Hydrogen Projects: planning barriers and solutions

Research findings

December 2023

Contents

1. Executive Summary

Research background

The Department for Energy Security and Net Zero (DESNZ) commissioned Verian (formerly Kantar Public) to conduct this research to understand barriers within the planning process for hydrogen projects in the UK, and identify potential solution areas which could address these barriers.

This research is comprised of two stages. Firstly, a scoping phase, comprising of four in-depth interviews with relevant stakeholders, and a literature review of:

- The current planning pathways for hydrogen projects.
- Differences across UK nations.
- Barriers already identified in the planning process, to explore further in the second phase.
- Actions taken by three adjacent countries to support planning for hydrogen projects.

The second phase consisted of twenty-five one-hour interviews conducted with individuals with experience of submitting or reviewing planning applications for hydrogen projects (covering developers and local authorities). Eight participants from the interviews were then invited to reconvened workshops with DESNZ attendees to discuss potential solution areas. All fieldwork was conducted in May and June 2023.

Key findings

Overall, participants' most significant concerns with the wider planning process in the UK were the level of complexity (and therefore the time and resources required to prepare and navigate the process), and the significant resource constraints in examining bodies and other statutory consultees.

Key barriers related to planning could be categorised as broader 'systemic' barriers, impacting hydrogen projects in specific ways, but also resulting from flaws in the wider UK planning system, and 'procedural' barriers directly related to the processes for hydrogen projects. The key barriers identified were:

- Lack of resources in local authority planning departments and other statutory consultees. This was consistently seen as the most significant barrier and the highest priority for UK Government to focus on improving.
- Lack of experience with hydrogen, in local authorities, other statutory consultees, and with developers.
- Public attitudes and opposition to development generally and hydrogen specifically.

- Difficulty co-ordinating involved parties (including regulators, local authorities, and local communities) throughout the process.
- Lack of published guidance for hydrogen planning.
- Challenges around thresholds for planning pathways and regulations.
- Lack of flexibility in the process.
- Inconsistencies across UK nations.

After these barriers had been identified, DESNZ and Verian developed indicative, high-level solution areas to discuss and develop in reconvened workshops with eight participants from the interviews. These were presented to participants as potential areas of improvement, developed to stimulate discussions, and were not intended as specific policy proposals. Findings should be interpreted with this consideration in mind.

No single solution area was seen as transformative at addressing the barriers, but participants did see some ways in which the UK Government could alleviate some of the barriers. The solution areas considered most positive were: a central support pool sitting in DESNZ as a longer-term solution; and a toolkit for pre-application discussions and informal forums for discussion and knowledge sharing as shorter term solutions. Solution areas around public safety information and resources, training for local authorities and statutory consultees, and increasing flexibility within the Development Consent Order (DCO) pathway (including opt-outs to refer larger projects to the Town and Country Planning Act (TCPA) pathway by mutual consent) were seen as potentially useful but not immediate priorities.

Participants consistently saw the planning processes for hydrogen projects in the UK as in need of significant change, and were pleased at the acknowledgement of this need from the UK Government. This was consistent across type and size of project and across different consenting pathways, although there were unique considerations to each project and consenting process.

2. Background

This section explains the context in which this research took place and the research methodology, including the limitations of the approach taken.

Project context

Hydrogen can support the decarbonisation of the UK economy, particularly in 'hard to electrify' UK industrial sectors, and can provide greener, flexible energy across power, transport and potentially heat. Recognising this, in the British Energy Security Strategy (BESS) the government doubled its ambition for new low carbon hydrogen production capacity to up to 10GW by 2030, subject to affordability and value for money, with at least half of this coming from electrolytic hydrogen production.[1]

Work is already underway to provide a supportive commercial framework but unlocking investment will also require removing other regulatory barriers. This is partially due to no dedicated planning regime for hydrogen projects at present, meaning that depending on their size, location and type of intended development, any given hydrogen project may be subject to different regulatory frameworks around planning, which further vary across the devolved administrations.

Securing planning permission for a large infrastructure project is a time-intensive process, and recent decisions on other forms of energy generation, such as wind and solar farms, have involved significant amount of public consultation and challenge from local communities, leading to extensions to deadlines. Analysis from DESNZ's consultation on hydrogen transport and storage infrastructure in late 2022 has shown that stakeholders recognise improvements for national and local planning policies and processes applicable to hydrogen projects.[2]

As part of its Hydrogen Strategy, the UK Government stated that it aims to have planning and permitting regimes in place by 2024.[3] To achieve this and ensure investment in hydrogen projects in the UK, deeper insight was needed into current barriers to investment related to the planning process and potential solutions to overcome these.

The Electricity System Operator, in advance of becoming the Future System Operator (FSO) will also be commissioned in early 2024 to produce an initial Strategic Spatial Energy Plan (SSEP) as recommended by Nick Winser, the UK's Electricity Networks Commissioner, in his review of electricity transmission network deployment. We expect the

[1] https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy
[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1175783/hydrogen-transport-storage-consultation-government-response.pdf
[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011283/UK-Hydrogen-Strategy_web.pdf

first iteration of the SSEP will cover associated infrastructure for power generation and hydrogen assets.

