



Department for
Energy Security
& Net Zero

Hydrogen Blending into GB Gas Distribution Networks

A Strategic Policy Decision

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Introduction

Hydrogen can support decarbonisation of the UK economy, particularly in ‘hard to electrify’ sectors. Hydrogen produced in the UK can create new jobs across the country, and secure greater domestic energy security, lowering our reliance on energy imports. In 2021, the UK government published its first Hydrogen Strategy,¹ which aimed for 5GW of low carbon hydrogen production capacity by 2030 for use across the economy. Building on these proposals, the British Energy Security Strategy committed to doubling this 2030 hydrogen production capacity ambition to up to 10GW, with at least half coming from electrolytic production.

Hydrogen blending refers to the blending of low carbon hydrogen with other gases (primarily natural gas and including biomethane) in pre-existing gas network infrastructure and appliances. Government set out an ambition to reach a strategic policy decision in 2023 on whether to support the blending of up to 20% hydrogen by volume into the GB gas distribution networks. We have been assessing whether there may be value in having hydrogen blending available to support the early development of the hydrogen economy and have been gathering evidence to determine if blending meets the required safety standards, is technically feasible, economic, and supports government’s broader strategic and net zero ambitions.

In the 2022 consultation on Hydrogen Transport and Storage Infrastructure we explored the potential strategic role blending could play to support the development of the hydrogen economy.² Government recently consulted (15 September to 27 October 2023) on our assessment of the potential strategic and economic value of blending and our proposals for aspects of the commercial, market, technical and billing arrangements that could accommodate blending should it be supported and enabled by government.³

This document sets out a summary of the strategic policy decision and policy positions on aspects of the commercial, market, technical and billing arrangements that could accommodate blending if enabled by government. It should be read alongside the government response to the consultation which has been published at the same time as this document.³

The scope of the strategic policy decision and policy positions referred to in this document pertain to hydrogen blending into the GB gas distribution networks. The Department for Energy Security and Net Zero intends to work with the Devolved Administrations as we assess the case for hydrogen blending to ensure that any recommended policies take account of devolved responsibilities. Where any proposals are suited to implementation on a UK or GB-wide basis, working with the Devolved Administrations can help to facilitate the successful deployment of these proposals and consistency with devolved policy.

¹ <https://www.gov.uk/government/publications/uk-hydrogen-strategy>

² <https://www.gov.uk/government/consultations/proposals-for-hydrogen-transport-and-storage-business-models>

³ <https://www.gov.uk/government/consultations/hydrogen-blending-into-gb-gas-distribution-networks>

Summary of strategic decision

Based on current evidence, government sees potential strategic and economic value in supporting the blending of up to 20% hydrogen (by volume) into the GB gas distribution networks in certain scenarios and circumstances that align with the strategic role of blending as set out later in the document. Any government support for blending would aim to reduce production and system costs whilst facilitating the growth of the hydrogen economy.

We will proceed with our proposal for the Hydrogen Production Business Model (HPBM) to be the primary mechanism to provide any subsidy support necessary for volumes that are blended, should blending be enabled by government.

HyDeploy industry trials, demonstrations and tests to gather evidence to demonstrate whether and/or how blending can be used safely in the GB gas distribution networks have been completed or are ongoing. Government intends to review this evidence before any steps to implement blending, such as amendments to the Gas Safety (Management) Regulations 1996 (GS(M)R), are made. The Department will work closely with the Health and Safety Executive (HSE) to ensure that safety evidence is assessed independently and robustly.

Following completion of the safety assessment, government will take a future decision on whether to enable blending which will consider any implications from the safety assessment on blending's feasibility and economic case.

We view that enabling blending at scale requires amendments to legislation, including the GS(M)R, which currently limit the amount of hydrogen in the existing gas networks to 0.1% by volume.

If the outcomes from the safety review and subsequent finalisation of the economic assessment support a future decision to enable blending in the GB gas distribution networks, government would then look to start the legislative process to implement amendments, working with networks and industry to define and deliver the technical implementation activities and processes required. Given likely timescales for this, we do not anticipate blending at a commercial scale to commence before 2025-26 at the earliest.

If the outcome from safety review does not support amending the GS(M)R or if blending is only allowed in limited circumstances, projects may be able to apply for regulatory exemptions and government may reconsider the chosen implementation options and/or economic analysis.

Note that any amendments to the GS(M)R cover GB only and it would be for the Health and Safety Executive Northern Ireland (HSENI) to decide whether to adopt any similar arrangements to the Gas Safety (Management) Regulations (Northern Ireland) 1997 (GS(M)R(NI)).

Strategic role of hydrogen blending

Current evidence suggests that blending has potential strategic and economic value in supporting the early development of the hydrogen economy in certain circumstances and scenarios.

