combined input of grid electricity and renewable electricity) which have different upstream GHG emissions associated with them. Under the LCHS, the hydrogen produced is broken down into discrete consignments according to the associated upstream emissions of the inputs.

A discrete consignment is an amount of hydrogen produced over a defined time period with a single measurable input with a consistent set of "environmental characteristics", such as the same upstream emissions. The LCHS provides the option to average consignments to allow more flexibility for producers who may experience periods of high grid intensity or CO_2 transport and storage network outages outside of their control, so long as the averaged emissions is still below the LCHS emission threshold.

The LCHS allows for the averaging of two or more consignments, into a maximum of one averaged consignment per month. Producers are also able to use discrete consignments to prove compliance with the LCHS. Under the current approach, producers may have to choose between submitting discrete consignments for certificates to be issued quickly or to adopt the flexibility of averaging and have to wait for at least a month to receive the relevant certificates. For the certification scheme, a different approach to averaging may be required, given that the certification scheme focuses on traceability for consumers of hydrogen. This will be considered as we move into a more detailed phase of scheme design.

International trade

One of the aims of the certification scheme is to facilitate international trade. To do this, we will need to develop an approach to certifying imports and providing hydrogen leaving the UK with a means of proving the emissions intensity of production. This will allow purchasers to have confidence in its carbon intensity and capture the full benefit of exporting low carbon hydrogen.

Certifying imported hydrogen could allow domestically produced and imported hydrogen to be compared fairly. However, as imported hydrogen will be produced to different standards to UK hydrogen this is not straightforward. We will need to carefully consider how best to adapt the scheme to facilitate international trade of certified hydrogen.

For example, some form of mutual recognition of other international certification schemes could allow us to certify imported hydrogen but would need to account for the differing scheme methodologies and ways of working, such as different approaches to Chain of Custody. To do this effectively we would need to consider working closely with international partners and ensure any policies such as mutual recognition of schemes are fully compliant with our trade obligations. Certifying exports may be more straightforward, as it could be that the normal functioning of the scheme is applied up to the point that the hydrogen leaves the UK[5]. At this point it is our ambition that the hydrogen could be certified by an international scheme, after which the UK certificate will need to be removed from circulation. Given that there may be different requirements in the jurisdiction that the hydrogen is to be exported to, our intention is to provide flexibility to producers through the provision of additional voluntary disclosure fields to enable them to demonstrate how they meet the requirements of international schemes.

Midstream considerations

The midstream is the part of the hydrogen value chain between production and end use. It moves both physical hydrogen and, depending on the nature of the contract, any corresponding certificates. The midstream typically has three main elements:

- Conversion and reconversion of hydrogen for the purposes of transport, including compression, liquefaction, and conversion to hydrogen derivatives such as ammonia and liquid organic hydrogen carriers.
- Transport and distribution including: pipelines, in containers onboard ships, trains, planes and lorries.
- Off-site hydrogen storage, including line-packing in pipelines, underground storage in salt caverns, and above-ground (tank) storage.

As we continue to develop the design of the certification scheme, we will need to consider the GHG emissions from energy used in the conversion, transport and storage of hydrogen, and hydrogen leakage which both loses energy content and creates an ‘indirect greenhouse gas’ if the hydrogen escapes into the atmosphere.

Additionally, we will need to consider our approach to blending hydrogen into the gas grid. Whilst our Chain of Custody approach theoretically allows for the possibility of distribution through the gas grid, whether or not this will be permitted is dependent on wider Government decisions on blending.

Questions

15. **Do you have any thoughts on how our consignment approach should be structured?**

[5] Further work will be needed to determine what this point is.

16. **Are you planning to import or export hydrogen? If yes, where to/from?**

17. **Do you have any suggestions on how the certification scheme can best enable imports of hydrogen, and ensure that imported hydrogen can be certified accurately?**

18. **Do you have any suggestions on how the certification scheme can best support exports of hydrogen from the UK?**

19. **Are there any additional areas to consider in the midstream beyond those set out above?**

Chapter 5 - Delivery and administration

To have a robust certification scheme there will need to be clear guidelines around data reporting and verification. Once the data is submitted, how the certificates will be issued and managed through the value chain will also be important to maintain the Mass Balance Chain of Custody. This section sets out our initial thinking on data reporting requirements, the transfer and retirement of certificates and how the scheme could be delivered.

