

UKPIA Response to the Consultation on Designing the Net Zero Hydrogen Fund

Introduction

As outlined in the BEIS Hydrogen Strategy, low carbon hydrogen (LCH) has an essential role to play in delivering a Net Zero UK¹. Whilst hydrogen is already used in many industrial processes as either a feedstock or energy vector, it is normally produced at the same site with currently a negligible market in place.

The UK downstream sector is currently the largest hydrogen-producing sector in the UK, responsible for almost half of UK production. The production processes are currently a mix of steam methane reforming (SMR), autothermal reforming (ATR), and as a by-product from catalytic reforming (CR) – the latter of which accounts for approximately half of all hydrogen production in the sector (see Figure 1).²

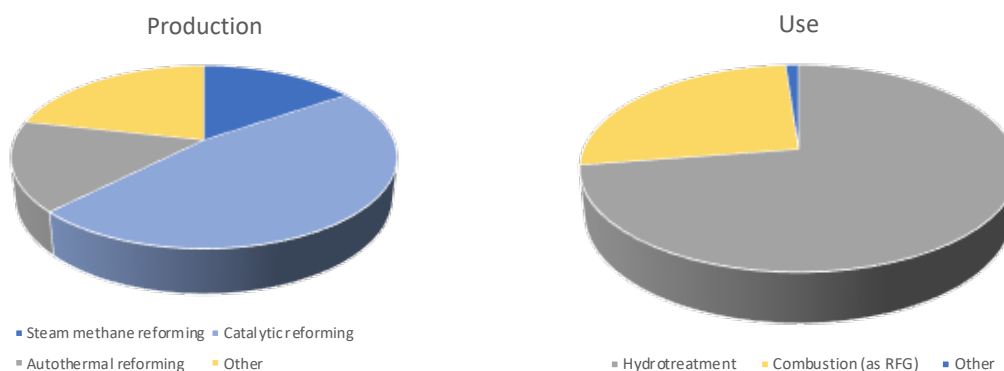


Figure 1: Proportions of hydrogen production methods and consumption processes in the UK refining sector

The vast majority of hydrogen used by a refinery is for the hydrotreatment of intermediate streams – the primary means by which sulphur is removed from the products. Hydrogen is also present in refinery fuel gas (RFG) in varying quantities, lowering the carbon content of the RFG used for firing/heating processes.

As such an integral part of the refining process, the downstream sector has decades of experience in producing and handling hydrogen and is already beginning to utilise this expertise for the deployment of LCH. The sector is also highly experienced in assessing the financial sustainability of hydrogen production projects, and essential criteria required prior to making a financial investment decision (FID) on such capital expenditure (capex) intensive activity.

Accordingly, the downstream sector is ideally placed to support the UK government in the design of its Net Zero Hydrogen Fund (NZHF) and helping to deliver a LCH economy in the UK. UKPIA welcomes the UK Hydrogen Strategy and the opportunity to engage via the accompanying consultations. It is essential that the right policy foundations are laid in the early 2020s to support the rapid scale-up of the nascent LCH market.

¹ UK Hydrogen Strategy, BEIS, August 2021

² UKPIA and BEIS data

1. What wider benefits could the NZHF deliver, such as local growth and low carbon leadership opportunities?

The primary benefit of the NZHF is likely to be in supporting front end engineering design (FEED) and pre-FEED LCH projects to enable informed FID processes. Whilst BEIS has included upfront capital cost as in-scope for the fund, the scale of the NZHF (£240 million) is unlikely to be sufficient to suitably de-risk capex investment for LCH production projects.³

Whilst support in the FEED and pre-FEED stages may mean multi-year time frames for the fund's benefits to be realised, supporting these stages is likely to enable more innovative projects to be designed and assessed. Therefore, an improved suite of projects for prospective investment should, in theory, be available relative to a counterfactual of no NZHF. Such investment should result in improved regional LCH availability, small/sub-cluster development, and, ultimately, employment and economic growth.

In addition, as previously shared with BEIS, LCH production best practice and intellectual property (IP)/know-how is likely to be one of the greatest export opportunities for the UK from the establishment of an LCH economy. A well-designed NZHF should foster and accelerate IP development in this area.

2. Do you agree with the proposed scope for the NZHF?

Yes, the NZHF should be production-focused but not exclude directly integrated local distribution support such as:

- Pipeline connection up to an existing distribution network (e.g. within a cluster or a regional/national network);
- Sea- or road-loading terminals (tanker or tube-trailer);
- Other novel distribution methods such as processing into liquid organic hydrogen carriers (LOHCs).