Research approach

Phase One: Scoping

Planning process review

For the first substantive activity, Verian conducted a review of the planning processes and approaches across the UK and in three adjacent jurisdictions of interest (Germany, the Netherlands and Canada). The review provided an understanding of how processes differ in other jurisdictions as a basis for assessing how this may impact relative perceptions of barriers.

These activities were conducted via web search of government or other relevant websites (e.g., sector bodies explaining the process to members). A full list of documents reviewed for this research is included in Appendix 1.

Literature review

The planning process review occurred alongside and fed into a parallel literature review of available academic and grey literature on the barriers to investment related to the planning process in the UK and elsewhere. As outlined in the brief, given the paucity of academic work in this space, a full systematic review was not possible or appropriate. Instead, the review drew on literature identified by the DESNZ project team, by stakeholders taking part in interviews (see below), as part of the planning process review and via Google Scholar searches. ten key documents were included in the literature review, a full list is included in Annex 1.

On reviewing each paper, information was extracted into a table designed around the key research questions. This covered the details of the different planning processes across jurisdictions (including the precise language used within the UK), the key barriers associated with these for hydrogen projects of different types, the extent to which these differ across jurisdictions, and any evidence of solutions that have worked to overcome barriers.

Initial stakeholder interviews

Alongside the other scoping stage activities, phase one included four interview discussions with relevant government or industry stakeholders, each lasting around one-hour and conducted online. The combination of stakeholders were chosen by the DESNZ team to provide a range of perspectives on the planning process. Stakeholders from DESNZ, Health and Safety Executive (HSE), Environment Agency (EA) and the Planning Inspectorate were participants for these interviews. These interviews provided an umbrella view of potential barriers for hydrogen projects engaging with the planning process, supplementing the literature review, and helping inform hypotheses for testing in the second phase of primary research.

Phase two: primary research

Interview approach

Phase two primarily consisted of a series of twenty five one-hour semi-structured interviews conducted with individuals with experience of submitting planning applications for hydrogen projects and individuals within Local Planning Authorities (LPAs) overseeing planning applications for hydrogen projects. All interviews were conducted online via Microsoft Teams and/or Zoom in May and June 2023. Topic guides and stimulus materials based on the phase one findings were developed by Verian and agreed with DESNZ. Interview schedules are included in Annex 3 of this report.

All participants were shown process maps for planning pathways developed by Verian from phase one findings. Participants reviewed the process maps and highlighted any elements which did not match their experience, or other ways that additional detail could be added. Final versions of these maps are included in section 4 of this report.

Sample and recruitment

Twenty-five participants were recruited for interviews. Participants were drawn from DESNZ's market intelligence data, with initial contacts made by DESNZ to improve the chances of engagement. The sample included coverage of a range of hydrogen project types across production, transport, storage, and end-users of hydrogen, as well as location (within England and including coverage of Scotland and Wales), and relevant planning pathway (DCO and TCPA consenting regimes). The sample was predominantly focused on onshore hydrogen projects, but some participants did have experience with offshore; both are covered in this report. A summary table of the sample is included at the end of this section and a full sample breakdown is included in Annex 1. The research focused on projects with experience submitting planning applications, and therefore included technologies with a higher TRL (technology readiness level). We anticipate that the planning barriers identified through this research would be the same for hydrogen technologies not sampled, including those with lower TRL levels.

All participants were screened by Verian before taking part in interviews to ensure relevant experience. Participants were offered an incentive payment of £80 to each individual taking part, in order to increase engagement (with the option of claiming this as a charity donation if preferred).

Reconvened groups

Following in-depth interviews, eight participants were invited back to take part in two 90-minute reconvened groups to explore potential solutions developed by Verian and DESNZ, based on phase one and interview findings. These participants were selected on the basis of having the most experience of navigating the planning process for hydrogen projects, and deliberately included a diverse range of projects (this included a range of generation,

transport and storage projects; onshore and offshore projects; and projects consented under DCO and TCPA pathways). All eight participants invited to reconvened groups attended. These groups were used to validate findings from interviews and explore potential solution areas in more depth. Each group consisted of four participants and was held online via Zoom in June 2023. Groups were moderated by Verian. DESNZ colleagues joined both groups as active participants in discussions in both reconvened groups. Participants were not incentivised to take part in this stage of the research, instead groups were presented an opportunity for them to help co-create ideas for solutions. Participants in reconvened groups consistently expressed an interest in continuing dialogue with the DESNZ team which has continued since the conclusion of the research.