Data reporting, frequency, and alignment with other schemes

To demonstrate compliance with the LCHS and qualify for certification, producers will be required to submit data that will then need to be verified. As certain NZHF and HPBM funding is contingent on meeting the requirements of the LCHS, these schemes are likely to require similar data and verification processes. Therefore, our intention is to design the certification scheme so that the information required for certificates is closely aligned with the reporting requirements for BEIS funding schemes, to minimise duplicated reporting requirements.

We anticipate the data will be provided through self-reporting and based on the data required to demonstrate compliance with the LCHS. We are working to understand the possible ways to collect and verify the data in the least burdensome way, including automatic metering and the development of IT systems to flag inconsistencies. We expect data reporting will be monthly. There is also a dependency on the consignment approach chosen; for discrete consignments it may be possible to issue certificates more immediately, however, if monthly averaged consignments are used, the average emissions intensity would need to be known prior to certificates being issued.

To keep costs proportionate, we envisage that monthly verification will be light touch, either only looking at a certain cut of the data or relying on an automated system to highlight any areas for investigation. The primary form of verification would be via annual audits conducted by approved third parties. These audits would include a visit to the facility and could look at: the production method, metering points, a sample of certificates and evidence behind them, the sustainability evidence of feedstocks used and/or other criteria.

Transfer and retirement of certificates

Based on the ‘minded to’ position that the Chain of Custody will be Mass Balance, certificates will need to follow the hydrogen through the value chain. To achieve this, any change of certificate ownership will need to be recorded. We propose this will be managed through an IT system where the prior owner of the certificate will need to transfer the certificates at the point of sale of the hydrogen. To reduce the transactions, we propose enabling the bulk transition of certificates in line with the sale volume of hydrogen rather than requiring a transfer for each

MWh certificate. Similarly, we may require that certificates are retired after the associated hydrogen is used and this would require users to retire the certificates using the IT system.

Retirement of certificates is a standard approach taken by guarantee of origin schemes and the primary aim of certificate retirement is to prevent the double counting of certificates. Retirement would occur when the physical hydrogen has been consumed or combusted and a retirement statement would be issued. Retirement is more common when a Book and Claim Chain of Custody is used, therefore the stricter nature of the Mass Balance system may mitigate the need for retirement as double counting would be much less likely.

How the scheme could be delivered

There are several ways Government could support the development of a certification scheme, ranging from providing guidance for industry to adopt and develop into a scheme, to designing and running a scheme in-house at BEIS. We believe BEIS is best placed to design a scheme which will fulfil the needs of Government funded producers and end users, maintain policy based on industry engagement, and is independent of industry. A Government-led scheme also has the advantage of being able to work with other Government policies such as funding for hydrogen production and with end use policies such as the RTFO. We are therefore 'minded to' develop a scheme led by Government.

Subject to discussions with the devolved administrations where areas of devolved responsibility are engaged, we envisage that BEIS could act as the competent authority. BEIS would be responsible for the underlying policy (in partnership with devolved administrations in areas of devolved responsibility), preparing any legislation that is required and potentially appointing partner/s to deliver the other aspects of the scheme. It is expected that the scheme will require a certification body, which will manage eligibility for the scheme, and ensure compliance and audits. An issuing body[6] would manage the certificates, ensuring they are issued and retired as required. The issuing body would manage an IT registry to support these transactions. For further detail, see indicative table of service components at Annex C.

Questions

20. Do you agree that monthly self-reporting with light touch verification is the most appropriate reporting method?

a. If answering yes to question 20 please state why. Or if answering no, what would you consider more appropriate?

