IET response to the Department for Energy Security and Net Zero Hydrogen blending into the GB gas transmission network consultation

About the IET

The IET is a trusted adviser of independent, impartial, evidence-based engineering and technology expertise. We are a registered charity and one of the world's leading professional societies for the engineering and technology community with over 155,000 members worldwide in 148 countries. Our strength is in working collaboratively with government, industry and academia to engineer solutions for our greatest societal challenges. We believe that professional guidance, especially in highly technological areas, is critical to good policy making. The IET are currently working in partnership with Cranfield University to deliver a birds-eye view assessment of the UK's Hydrogen landscape. This project is expected to be delivered in autumn 2025. For further details on the evidence submitted, please contact policy@theiet.org

Question 1.

a. Do you agree with the assessment of the impacts of blending up to 2%, 5% and 20% hydrogen by volume on NTS connected end users? Please provide evidence to support your response.

Hydrogen blending should be viewed as an important transitional step towards establishing a UK hydrogen economy, rather than an objective in itself. With blending serving as a means of stimulating early demand and investment in hydrogen production and infrastructure in support of the potential requirement to develop of a dedicated UK 100% hydrogen network. Clear evidence-based targets, careful selection of injection locations, and dedicated R&D into the technical limits of blending are all vital elements to ensure successful delivery of this hydrogen blending objective.

Forecasts from the Climate Change Committee (CCC) and National Energy System Operator (NESO) highlight a potentially comprehensive role for hydrogen by 2050, supporting cross-sector decarbonisation, providing balancing and resilience to the electricity system, and decarbonising industry alongside electrification. In this context, hydrogen blending can provide early momentum towards scaling supply but must be planned carefully to ensure that blending does support provision of a pathway to an ultimate end goal (which has still to be fully defined and articulated).

Infrastructure and Location Considerations

It is not currently known exactly how much of the UK's gas network are well suited for blending at scale., Government should explore this. To avoid creating supply issues such as slugging of higher percentage flows hydrogen within the natural gas network, successful blending is likely to require that hydrogen be injected at locations where it can feasibly be blended with natural gas at scale. The most feasible locations for hydrogen blending at scale are therefore anticipated to be entry points to the natural gas NTS, not irregular points along the transmission network. Suitable sites include:

- North Sea production entry points
- LNG terminals (Pembrokeshire, Isle of Grain, etc.)
- Interconnectors with Europe

However, the viability of North Sea injection will diminish as domestic gas production declines. Careful selection of locations is therefore critical to avoid technical issues such as uneven distribution within the transmission system.

As a result, blending may not fully enable decentralised electrolytic producers to utilise otherwise curtailed renewable electricity, as Chapter 3 of the consultation envisages. Especially for renewable electricity production in Scotland if key locations for hydrogen blending at scale are most likely to be located in South Wales and the South East of England. The constraints of transmission-level blending suggest that such producers may ultimately be better served by connection to a future national hydrogen network.

Safety, Technical Constraints, and Leakage.

Safety: If assuming that new hydrogen production facilities will be bespoke developments, safety aspects are anticipated to be particularly relevant to blended gas transport and storage arrangements and end use applications. Although initial steps have been taken, e.g. with the National Transmission System Hydrogen Blending Stakeholder Engagement Report produced by Arup for UK government, further work is still needed to confirm that hydrogen blending can be implemented safely across the whole system chain.

While produced initial evidence has indicated that blending levels such as 20% can be reached, further practical research, combined with demonstrations and pilot project work needs to be carried out to confirm this in detail. A key area for future research and development should therefore be to establish the technical constraints of the existing network, including metallurgy, leakage risk, and safe operating margins. These constraints may ultimately set the practical upper limit of blending before full transition to a 100% hydrogen network becomes necessary.

Government must also provide explicit clarity in its definitions of blending:

- What does a “2%” or “20%” blend mean in practice? - details are needed over when and how much hydrogen will be blended into the system. For example, will there be a consistent blend of 80/20 hydrogen gas, or would that be an average across a specified period
- How much hydrogen is being blended, at what times, and with what expected impacts on households and industry?

However, much of a margin might be required below a set blending target (whether 2%, 5% or 20%) to enable the natural gas network to act as a hydrogen offtaker of last resort as envisaged in the consultation document.

Hydrogen is itself a greenhouse gas and highly reactive, so minimising leakage must be a core principle in the design and repurposing of any future network. Current NTS pipeline metallurgy may impose technical limits on the maximum safe level of hydrogen blending that can be achieved, particularly if leakage rates rise as the proportion of hydrogen increases.