One of the current primary barriers to hydrogen provision is transfer from existing production sites as hydrogen presents significant technical challenges relative to carbon-based liquid and gaseous fuels/feedstocks. The inclusion of production site off-loading in the NZHF will help support producers identify and establish potential off-take routes to more rapidly grow LCH deployment. Off-takers should also be supported via separate, parallel demand-side policy interventions.

For clarity, whilst the above distribution options should be included as part of a production project, UKPIA agrees with the BEIS proposed scope: dedicated distribution and storage projects should be out of scope of the NZHF.

3. Are there any technologies for low carbon hydrogen production, other than CCUS- enabled and electrolytic hydrogen, that you think could begin production of low carbon hydrogen during the early 2020s? Please give details.

UKPIA agrees that it is unlikely that any other LCH production technology will be commissioned at scale in the early 2020s. With further research, the pyrolysis of methane may offer another means of producing LCH in the coming decades, however, its current technology readiness is low relative to CCUS-enabled and electrolytic production.⁴

³ Blue Hydrogen, Global CCS Institute, April 2021

⁴ State of the Art of Hydrogen Production via Pyrolysis of Natural Gas, S. Schneider et al, ChemBioEng Reviews, July 2020

A means of enabling short-term hydrogen provision for hydrogen demonstrators/trials would be supporting pressure swing adsorption (PSA) technology. Hydrogen produced via CR has a lower carbon intensity than from SMR or ATR and could be separated/purified for onward distribution via PSA. Therefore, if a secondary policy objective of the NZHF is to also support lower carbon hydrogen deployment for demonstrators and trials, it may be prudent to include PSA as a supportable technology in the NZHF.

There is existing precedent for by-product hydrogen from a chemical process being utilised for hydrogen demonstration – byproduct hydrogen from chlor-alkali manufacture is currently captured and transported for use by twenty hydrogen fuel cell-powered double-decker buses in London⁵ and identified as a hydrogen production method in the low carbon hydrogen standard (LCHS) consultation document.

4. What boundary should the NZHF set around production projects? Please explain your rationale, including any considerations that may change over time and / or vary according to the types of projects.

As summarised in question 2, the NZHF should include immediate, integrated distribution from production plants to a point of off-take such as a tanker, tube trailer, or networked pipeline. UKPIA agrees with the proposed scope of support from pre-FEED to FEED to deployment with the fund likely to have the most material impact in the early development and FID phases.

As an increasing number of projects are announced and likely to co-locate/aggregate for access to a regional LCH market there may be a shift from FEED support to capex support for isolated, smaller-scale projects.

5. Noting the importance of revenue support which could be covered by the Hydrogen Business Model, do you agree that capital grant funding is the most effective option for low carbon hydrogen projects to come forward? Please explain your answer.

Agree, a capital grant funding approach for the NZHF best meets the policy objectives of supporting project upfront costs and stimulating a future pipeline of projects as it reduces upfront capital risk whilst maintaining private sector fiscal responsibilities and duties independent from the public sector.

As the LCH market is in such early stages, there is likely to be a high degree of uncertainty in ascertaining project feasibility and ranges in technical complexity. Therefore, any funding-type requiring more direct or ongoing government intervention such as loans or an equity stake is unlikely to be practicable given the need to demonstrate fiscal responsibility to the taxpayer.

6. If capital grants were not available, would you consider applying for government loan funding?

UKPIA is unable to provide a detailed answer to this question as its members would consider such an approach on a project-by-project basis. As a key objective of the NZHF is to support a pipeline of innovative LCH projects, it is unlikely that a loan approach would provide significant additional value from what is currently feasible. Government loan funding would be more appropriate to support the capex phase but would likely need to be an order of

⁵ <https://www.smmf.co.uk/2021/07/englands-first-hydrogen-bus-fleet-hits-the-road/>

magnitude higher than is proposed to support the engineering, procurement, and construction (EPC) of multiple LCH projects.

7. Do you agree that CAPEX support through the NZHF will help projects to reach Final Investment Decision? Please explain your answer.

Agree, as much certainty in capex and opex estimates as possible is required for the FID. As the estimates and associated level of certainty can vary greatly from concept to FEED to FID, suitable expenditure in the early phases to achieve this can present a barrier to project development.

By supporting development expenditure (devex), the NZHF will reduce the risk of regret costs being incurred by investors as they seek to establish required information for the FID and therefore encourage investors to pursue awarded/funded projects to the FID stage. This, in turn, should increase the number of viable projects (subject to policy support under other policies such as the LCH business model) and thereby grow UK LCH production.

8. Do you know of any projects that may only want CAPEX support, without a requirement for a hydrogen specific business model, in order to take FID? If so, please give details of the project(s).