21. Do you think there is anything else that should be assessed during annual audits?

[6] This role could either be carried out by the certification body or another party

22. **Which would you prioritise, immediacy of certificates or the flexibility of averaging consignments across a month?**

23. **Do you have any suggestions for the approach to certificate retirement?**

24. **Are you aware of any industry-led hydrogen certification schemes being developed? If yes, please give details.**

25. **How important is Government backing to provide confidence in the scheme?**

26. **What would you consider to be the main advantages of Government oversight of a certification scheme?**

27. **Noting that a decision has yet to be taken on whether to go out to external tender, do you have an interest in being considered as a delivery partner for the certification scheme, and if yes, in what role?**

28. **If you are a producer of hydrogen, would you sign up to a Government-led certification scheme?**

    a. **Please give your reasons.**

29. **If you are a purchaser of hydrogen, do you see the value in a Government-led certification scheme?**

    a. **Please give your reasons.**

Accompanying this consultation is a de minimis assessment which sets out our estimates of the costs to business from participating in the scheme. Please read this before answering the following questions.

30. **Would there be any significant costs of participating in the certification scheme that are not captured?**

    a. **Please provide details.**

31. **Are the assumptions about the time taken for, and the cost of, each activity reasonable?**

    a. **Please provide details.**

32. **Do you expect there to be a green premium associated with the certification of hydrogen?**

    a. **If so, please provide details, including indications – if possible – of how large you expect this green premium to be.**

Next steps

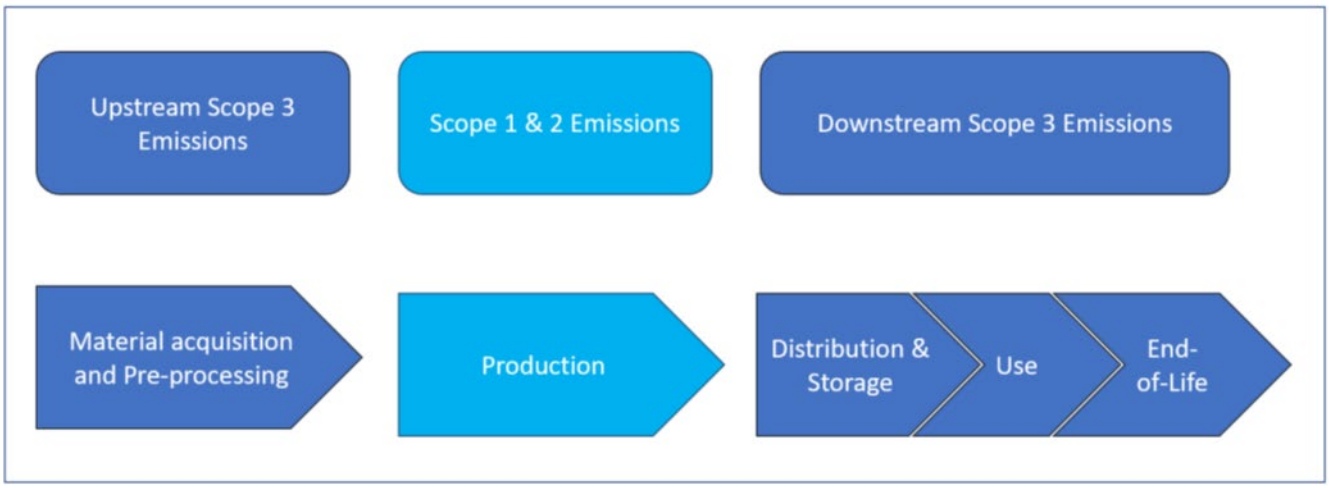
This consultation will close at 11.45pm on Friday 28th April 2023, after which responses will be analysed followed by the Government response which will be published in due course.

Following the Government response, we expect to continue to work with industry and across Government including the devolved administrations to finalise detailed design elements of the low carbon hydrogen certification scheme.

Annex A – Emissions scopes

Emissions Scopes are a way of categorising different greenhouse gas emissions sources for reporting purposes.

- Scope 1 (direct emissions): emissions from activities owned or controlled by an organisation. For example, emissions from combustion in owned or controlled boilers, fuel used in company vehicles, and emissions from chemical production in owned or controlled equipment.
- Scope 2 (indirect emissions): emissions associated with an organisation's consumption of purchased electricity, heat, steam and cooling. These indirect emissions are a consequence of an organisation's energy use, but occur at a source not owned or controlled by the organisation (e.g. a power plant).
- Scope 3 (other indirect): emissions as a consequence of an organisation's actions that occur at sources not owned or controlled by the organisation and are not classed as Scope 2 emissions. This includes both upstream and downstream emissions.
- Upstream emissions: e.g. business travel by means not owned or controlled by the organisation, waste disposal or the embodied emissions of materials or fuels purchased by an organisation.
- Downstream emissions: e.g. processing of sold products, use of sold products and the end-of-life treatment of sold products.
- Product Lifecyle Emissions: all the emissions associated with the production and use of a specific product from cradle to grave, including emissions from raw materials, manufacture, transport, storage, sale, use and disposal i.e. Scope 1, 2 and 3 combined.