As an **offtaker of last resort**, as was previously described as a 'reserve offtaker' in the consultation, blending could play a role in managing the risk of hydrogen producers being unable to sell sufficient volumes of hydrogen, for example, if an offtaker (e.g. an industrial facility) is no longer able to buy hydrogen from the producer (known as "volume risk") impacting the production project's revenue. Blending may also help to mitigate cross-chain volume risks relating to development of hydrogen transport and storage infrastructure, for example if an infrastructure project is delayed. Having the option to blend could help to reduce investment risk into hydrogen production and in certain circumstances may have the potential to lower production costs, as explored in the Economic Analysis section of the consultation.

In addition to this, and in the initial absence of larger-scale hydrogen transport and storage infrastructure, blending may also have value as a **strategic enabler** to enable electrolytic hydrogen producers to locate to support the wider energy system. This could be beneficial for electrolytic hydrogen producers located behind electricity network constraints using excess renewable electricity that would otherwise have been curtailed. Carbon Capture Usage and Storage (CCUS)-enabled hydrogen projects would be unable to support the wider energy system in this way. The strategic value of these projects is to produce hydrogen at scale in centres of high demand, such as industrial clusters, so allowing these projects to blend as a majority offtaker risks diverting low carbon hydrogen away from local end users with greater decarbonisation potential. Therefore, government would be unlikely to support CCUS-enabled hydrogen projects to use blending as a majority offtaker.

Blending could therefore play a role to facilitate an optimised hydrogen economy both in terms of location of electrolytic production and minimising system costs for consumers.

However, we believe that blending should only be a transitional option. It relies on an extensive natural gas network being available to blend into, which we expect to reduce as we progress towards net zero. For this reason, it may only have a limited and temporary role in gas decarbonisation as we move away from the use of natural gas. As set out in the UK Hydrogen Strategy, the use of hydrogen would be most valuable where there are limited alternative routes to decarbonisation, such as for industries for which direct electrification is not an option.

It is also important that we avoid distorting the offtaker market and reduce the risk of blending 'crowding out' other offtakers of hydrogen who require it to decarbonise by targeting blending in circumstances where it has potential to reduce overall costs.

The primary strategic role of blending is not to decarbonise the existing gas network or to facilitate a transition to heat decarbonisation. Whilst there would be carbon savings as low

carbon hydrogen displaces natural gas, the main objective of blending would be to support hydrogen production in a targeted way where it has potential to reduce risk and cost at a project or system level. In light of the many policy decisions in this space, and as the hydrogen economy develops beyond our initial blending strategic policy decision, we will continue to assess the strategic role and value of blending.

Policy positions on implementation options

Our intention is that blending should be implemented in a way that is of least cost and change to current gas system arrangements. The following sections set out aspects of the commercial, market, technical and billing arrangements that could accommodate blending should it be supported and enabled by government.

Commercial support model

Our aim would be to support blending through a mechanism that delivers value for consumers as well as being accessible and effective for hydrogen producers. Therefore, government considers that the Hydrogen Production Business Model (HPBM) would be the most appropriate mechanism to support hydrogen blending if it is enabled by government. We would aim to focus support on circumstances and scenarios that align with blending's strategic role described in the previous section. It is important that we avoid distorting the offtaker market that could result in blending 'crowding out' other offtakers of hydrogen who require it to decarbonise by determining any conditions or criteria under which subsidy support may be provided.

Any subsidy support provided for blending would need to be reflected in the HPBM contract, the Low Carbon Hydrogen Agreement (LCHA), where blending is currently a non-qualifying offtaker. This includes the interaction with existing design features of the HPBM (e.g. the role of Risk Taking Intermediaries (RTIs), technical requirements (e.g. metering and billing) and confirming the level of subsidy support for blended volumes. This work will also consider how any project that has already been awarded a LCHA through earlier allocation processes, may be able to request a change to their contract, aligned with our strategic position on blending, to the government appointed counterparty.

We will continue to engage with stakeholders on the design of how HPBM support may be applied to blending as we develop further thinking and policy positions in these areas via working groups and bilateral engagement.

In the recently published government response to Hydrogen Allocation Round (HAR) 2 Market Engagement we set out that blending will remain a non-qualifying offtaker.⁴ This is because whilst government has now made a positive strategic policy decision to support blending into the GB gas distribution networks in certain circumstances, whether blending is enabled is still subject to the outcome of the safety case which may change the economic case for blending. Similarly, projects will want to understand how blending support would be integrated into the LCHA before making investment decisions based on blending becoming an eligible offtaker.

We will, in parallel to the commercial work on the HPBM, consider when to allow blending to become an eligible offtaker for future HARs and CCUS allocation rounds of the HPBM.