Strategic Transition to 100% Hydrogen

Finally, the UK should seek to identify the potential tipping point at which further incremental increases in blending become less effective than progressing towards a dedicated 100% hydrogen network. For example, modest early blends (e.g. 2–5%) may be useful to stimulate supply, but the transition to full hydrogen use may be more efficient than pursuing ever-higher blends within the existing network. I.e. Even if achieving a 20% blend were technically feasible, progressing such a target may be sub-optimal if the overall strategic objective is to realise a 100% hydrogen network across the UK.

Given UK gas demand in 2023 exceeded 700 TWh, even modest blending percentages (e.g. 2% = 14 TWh, 5% = 35 TWh of hydrogen) would represent significant new hydrogen production requirements. Careful strategic planning is therefore essential to balance scaling of hydrogen supply with efficient use of infrastructure and investment.

Appropriate Blending Targets

The precise numerical blending targets (2%, 5%, 20% etc.) should not be set arbitrarily. What is critical is understanding the implications of each blending threshold, including:

- Identifying the maximum safe blending percentage that can be achieved without requiring modifications to end-user equipment.
- Recognising that blending percentages should evolve through progressive development of engineering evidence and investigation (and understanding), rather than rigid and arbitrary pre-selected values.
- Accepting that there may be a natural tipping point, well before a 20% blend is reached, at which it may become more efficient and effective to focus resources on progressing a 100% hydrogen network instead of continuing with incremental increases.

Alignment with European blending standards also needs to be considered. Under EU rules, a 2% limit for boundary targets has been confirmed. Continued cooperation with European partners is therefore essential.

<u>Question 2.</u>

> Do you agree that if transmission blending is enabled and intended to be commercially supported by government, the most appropriate mechanism would be via the

Hydrogen Production Business Model? Please provide evidence to support your response.

Since hydrogen blended into the gas transmission system would be transported and stored using the existing natural gas NTS infrastructure, it follows that the primary focus of commercial support should be on hydrogen production itself.

In this respect, the IET agrees that the most effective route may be to expand the existing Hydrogen Production Business Model (HPBM) to incorporate blending applications. This would avoid unnecessary complexity while providing a consistent and scalable framework to support hydrogen production for blending purposes. Introducing an entirely new commercial model for blending would risk duplication and administrative burden without delivering corresponding added value.

A central issue still to be resolved is how end-use applications of blended gas should be treated in comparison with 100% natural gas consumption. This includes:

- How fuel composition is measured and/or allocated
- How emissions are reported
- How carbon taxes or levies are applied

Ultimately, forcing blending without resolving these wider issues could create unintended consequences and inefficiencies. Therefore, government should ensure that commercial and regulatory frameworks for hydrogen blending are integrated with carbon pricing, reporting, and emissions accounting mechanisms. Only then will blending act as a meaningful stepping stone towards the wider goal of scaling hydrogen production and progressing towards a 100% hydrogen network.

Question 3.

Do you agree with our minded to position, if blending were enabled, to allow both the gas transmission network operator and gas shippers to purchase hydrogen produced for blending? Please provide evidence to support your response.

Yes, the IET agrees with this minded position. It is appropriate that both the transmission network operator and gas shippers are permitted to purchase hydrogen for the purposes of blending. This approach provides a balanced means of enabling early use of hydrogen within the gas system and supports the broader aim of building a viable hydrogen economy.

It will be important, however, that the commercial framework recognises blending explicitly. In particular, provision for hydrogen blending should be incorporated into the Low Carbon Hydrogen Agreement (LCHA) so that it is clearly covered within the ongoing Hydrogen Allocation Round (HAR) process and associated hydrogen production business model arrangements. Doing so would ensure coherence between blending activity and wider policy mechanisms designed to stimulate hydrogen supply.

Question 4.

Do you agree that working within the current gas billing arrangements will not result in an increase in billable usage and gas bills for end users connected to the NTS, should transmission level blending be enabled by government? Please provide evidence to support your response.

This remains an area of uncertainty that requires further work. Government should prioritise engagement with the key industrial stakeholders most affected—including large industrial end-users—to help shape workable solutions. Wherever possible, new arrangements should seek to preserve consistency with existing natural gas billing frameworks, rather than creating systems that add unnecessary burden or risk misalignment with established practice.

Question 5.

a. Do you agree with our minded to position, if blending were enabled, to consider further whether to support and enable transmission blending of up to 2% hydrogen by volume? Please provide evidence to support your response.

We agree in principle with the government's minded-to position that hydrogen blending at the transmission level is likely to represent an important step in enabling large-scale hydrogen production and supporting the decarbonisation of the UK gas network.

Further work is required to confirm whether a 2% hydrogen blending target is technically feasible while ensuring continued safe network operation and avoiding adverse impacts on existing natural gas end users connected to both the transmission and distribution systems. Any such target should also be considered within the context of a long-term trajectory for hydrogen development. This should include clarity on the role that blending is expected to play in the transition, and the extent to which higher blending levels might be contemplated as part of a broader strategy towards a 100% hydrogen network.