Annex B – Chain of Custody additional information

Hybrid approaches to Chain of Custody

We considered 4 hybrid approaches:

- Book and Claim+ is an augmented[7] Book and Claim system with the option to provide Mass Balance data which complies with domestic (e.g., RTFO) or international regulations. These voluntary fields are not verified by the certification body.
- Domestic Book and Claim+, International Mass Balance is a dual system[8] where a domestic Book & Claim system is run in parallel with a Mass Balance for international trade.
- Unbundled after sale is a dual system using Mass Balance from producer to first non-intermediary off-taker (e.g., energy retailer, industrial user), with full Book & Claim afterwards; requires H_2 and certificate to be 'bundled' together on sale of hydrogen.
- Book and Claim and Mass Balance in parallel is a dual system where, producers can choose which system they use, leading to a two-tiered Chain of Custody scheme, with two separate certificates with different price. In this system all data related to Book and Claim or Mass Balance chains of custody would be verified by the certification body.

The tables on the following pages demonstrate our assessment of the Chain of Custody options against our scheme objectives across a simple baseline scenario for the hydrogen market, and a more complex future market.

- **Baseline scenario:** the hydrogen market configuration is similar to today: no grid blending, limited international trade, and an absence of large-scale storage and hydrogen-to-power.
- **Complex future scenario:** market developments have led to a more complex hydrogen market characterised by grid blending, extensive international trade and large-scale storage, and hydrogen-to-power. Without judging what the most likely scenario is for the future, this option reflects one of the most complex plausible outcomes.

[7] Altering or adding to the features of a single model creates an 'augmented system'
[8] Combining two standard approaches into a single certification scheme creates a 'dual system'.

Table 1: Simpler baseline scenario

	Scheme-specific objective and priority design features				Broader policy objectives
Options	Encourage decarbonisation (Scheme objective)	Instil confidence (Primary design feature)	Stimulate market growth (Secondary design feature)	Facilitate international trade (Secondary design feature)	Ease of execution
Identity-preserved	Higher administrative burden prevents scaling up	Extremely accurate, robust, and transparent, because of direct connection between product and certificate	Leads to higher transport costs for shippers and compliance costs for suppliers; significant administrative burden	N/A in this scenario	Moderate set-up burden, given higher complexity and need to ensure physical trading
Segregation	Blending restrictions could prevent scaling up	Very accurate, robust, and transparent, because of direct connection between product and certificate	Leads to higher transport costs for shippers; moderate administrative burden and cost		Moderate set-up burden, given higher complexity and need to ensure physical trading
Mass Balance	Aligned with net zero objectives; avoids risk of	Accurate, robust, and transparent, because of physical connection	Most initial H_2 has direct connection to consumers; limited impact of lower liquidity and market		Moderate set-up burden, given higher complexity and need

	greenwashing design choices		access; moderate administrative burden		to ensure physical trading
Book and Claim	Potential risk of greenwashing	Potential for double-counting, limited traceability given no physical connection	Market access to all; increases liquidity and pool of buyers; limited administrative burden		Limited set-up burden
Book and Claim+	Potential risk of greenwashing	More robust than simple Book & Claim because actors can prove Mass Balance if they want to	Market access to all; increases liquidity and pool of buyers; limited administrative burden		More complex than Book & Claim, given option to provide Mass Balance data, but less complex than full Mass Balance
Domestic Book and Claim with physical evidence of arrival	Similar to Book & Claim because the benefit from less international trade greenwashing is limited given small trade volumes	As most physical trade is domestic, higher confidence in international trade has limited to no effect on confidence; limited impact of double counting	In a world of limited international trade, this works just as well as Book & Claim		Difficult to execute because of having to set up dual systems
Unbundled after sale	Slightly better than Book & Claim because there is no potential for greenwashing in the	Higher confidence than Book & Claim, given physical delivery to first non-intermediary off-taker; however, not	Use of Book & Claim after first off-taker increases market access; however, moderate		Set-up burden is higher than Mass Balance