For future HARs and CCUS allocation rounds, we will also consider how to adapt eligibility criteria to be consistent with the two different strategic roles we envisage blending playing. This means that:

- For CCUS-enabled hydrogen projects, while blending would become an eligible offtaker, we would only envisage this for projects where blending is a reserve (or minority) offtaker. This would be confirmed via future CCUS allocation processes.
- For electrolytic projects in addition to the offtaker of last resort (or minority) role, we also consider that there may be a case for a project which proposes blending as a majority offtaker as it can help to optimise the location of electrolysers to help manage grid constraints (i.e. the strategic enabler role) as a precursor to regional or national hydrogen transport and storage infrastructure in certain locations. This would be confirmed via future Hydrogen Allocation Rounds.

Market and trading arrangements

This section sets out the government's position on aspects of the market and trading arrangements for hydrogen blending, if enabled, in the context of the current gas market and trading arrangements, including the question of which market participants could purchase hydrogen produced for blending. In addition, it sets out proposals for blending interactions with any low-carbon hydrogen certification schemes and the UK Emissions Trading Scheme (UK ETS).

Which market participants could purchase hydrogen produced for blending?

As set out above, our aim would be to implement blending with minimal change to the current gas trading arrangements, whilst also being able to fulfil blending's strategic objectives. Therefore, based on the evidence gathered and assessed to date, we propose to strategically support a hybrid approach where both gas distribution network operators and gas shippers are

⁴ <https://www.gov.uk/government/consultations/hydrogen-allocation-round-2-market-engagement>

able to purchase low-carbon hydrogen, and shippers are able to sell hydrogen produced for blending, if blending is enabled by government.

We note that sales of hydrogen to RTIs (which would include gas shippers) are not currently an eligible offtaker under the HPBM. Further consideration will be given to the commercial design and integration of blending, if blending is supported by government, within the HPBM.

Low Carbon Hydrogen Certification Schemes

A number of respondents raised concern about the inability to generate revenue from certificates for blended volumes of hydrogen, where government proposed to preclude the sale of certificates after the point of injection. Government plans to further consider this issue and feedback from respondents. We aim to take a decision on how certificates should be treated in a blending scenario ahead of the launch of the certification scheme.

Government remains committed to ensuring certification schemes for low carbon hydrogen are used to provide a robust means of verifying the emissions credentials of low carbon hydrogen and has recently published the key design features of its certification scheme in the government response for certification.⁵

This further consideration will allow government to engage more with industry on this issue ahead of reaching a decision.

UK Emissions Trading Scheme (UK ETS)

The existing regulations provide ETS participants some flexibility in terms of which methodology they use to monitor emissions and include provisions enabling operators to install measurement devices if they require more accurate values. This may allow participants who are adversely impacted by receiving a hydrogen blend to change their methodology and manage the risk of any competitive distortions.

Government therefore confirms that it will not amend the UK ETS to accommodate hydrogen blending, if enabled.

Technical delivery model

The consultation set out our assessment of the technical delivery models for injecting hydrogen blends into the existing GB gas distribution networks as identified by the Energy Network Association's Gas Goes Green programme.⁶

Our aim would be to adopt a least change approach for technical delivery which is accessible for hydrogen producers whilst also minimising any additional transportation costs that may be

⁵ <https://www.gov.uk/government/consultations/uk-low-carbon-hydrogen-certification-scheme>

⁶ <https://www.energynetworks-org.webpkgcache.com/doc/-/s/www.energynetworks.org/industry-hub/resource-library/britains-hydrogen-blending-delivery-plan.pdf> (Accessed in December 2023)

required to enable blending. Therefore, government confirms that based on the evidence gathered and assessed to date, the free market approach, as described by the Gas Goes Green programme, is the preferred technical delivery model for hydrogen blending, should hydrogen blending be enabled by government. The free-market approach mimics the existing arrangements for connections to the gas network and would let the market decide where to inject hydrogen into the network. Theoretically, blending could occur wherever hydrogen producers apply to connect which could be at any location and pressure tier across a gas distribution network (GDN), subject to network capacity, thereby maximising the potential geographic extent of blending. It would be for the gas network operator to monitor hydrogen levels across their network to ensure a maximum hydrogen level is not breached, as they do for current gases in the GDNs.

We will continue to work closely with the GDN operators and wider industry to explore the most appropriate means to allocate capacity for hydrogen injections under the free market approach, should blending be enabled by government. Through appropriate design of capacity allocation procedures, we view that a sufficient degree of strategic planning may be realised to help ensure blending occurs where it is of most strategic value and to manage risks such as in relation to ‘network sterilisation’, and we aim to keep this process under review.