While pilot projects such as HyDeploy and HyDeploy2 have already provided valuable insights, there remain outstanding questions regarding operational impacts, system management, and interactions with suppliers and customers. It will therefore be important to build on existing work ensuring that future research and development is targeted at closing the remaining evidence gaps.

b. Do you have any further concerns on enabling blending up to 2% hydrogen by volume into the NTS? Please provide evidence to support your response.

At present, there has been limited clarity on what is meant in practice by a "2% hydrogen blend" within the National Transmission System (NTS). The government's consultation appears to indicate that end users should not receive temporary higher hydrogen concentrations, but instead that blends would be maintained within an upper threshold of 2%

by volume. It would be helpful for this to be stated more explicitly in order to provide confidence to stakeholders.

If there is no technical issue with end users receiving up to 2% hydrogen by volume, then variation between supplies of 100% natural gas and supplies of 98% natural gas with 2% hydrogen should not in itself pose technical problems. The more significant issue may be ensuring that commercial and contractual arrangements are capable of accommodating these variations in blend percentage in a transparent and equitable way.

Given that blending at the NTS level could ultimately result in hydrogen being supplied to all users connected to the gas grid, further work is required to provide assurance that end users will not be adversely impacted by the proposed 2% hydrogen blend. This should build on the evidence already generated by aforementioned pilot projects.

c. Is there a maximum level of blend that would be feasible with minimum modifications for sites connected to the NTS?

The National Gas Transmission Hydrogen Acceptability Study published in Jan 2025 which was undertaken by Progressive Energy on behalf of National Gas Transmission focused on consideration of switching to a 20% hydrogen blend and an ultimate transition to 100% hydrogen. The scope of this study did not include identification of the maximum level of blend that would be feasible with minimum modification for sites connected to the NTS. A study focused on the maximum blend which could be achieved with minimum modification would be a useful next step in developing an evidence base to support decision making for a UK hydrogen blending technology maturation and eventual implementation programme.

Question 6.

a. We welcome feedback on the economic assessment presented and any further analysis on the costs and benefits of transmission blending.

b. Please provide any additional information on the costs of any required modifications or mitigations required for NTS connected sites to be able to accommodate a blend of up to 2% hydrogen by volume. If you do not currently have this information, how long do you expect it take to assess what mitigations might be needed and what the costs of these could be?

The IET recognises that National Gas is best placed to provide detailed information on the capabilities and condition of the National Transmission System (NTS), as it owns and operates the infrastructure and holds the relevant data. While this information is not publicly accessible, the IET would be willing to engage with National Gas to help collate and publish technical data in a form that supports transparency and stakeholder engagement.

Regarding the economic assessment of hydrogen blending, it is currently difficult to provide fully informed feedback due to a lack of clarity on the underlying assumptions. For example, the consultation assumes that blending will not progress beyond 2%

[Fig.3], yet if the UK is to progress towards a 100% hydrogen network, this assumption may be overly restrictive. Blended hydrogen volumes will also depend on future forecasts of natural gas demand across end-use sectors between 2025 and 2050, which have not been published. Greater transparency on these assumptions would support more considered feedback.

From a practical perspective, if blending is to be a flexible off-taker, the allowable hydrogen concentration may need to be below 2% in certain circumstances to provide smooth supply to end users. Actual blending levels will be influenced by the availability of hydrogen at various injection points and the need to maintain operational safety margins. Further detail is therefore required on how the government intends to set normal operating targets, manage network operations, and reconcile variability in hydrogen availability with the aspiration for a consistent blend delivered to end users.

In terms of enabling costs, such as the £300m estimated by National Gas for Project Union, more information is needed to understand the assumptions underpinning these figures, including the number and location of injection points considered for hydrogen blending. Similarly, the risk of stranded assets—particularly for hydrogen production and blending equipment—should be assessed in the context of a longer-term transition plan towards a 100% hydrogen network. Evidence from CCC, NESO, and ESC analyses suggests that such risks are limited, but careful planning is required, especially to ensure production assets align with the geographical extent of a future hydrogen network.

Finally, the IET reiterates that commercial and locational incentives for hydrogen production should be aligned with long-term network and decarbonisation objectives. Developers must have clarity on whether hydrogen injection sites can be optimally located to facilitate blending, while supporting the ultimate trajectory toward a dedicated hydrogen network. National Gas' Project Union roadmap already identifies key locations—such as LNG terminals at Milford Haven, Isle of Grain, and Bacton, as well as Teeside, Grangemouth, St Fergus, and Burton Point—indicating that essential infrastructure is broadly covered. Future government strategy should provide clarity on how these geographical considerations relate to broader hydrogen network development.