	first step of the value chain.	as high as full Mass Balance system	administrative burden of Mass Balance system		
Book and Claim and Mass Balance in parallel	The same as Book & Claim because actors preferring this option will use it	Encouragement of partial Mass Balancing increases confidence above pure Book & Claim system	Flexibility for those constrained by Mass Balance to use Book & Claim stimulates market growth		Difficult to execute because of having to set up dual systems

Table 2: Complex future scenario

Fully aligned with objective | Not aligned with objective | Priority

	Scheme-specific objective and priority design features				Broader policy objectives
Options	Encourage decarbonisation (Scheme objective)	Instil confidence (Primary feature)	Stimulate market growth (Secondary feature)	Facilitate international trade (Secondary feature)	Ease of execution
Identity-preserved	No change	No change	As above. In addition, does not support grid blending	Significantly stricter requirements than international standards could harm trade; high compliance predictability	No change
Segregation	No change	No change	As above. In addition, grid blending only possible in H_2 specific network	Stricter than international standards, although compliant; high compliance predictability	No change
Mass Balance	No change	No change	Blending possible, also in gas grid. This increases low carbon H_2 market access and thus value of the certificate	Stricter than international standards so potential issue for imports; high predictability	No change

Book and Claim	International trade increases potential for greenwashing	Introduction of international trade reduces traceability and more risk of greenwashing; large-scale storage could potentially reduce connection between time hydrogen is consumed and when its sustainability properties are claimed, i.e., 'temporal correlation'.	Remains strong given flexibility around international trade, blending, and storage	Most nations initially have Book & Claim systems, so aligned with international standards; could form potential issue for UK export companies if other countries choose Mass Balance	No change
Book and Claim+	Introduction of international trade reduces traceability, as providing Mass Balance data is optional	Introduction of international trade reduces traceability as providing Mass Balance data is optional; large-scale storage reduces temporal connection	Remains strong given flexibility around international trade, blending, and storage	Allows for compliance with all international systems	No change

Domestic Book and Claim+, international Mass Balance	Importance of avoiding international trade greenwashing is increased given higher trade volumes	No change as international traceability is maximised	No change	Same as Mass Balance	No change
Unbundled after sale	No change	No change as international traceability is maximised (the first off-taker is abroad, so Mass Balance applies)	Blending possible, also in gas grid. This increases low carbon hydrogen market access and thus value of the certificate	Same as Mass Balance	No change
Book and Claim and Mass Balance in parallel	Increased international trade increases potential for greenwashing, given that international Mass Balance is not mandated	Optional nature of the system does not guarantee traceability for international trade; large-scale storage reduces temporal connection	No change	Aligned with international standards	No change

Annex C – Service component table

Indicative Service component table based on early thinking.

Competent Authority	Based on our minded-to position, BEIS's responsibilities would be to: • Own the policy • Own, publish and update any legislation which is required to run the certification scheme • Appoint the certification body and issuing body • Evaluate the scheme outcomes • Manage scheme updates and engagement with stakeholders
Certification Body	• Verify the eligibility of production facilities and producers who can produce LCHS-compliant hydrogen • Oversee annual audits, including owning the list of approved audit bodies and reviewing audit reports to make the decision on whether to continue to certify or not • Report error concerns, double counting and greenwashing – with the handling of this being agreed with competent authority
Issuing Body	• Develop and manage the IT infrastructure, enabling reporting of data to prove compliance of consignments with the LCHS • Issue, transfer and retire certificates • Monitor compliance data of hydrogen produced and flag any inconsistencies • Report KPIs to certification body and competent authority

This consultation is available from: https://www.gov.uk/government/consultations/uk-low-carbon-hydrogen-certification-scheme

If you need a version of this document in a more accessible format, please email alts.formats@beis.gov.uk. Please tell us what format you need. It will help us if you say what assistive technology you use.