We note the possibility that a review of blending safety evidence could suggest that blending is not suitable in specific regions of the GDNs. If this occurs, we will consider whether this could still align with the free-market approach and, if needed, consider an alternative technical delivery model.

Gas billing arrangements

Our objective is to incorporate blending in a way which minimises consumer impacts and is of least cost and regulatory change to current gas system arrangements. Therefore, based on evidence gathered and assessed to date, government intends to work within existing gas billing frameworks, should blending be enabled by government. This approach was supported by the Future Billing Methodology Project, conducted by industry (networks, consultants) with funding agreed under Ofgem’s Gas Network Innovation Competition, which provided options and recommendations on how the attribution of energy content (CV) for billing could be treated in a future with a wide variety of gas sources.⁷

Although hydrogen blending under existing billing arrangements would likely limit the permitted level of hydrogen blending to be below 20% by volume across the GB gas distribution networks in practice (to ensure that variations in gas CV are maintained within current regulatory limits and ensure fairness for consumers), we do not view this as being incompatible with our strategic objectives for blending, as set out above. Significant amounts of hydrogen

⁷ https://www.xoserve.com/media/43317/xos1434_xoserve-fbm-consultation-output-v7-final.pdf (Accessed in December 2023)

blending could be achieved under the existing billing regulations, and this is the lowest cost and quickest to implement option for hydrogen blending.

Blending interactions with gas meters

As part of the HyDeploy project, the TÜV SÜD National Engineering Laboratory carried out a test programme to determine the accuracy of a sample of domestic and industrial gas meters when receiving hydrogen blends of up to 20% by volume. The resulting report, which indicates that gas meter performance and accuracy with hydrogen blends of up to 20% by volume may be comparable to their operation with natural gas, will be reviewed by government, including as part of the wider hydrogen blending safety review. Should any modifications or cost requirements be identified as necessary to ensure that gas meters can perform within operational limits when receiving hydrogen blends of up to 20% by volume, this would be considered when reviewing the economic analysis for blending.

Impact of blending on industrial users connected to the GB gas distribution networks

Government is assessing evidence to further understand the safety and usability impacts of receiving hydrogen blends on industrial users connected to the GB gas distribution networks. HyDeploy evidence from trials, demonstrations and tests undertaken will be reviewed as part of the safety assessment. Should any significant costs or mitigations be required, government will assess options for cost allocation and will confirm our position following completion of the safety assessment and subsequent review of the economic analysis.

Economic analysis

We have been undertaking further economic analysis to assess the value of blending in helping to enable electrolytic producers to locate on the right side of electricity system network constraints and support the wider energy system ahead of the development of hydrogen transport and storage infrastructure.

Based on current evidence, the economic analysis suggests there may be potential value in supporting blending in certain circumstances. This is because blending has the potential to reduce risk and costs at both a project and system level.

As blending trials progress and safety evidence is reviewed, we note that further costs may be revealed and therefore the costs and benefits associated with blending will be considered again in the future prior to any decision to enable blending.

Blending into GB gas transmission networks

There are further considerations associated with transmission-level blending that will need to be evaluated as part of the economic and safety assessments for transmission-level blending. These include the impact of blends and/or varying blend rates on industrial end users connected at transmission-level and the possible need for mitigations such as deblending, with associated costs. We anticipate that this may be more significant for larger-scale transmission connected industrial users, compared to users connected at distribution-level. Government will also consider developments across Europe, such as in relation to the EU Hydrogen and Gas Market Decarbonisation package, and any implications on international gas trading agreements.

Future Grid, a project led by National Gas, is leading trials and tests to gather evidence to assess the safety of blending into the existing gas transmission system.

The strategic policy decision announced in this document pertains to blending into the GB gas distribution networks only. We recognise the need to provide clarity to industry on transmission-level blending, particularly given its interactions with distribution-level blending. Government will therefore aim to provide an update on timings for a transmission level blending policy decision next year.

Next steps

Following publication of this strategic decision the Department for Energy Security and Net Zero will continue to work with industry and the Health and Safety Executive to ensure that hydrogen blending safety evidence is independently and robustly assessed.

Following completion of the safety assessment government will review this strategic policy decision and take a future decision on whether to enable blending which will consider any implications from the safety assessment on blending's feasibility and economic case.

We will continue to engage with stakeholders on the design of the Hydrogen Production Business Model support, with a view to potentially incorporating blending as an offtaker as we develop further thinking and policy positions in these areas. In addition, we will set out how we may change our hydrogen allocation processes if blending is confirmed as an eligible offtaker and how we would ensure blending is supported in line with the strategic role envisaged for it.

This publication is available from: www.gov.uk/government/publications/hydrogen-blending-in-gb-distribution-networks-strategic-decision

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