Research limitations

The limits of this research approach should be taken into account when interpreting these findings:

- This is a qualitative research approach with a relatively small and heterogenous sample, and each organisation had unique circumstances that influenced their experience and perceptions of the planning process. The extent of this heterogeneity was itself a finding of the research. However, this limits the extent to which the findings can be seen as truly representative of other projects.
- Participants were recruited through convenience sampling for practical reasons, with contacts taken from DESNZ's existing market intelligence data. This may result in a sample which has a higher level of engagement with DESNZ than is truly representative. This sampling approach was most appropriate due to the need to reach the required sample quota in the required time frame for this research.
- Due to the sample available, more developers than local authorities are represented in the sample. Again, this was a result of the sampling approach required to complete the research in the required time frame. This report specifically highlights how findings from local authorities differed from other participants where relevant, but the overall balance of the sample should be taken into account.
- Reconvened focus groups were moderated by Verian with DESNZ attendees joining both discussions. Direct involvement by DESNZ attendees allowed a greater level of depth and technical detail in discussions. It should be considered that attendance by DESNZ officials may have influenced participants' responses. When designing the approach, DESNZ and Verian concluded that the benefits of DESNZ officials hearing directly from and being able to engage directly with participants outweighed this potential risk.

Despite these limitations the research is appropriate and proportional to the intended use.

Table 1: Summary of the sample achieved

Type of organisation	Categories (including past experience)	Number of participants
Developers	Production only	10
	Production and transport	3
	Production and storage	1
	Production, transport, and storage	4
	Transport	2
	Transport and storage	1
	Undetermined at interview	1
	Industry association	1
Local authorities	Local authorities	2

3. Context: Hydrogen planning in the UK

This section discusses contextual factors which relate to and influence planning for hydrogen projects.

Context for hydrogen projects: factors relating to planning

Participants consistently highlighted a broad range of factors impacting planning applications, which must be considered when assessing the viability of hydrogen projects. Although interviews predominantly focused on the process for seeking planning permission, legal and commercial challenges were seen as having significant direct and indirect implications for planning. As a nascent industry and area of energy policy, planning applications for hydrogen projects must account for a large amount of uncertainty.

"There's a real tension between the amount of specific detail required in a planning application for any UK project and the uncertainties we have in how the industry will unfold from a financial and technological point of view." (Stakeholder interview, developer)

Key factors highlighted by developers and other stakeholders

Policy and regulatory uncertainty

Many participants highlighted the lack of dedicated regulatory policy for low-carbon hydrogen. Most importantly from a planning perspective, key sources of uncertainty were: the lack of specific guidance and a lack of clarity on how existing policies apply to hydrogen projects, including the lack of a National Planning Policy Framework (NPPF) referencing hydrogen projects; outdated National Policy Statements (NPS) which do not reflect the current and short-term future applications for hydrogen; and a lack of guidance on what 'good design' looks like for hydrogen infrastructure in e.g. the National Infrastructure Commission (NIC) design principles. These challenges are discussed in more detail in the barriers section.

Limited physical infrastructure

Participants saw a challenge in the currently limited existing distribution and storage infrastructure for low carbon hydrogen and saw this as a key challenge to make full use of hydrogen's potential as flexible energy storage. Developers highlighted that the nascent industry 'lacks resilience' without wider transport infrastructure to ensure that hydrogen can be used to meet needs beyond a small local area (e.g., not just in limited industrial clusters). This was seen as a significant risk when considering developing projects requiring significant investment, including in the consenting process. Conversely, many developers were optimistic about the potential for low carbon hydrogen to scale quickly and diversify in uses once wider network effects begin to increase.

"Lack of infrastructure adds additional jeopardy to the gamble on lengthy, expensive planning applications." (Stakeholder interview, developer production and storage)

Technological uncertainty around hydrogen at scale

While participants highlighted that some forms of hydrogen have been in use in the UK energy system for decades and, in many ways, hydrogen is not 'new', several raised concerns about the scalability of some low carbon hydrogen applications. Although some degree of uncertainty was seen as inevitable when developing new technology, participants highlighted the lack of Best Available Techniques (BAT) for some hydrogen projects as a current challenge and saw this as an important priority for the UK Environment Agency to develop as soon as it becomes feasible. It is important to note here that in February 2023, the Environment Agency published regulatory guidance on the production of hydrogen from methane with carbon capture, otherwise known as 'blue' hydrogen.[4] The guidance will help businesses design and develop industrial facilities for the production of 'blue' hydrogen.

In the context of technological uncertainty, participants saw being able to successfully navigate the planning process in a reasonable timeframe with predictable requirements (i.e., what developers should expect to include in submissions) as crucial. Many participants highlighted the need for a reliable process to follow to minimise uncertainty, as projects were funded with a finite amount of resource to achieve planning permission. Significant delays and unexpected additional costs in achieving the necessary permission and consents were highlighted as a threat to the viability of projects. Although no participants in our sample had specific examples of projects which had to be cancelled specifically due to planning permission delays, several mentioned examples where the perceived cost and complexity of achieving planning permission had been one factor in deciding not to proceed with a project.

Clustering effects in local areas

As discussed above, increasing the overall number and diversity of hydrogen projects in a specific region was seen as highly important to increase resilience in the hydrogen industry (e.g., increasing the number of potential off-takers to leave low carbon hydrogen producers less vulnerable to sudden decreases in demand). However, participants also raised some constraints, indirectly related to planning permission, for increasing hydrogen production and usage in specific areas around water availability and power agreements (grid connections).