UKPIA is not aware of such a project. In the downstream sector – and most other industrial sectors where natural gas is a significant input feedstock/energy vector – large scale LCH cannot be produced at sufficiently competitive cost that business model support is not required.

9. What reflections do you have on the approach we have identified to address the main challenges in building new hydrogen production facilities?

UKPIA agrees with the overall proposed approach for the NZHF. Based on the consultation document, UKPIA would reflect that BEIS may be optimistic in the level of support the NZHF could provide at the deployment/EPC phase of a LCH project – a share of £240 million is unlikely to provide significant financial support. However, such support at the FEED and pre-FEED stages should achieve the policy objectives of supporting early project costs and building a pipeline of future LCH projects.

UKPIA would encourage BEIS to launch the NZHF scheme before or in parallel with the LCH business model as its potential capex support may form part of project considerations when a producer is negotiating a strike price under the business model. Whilst discussions with BEIS under these schemes may occur in parallel given their interdependency, award of funding under the NZHF and terms under the business model will need to be granted independently/separately to ensure fiscal transparency.

10. Do you agree that there is a need/demand for government intervention to support hydrogen production projects with their development costs?

Agree, as explained under question 7.

11. In light of available funding sources for project development, at what stage of the project life cycle would government support ensure the most effective use of the NZHF's resources and why?

As outlined in previous questions (1, 5, 7, 9), the NZHF is best-placed to support the LCH project pipeline at the FEED and pre-FEED stages. However, it should be noted that currently the greatest need for LCH production funding support is post-FEED to EPC for progressing announced projects under development. Funding support for these will be an order of magnitude greater than offered by the NZHF and more appropriately met via the LCH business model.

As local LCH networks develop and more projects are needed for inter-regional LCH supply, devex support provided by the NZHF may again prove to be needed. As early LCH projects come online and enter operational phases, Nth-of-a-kind (NOAK) plants should be brought online more quickly and at increasingly lower financial risk to investors as the market and technologies are better understood. This growth and 'waves' of project development/investment will be contingent on suitable demand, necessitating the need for demand-side policy support.

12. Do you agree with the proposed high-level eligibility criteria for NZHF applications? Please expand your answer.

Agree, however an agreement in principle between producer and off-taker for an uncertain market may prove unrealistic – a memorandum of understanding may be a more appropriate demonstration of eligibility.

13. Do you agree with the proposed high-level assessment criteria for NZHF applications, and in particular? Please expand your answer.

Agree in principle, whilst ensuring project 'replication' is subject to the usual IP protections. Further areas of clarification will be needed prior to/as part of publication of the NZHF outcome:

- How must 'value for money' be demonstrated? 'Cost-effective hydrogen' may be demonstrable within the context of the cost of producing hydrogen that meets the LCHS, however, value for money is less clearly defined.
- Given produced hydrogen will be required to meet the LCHS, what further demonstration of carbon savings will be needed for assessment (if any)?
- Are BEIS intending to assign any relative weighting between the categories outlined in table 6 of the consultation document?

14. Do you have any comments on the application process for the NZHF? Please explain any practical considerations the government should take into account when designing the final bidding system.

UKPIA has no comments on the proposed bidding system – this appears fair and feasible.

15. If your organisation is likely to apply to the NZHF, could you please state whether you would be seeking capital or development support and the estimated size of the bid? If your projects require capital support, please also express this as percentage of the overall costs.

UKPIA is unable to provide a detailed answer to this question as its members would request capex and/or devex on a project-by-project basis. As outlined in previous questions, it is likely that the majority of projects for such a nascent market will require both devex and capex support (especially for first-of-a-kind (FOAK) plants). However, the NZHF may most appropriately provide support for the former – meaningful LCH production capex support would likely require significantly more funding to be available.

16. If you are seeking capital support, what stage of your construction are you looking to get funding for?

UKPIA is unable to provide a detailed answer to this question as its members would consider such an approach on a project-by-project basis. Investors in LCH production will be looking to ensure greatest possible levels of capex and opex certainty to reach FID and therefore any construction funding would need to be confirmed prior to the FID being taken.

17. Glossary

ATR	Autothermal Reforming
CR	Catalytic Reforming
EPC(M)	Engineering, Procurement, and Construction (Management)
FEED	Front-End Engineering Design
FID	Final Investment Decision
FOAK	First-of-a-Kind
HRS	Hydrogen Refuelling Station
LCH(S)	Low Carbon Hydrogen (Standard)
LOHC	Liquid Organic Hydrogen Carriers
NOAK	Nth-of-a-Kind
NZHF	Net Zero Hydrogen Fund
PSA	Pressure Swing Adsorption
RFG	Refinery Fuel Gas