Water availability

While predominantly relevant to green hydrogen using water for electrolysis, this was flagged as a risk in other projects as well such as for pipeline testing. This was raised as a challenge in water-constrained regions such as the South Coast, but was also flagged as a potential future issue in less water-constrained regions including the north-west of England. Participants also highlighted a lack of specific guidance from government on water supply impact to help guide the development of projects and give assurance to regulators and local

[4] https://www.gov.uk/government/publications/emerging-techniques-for-hydrogen-production-with-carbon-capture/emerging-techniques-for-hydrogen-production-with-carbon-capture

authorities considering planning applications. DESNZ has been conducting a project with the Climate Services for a Net Zero World (CS-N0W) consortium to better understand water requirements by hydrogen production technology type, and links to wider water availability. While early indications suggest there are likely to be adequate resources to meet overall water demand for hydrogen within the UK, water availability and quality considerations will have to be assessed at a regional and local level to ensure supply issues do not arise and any environmental impacts are accounted for and properly mitigated. Water demand for hydrogen production is set in the context of some regional challenges in water supply in the UK, with specific regions forecasting water supply risks out to 2050.

Grid connections

Participants also highlighted both the time taken to wait for grid connections (delaying projects) and a potential constraint on feasibility of projects. Participants described multiple cases of hydrogen production projects which had been delayed due to significant delays for grid connections. Grid constraints were seen as a significant challenge now and expected this to intensify. Participants felt that grid constraints could potentially impact planning in the future by making the consenting process more complicated (rather than this being a known live issue related to the planning process).

In several interviews, there was a fear that local areas will be ‘capped’ by these constraints, limiting the growth of regional hydrogen networks and hubs. This was also seen as a potential risk in preventing local planning authorities from building up significant experience with hydrogen.

Case study: Hydrogen Sussex Strategy

Hydrogen Sussex has an ambitious strategy to bring together local authorities and other public sector organisations, transport companies, engineering companies, utilities providers and a range of other stakeholders to build and grow local hydrogen production and storage, support uptake for a range of applications and demonstrate a scalable hydrogen economy. The strategy covers an area categorised as under serious water stress by the Environment Agency. Water availability for abstraction is a key challenge currently under consideration to ensure this does not act as a constraint on local green hydrogen production (while this has not been a barrier to currently planned projects it is a potential concern for future capacity). Participants with experience of planning applications in this region (developers and local authority staff) were eager to see updated guidance from Government and improvements to efficiency and recycling of water as hydrogen production technology develops.

International comparisons: adjacent country review

As part of the scoping phase of the project, three countries were chosen for the adjacent country review: Germany, Canada, and the Netherlands. These countries were selected as

although they had nascent hydrogen industries, their strategies and ambitions are further developed than other countries and features some broad similarities with the UK. The adjacent country review summarised each country's hydrogen strategies and planning legislation. Research was conducted to understand the overall context of hydrogen policy in each country; the specific status of hydrogen projects for planning permission, and any country-specific innovations in approach which could have relevance and learnings for the UK. The full list of literature reviewed is detailed in Annex 2. Key findings for each specific country are summarised in the table below.

Overall, it is not clear that other jurisdictions' current planning processes are likely to be a major advantage in helping them to develop a hydrogen economy compared to the UK: relatively little specific planning guidance or support was found for hydrogen projects, and there were few examples seen of innovative approaches.

Two notable examples with relevance in addressing challenges raised in the UK were:

Germany: new provisions specifically for the regulation of hydrogen networks have already been developed and used to guide current planning applications, while the UK's NPS for energy were still seen as requiring to be updated for hydrogen projects.

Netherlands: An online portal is available as a 'one stop shop' for applying for planning permission (including for hydrogen projects), environmental permits, etc. – also directing applicants to appropriate local authority sites. As discussed below, this contrasts with the more uncertain and time-intensive process of engaging with local authorities in the UK.

Table 2: Adjacent country review summary

	Germany	Netherlands	Canada
Policy context	Germany's hydrogen policy almost exclusively prioritises green hydrogen in the hydrogen strategy announced June 2020, with a target of 5GW production by 2030. The strategy was supported with 9 billion euros from Federal Government stimulus package. Germany has also convened a National Hydrogen Council to provide advice on development of a hydrogen economy. There is currently no regulatory driver for agencies to transition to zero emissions.	The Netherlands has created unique public-private partnerships with industry and academia to develop a national hydrogen roadmap to optimise its outputs. A 10 year, 4-phase, roadmap was announced as part of hydrogen strategy in March 2020. 2021-2022 – preparing the market; 2023-2025 – developing regional infrastructure; 2026-2028 – facilitate growth and market creation; 2029-2030 – global market readiness. The Government has made EUR 750 million of funding available to support the Dutch hydrogen ambition.	Canada has developed an ambitious hydrogen strategy that allows each jurisdiction to pursue its own comparative advantage. Canada's Hydrogen Strategy, released in December 2020, aims for hydrogen to deliver 30% of end-use energy in Canada by 2050. Most provinces in Canada have also released their own individual hydrogen strategies. Promoting investment through the Clean Fuel Standard, $1.5 billion low-carbon and zero-emissions fuels fund.

<table>
<tr>
<td>Specific status of hydrogen for planning permission</td>
<td>Germany has a federal system and lacks specific hydrogen guidance.
BNetzA, is the competent authority on a federal level.
Hydrogen falls under the existing regulation of the gas and electricity markets.
Industrial scale production requires a formal permit procedure with public engagement.</td>
<td>Existing laws on regulation of gas, and those applying to the energy, transport, and heating sectors, apply in the context of hydrogen projects.
<table>
<tr><th>Regulatory body</th><th>Role</th></tr>
<tr><td>Local Authorities, Municipalities, Provinces</td><td>Regulates land use; Environmental impact assessment</td></tr>
<tr><td>State Supervision of the Mines</td><td>Hydrogen storage</td></tr>
<tr><td>Netherlands Vehicle Authority (Rijksdienst Wegverkeer)</td><td>Approves hydrogen transport vehicles</td></tr>
<tr><td>Minister of Economic Affairs</td><td>Regulates new pipelines and decommissioning</td></tr>
<tr><td>Netherlands Authority for Consumers and Markets (Autoriteit Consument & Markt)</td><td>Regulates the gas network</td></tr>
</table>
</td>
<td>Permits are obtained working with both federal and provincial regulators.
Policies are inconsistent across different Canadian provinces, resulting in a ‘patch-work’ approach.
For example, in Alberta the Gas Utilities Act doesn’t consider hydrogen in the definition of a gas, while other provinces do.</td>
</tr>
<tr>
<td>Country-specific innovations in overall strategy that could have</td>
<td>Amendment to the Energy Act (July 2021) contains new provisions specifically for the regulation of hydrogen networks which can aid the advancement of infrastructure.</td>
<td>Regulatory sandbox allows companies to test new technologies and business models without being subject to normal regulatory requirements.
An online portal has been proposed as a ‘one stop shop’ for applying for planning permission,</td>
<td>Codes and Standards working group including inter-provincial ‘Authorities Having Jurisdiction’ representatives.</td>
</tr>
</table>

some relevance for planning	Renewable Energies Sources Act designed to support green hydrogen by partially exempting producers from an existing levy for power consumed in production of green hydrogen.	environmental permits, etc. – also directing applicants to appropriate local authority sites.	Updated Canadian Hydrogen Installation Code 2023 to harmonise requirements. Regional HUBS piloting pre-commercial applications, ensuring federal participation and identifying specific opportunities.

Although not included in the adjacent country review, one participant's experience navigating the planning process for a hydrogen project in Sweden revealed significant differences with the UK:

Case study: navigating the planning process for a hydrogen production facility in Sweden

One participant worked for a multinational manufacturing company with recent experience of adding 5MW capacity electrolysers to produce green hydrogen at a facility in Sweden, replacing natural gas in a furnace. This organisation was also an unsuccessful applicant for an earlier DESNZ (formerly BEIS) competition in the UK. Overall, the process was described as efficient and straightforward, with several relevant implications for hydrogen projects in the UK.

Fast turnaround time: the process of seeking planning permission for the electrolyser was almost complete at time of interview. This had taken 9 months from initial contact with the local authority to time of approval. The local authority responded with clarifications to the initial submission within six weeks. When reviewing the submission, response points (such as the requirement to change the proposed siting of the electrolyser within the compound away from gas pipes) were quickly identified by the local authority and relevant environmental permitting agency. Additionally, suggested changes were reviewed and approved within weeks. A geotechnical survey was requested after the initial submission. The participant noted that, in hindsight, this survey could have been provided at the start with the initial submission to save time.

Early engagement with local authority and central government: the developer described a strong and constructive working relationship with the local authority established over many years. In addition to this, active effort was made to engage early while feasibility was still being explored to ensure the local authority was aware in advance of the submission. Central government officials were also invited to the site to 'showcase' the project and secure further support.

"We've also been really proactive in bringing local authority officials, but also local government officials to our site, walking them around and talking them through the challenges, such as where we were going to install the electrolyser."

"We have one point of contact with the local authority; having that one point of contact throughout who engaged us back and forth regularly through the process has been really helpful. We think that has expedited the process quite a lot, chases up other bodies for their input too." (Stakeholder interview)

Proactive, early engagement with the community: the organisation could take advantage of well-established relationships with the community as a major employer

in the region. The participant described being able to build on long-established goodwill to address potential concerns from local residents about safety concerns.

4. Current experiences of the planning process

This section discusses the current pathways for seeking planning permission for hydrogen projects in the UK, and how these pathways are viewed by developers and other stakeholders.

Planning pathways for hydrogen projects

Planning pathways within the wider project design process

Many developers felt that planning must be understood within the wider context of other tasks and workstreams of a given project. Developers described the relationship between the planning application and the technical designs of the project as highly complex. Planning and other workstreams were described as difficult to manage in parallel. Applications must include a level of sufficient technical detail to be properly assessed, but technical design work can only be done to a certain degree before planning permission has been secured. If a Final Investment Decision (FID) requires planning permission to have been granted, resource and funding to develop detailed technical designs may not be available. This complexity was more relevant for larger, more complicated hydrogen projects, as per the example discussed in pipelines case study in section 5. This challenge was not considered to be unique to hydrogen projects, but made more complicated by the relative uncertainty and lack of experience (both discussed more in section 5 of this report on barriers).

Participant views of the ‘ideal’ planning process

Participants from developer organisations, local authorities, and other statutory consultees interviewed for the research all had broadly consistent views of what an ‘ideal’ planning process should aim to achieve:

Balanced: a process which can limit risk, but ultimately is possible to progress through within the commercial constraints of a project. Both developers and local authority participants were keen to stress the importance of a proportionate attitude to risk when applications are developed and determined.

Reliable: there were several desired components to a ‘reliable’ planning process. Reliable timescales were also seen as hugely important to allow developers to plan other workstreams related to or requiring planning permission, and avoid delays draining finite resources. Additionally, decisions made early in the process (e.g., that a particular assessment does not need to be included in the submission) can be relied on and not reneged on later in the process.

Clear: predictable requirements for a what an application should include, so that applications can be as close to ‘right first time’ as possible - saving all parties time and resource in clarifications and follow-up information. Participants also felt that different parties should be as open with one another as possible.

Flexible: an ‘ideal’ process would acknowledge and account for the fact that many technical/design decisions are not possible to make before consent, and therefore should allow an appropriate degree of flexibility. Participants also highlighted the importance of some flexibility in allowing local authorities to make decisions about what should be required in applications and what can be considered an associated development under an existing planning permission.

Perceived disconnect between ambitious targets and the lack of a comprehensive hydrogen planning regime

Participants consistently recognised that the UK Government sees hydrogen production, transport, and storage as a key pillar of its Net Zero strategy. Participants generally acknowledged that there are high ambitions in place, and that meeting them would require significant work to increase capacity quickly. However, many participants felt that there are major gaps that must be addressed quickly to meet these ambitions, and some questioned whether there is adequate acknowledgement of the challenges within UK Government.

"There is a real lack of joined up thinking, all the strategic implications of hydrogen. strategy, water, grid, finances, planning, safety – it’s a very long to-do list, there has been good progress in some areas but not enough at a systems level.” (Stakeholder interview, developer)

The lack of a comprehensive regulatory framework for hydrogen production, transportation and storage was seen as one of the most significant challenges to scaling up the UK hydrogen industry in line with these targets. Due to the current gaps in up-to-date guidance and legislation, developers felt that they must ‘piece together’ regimes applicable to the chemical and gas processing industries, as well as power generation and carbon capture and storage. Elements of hydrogen production, transport, storage, and distribution often fall within remit of various different rules and regulators, while others have no clear regulation.

Consenting pathways for hydrogen projects

At present in England and Wales, all projects that meet Nationally Significant Infrastructure Project (NSIP) size thresholds are assessed against a series of NPS laying out government objectives for energy infrastructure, alongside environmental and other principles. The Secretary of State for DESNZ is the decision-maker for onshore generating stations generating more than 50 megawatts (MW) in England and 350MW in Wales, and for offshore generating stations generating more than 100MW in England and more than 350MW in Wales, with applications assessed by the Planning Inspectorate’s National Infrastructure Planning Unit and permission granted via a Development Consent Order (DCO).

Smaller onshore hydrogen projects can request to be considered as an NSIP, but otherwise require planning permission under the Town and Country Planning Act 1990. These

applications are considered by the local planning authority, although in certain circumstances, the Secretary of State may seek involvement and refer an application to the Planning Inspectorate. Decisions are generally taken in accordance with each local authority's local development plan. In addition to this, some smaller projects must obtain consent under section 36 of the Electricity Act 1989, if it involves a generating station above a certain size. Larger projects that require a DCO may still need to seek TCPA planning permission for some elements of their development.

The process for seeking planning permission under either pathway is summarised in the process maps below. These maps were developed throughout the research and were discussed and iterated with input from stakeholders.

Discussions before the formal application process

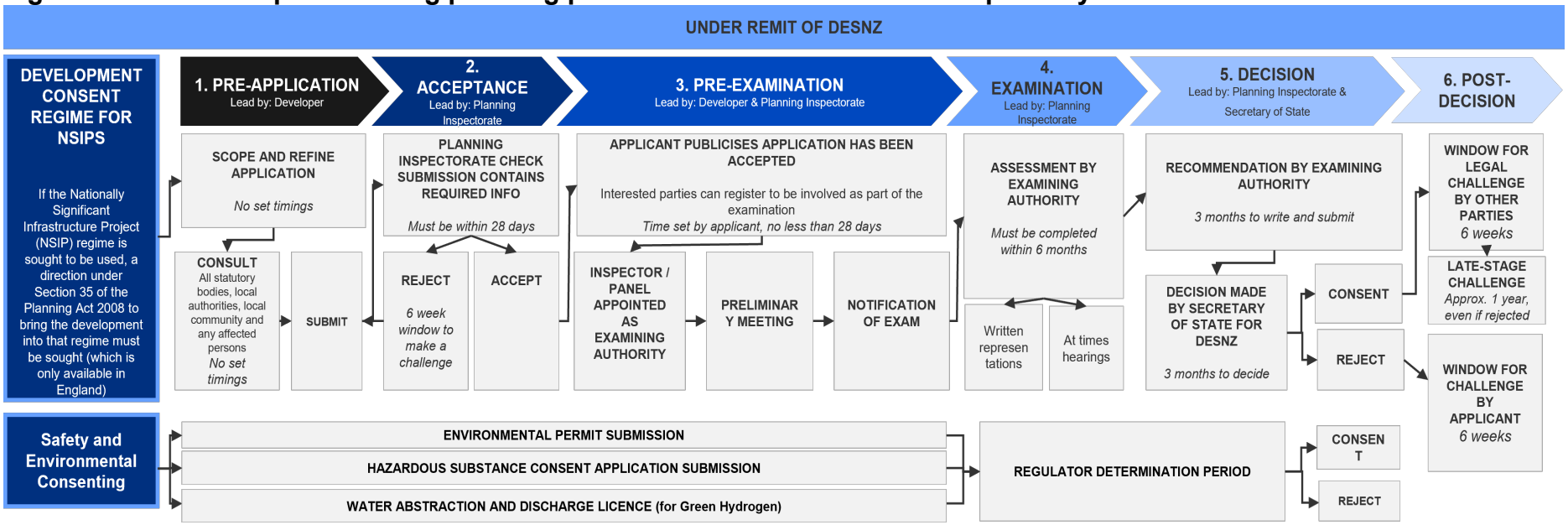
Before starting the application process outlined in the process maps below, participants highlighted the importance of more informal discussions with relevant planning authorities even earlier than the 'pre-application' phase. Early discussions were seen as most productive, ideally alongside the final site selection and the initial design processes. Developers saw this as beneficial for making the actual pre-application process and subsequent phases more efficient with early engagement (e.g., by establishing senior support from planning authorities, identifying potential issues as quickly as possible). Participants from local authorities and other statutory consultees also highlighted the benefits of early, informal engagement, particularly the benefits of understanding as early as possible when resource might be needed to review applications. This is particularly relevant when there is a risk of a 'bottleneck' of applications if many are submitted in a short timeframe. As this stage, some developers with an existing presence at or near the site also include some 'groundwork' for public engagement to start this process as soon as possible.

"Discussions before the formal application begins are essential, almost a pre-pre application phase. Ideally you would have everyone in a room together, all the stakeholders, if the time is made for it to happen." (Stakeholder interview, developer)

"We want to engage as early as we can, where it's feasible and we have the ability to do it. We want to bring projects to the area, we know the benefits it can bring locally." (Stakeholder interview, local authority)

NSIP/DCO process map

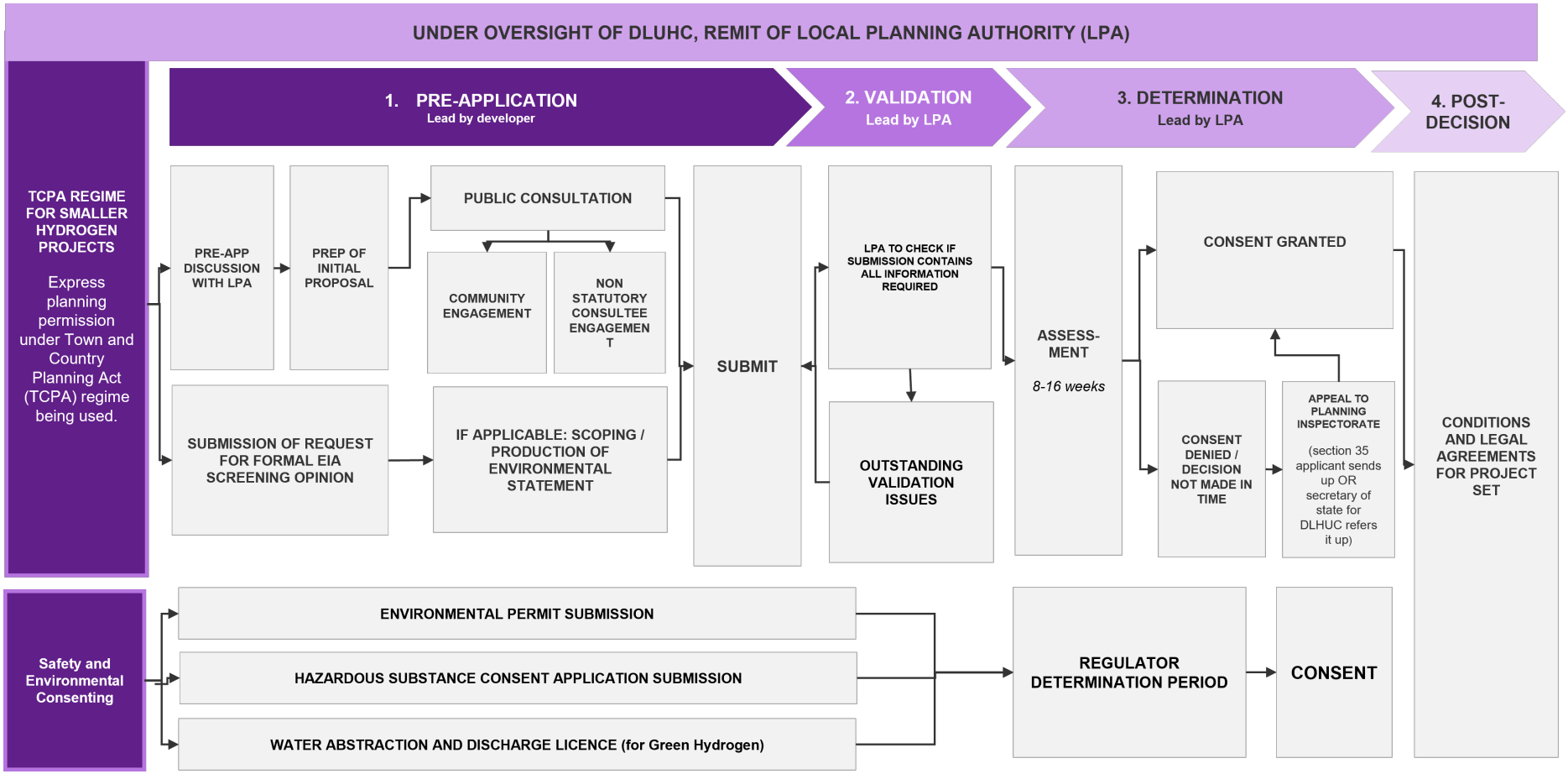
Figure 1. Process map for seeking planning permission under the NSIP/DCO pathway



Statutory timeframes are noted in italics.

NSIP/DCO process map

Figure 2. Process map for seeking planning permission under the TCPA pathway



Statutory timeframes (assessment period) are noted in italics.

Key planning legislation associated with or part of the overall planning process across England and devolved nations

Devolved nations follow a broadly similar process, with nuances in planning policy, timings, and in the bodies tasked with overseeing each step:

Table 3: summary of differences across England and devolved nations

	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
Overall Planning Policy	National Planning Policy Framework National Planning Practice Guidance	National Planning Framework 4 Scottish Planning Policy	Planning Policy Wales	Planning Policy Statements
Statutory Response Time (For LPA to provide Environmental Impact Assessment (EIA) scoping opinion)	5 weeks	8 weeks	5 weeks	30 days
Consultation Report (Included in the planning application)	Statement of Community Involvement	Pre-Application Consultation Report	Statement of Community Involvement	Pre-Application Consultation Report
Legal Agreements (Possible legally binding planning obligations with the developer)	Section 106 Agreement	Section 75 Town and Country Planning (Scotland) Act 1997	Section 106 Agreement	Article 10

Hazardous Substances Consent (Threshold 2 tonnes of hydrogen)	The Planning (Hazardous Substances) Regulations 2015	The Town and Country Planning (Hazardous Substances) (Scotland) Regulations 2015	The Planning (Hazardous Substances) (Wales) Regulations 2015	The Planning (Hazardous Substances) (No. 2) Regulations (Northern Ireland) 2015
Control of Major Accident Hazards (HSE consults but LPA decides)	Control of Major Accident Hazards Regulations 2015	Control of Major Accident Hazards Regulations 2015	Control of Major Accident Hazards Regulations 2015	Control of Major Accident Hazards Regulations (Northern Ireland) 2015
Environmental Regulator	Environment Agency	Scottish Environment Protection Agency (SEPA)	Natural Resources Wales (NRW)	Northern Ireland Environment Agency
Environmental Permitting (Hydrogen production, abstraction/treatment/discharge of waste waters are regulated activities)	Environmental Permitting Regulations 2016 (as amended)	The Pollution Prevention and Control (Scotland) Regulations 2012	Environmental Permitting Regulations 2016 (as amended)	The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 (as amended)

Discharge Consent (For Green Hydrogen projects if Environmental Permit not required)	Water Resources Act 1991	Water Environment and Water Services (Scotland) Act 2003	Water Resources Act 1991	The Water (Northern Ireland) Order 1999
Abstraction License Volume (For Green Hydrogen projects - under same acts as Discharge Consent above)	20 m3 per day	50 m3 per day	20 m3 per day	10 m3 per day
Trade Effluent Consent (For Green Hydrogen projects)	Water Industry Act 1991	Sewerage (Scotland) Act 1968 Control of Pollution Act 1974	Water Industry Act 1991	The Water and Sewerage Services (Northern Ireland) Order 2006

Projects can be split across multiple consenting regimes

Due to the multifaceted nature of some hydrogen projects, projects are likely to require multiple consents and/or permits. Participants described multiple cases of projects having to account for multiple consenting pathways in parallel instead of a single application regime, making the process challenging. Examples included:

- Combined TCPA & DCO applications, notably for pipelines. This had reportedly resulted from ambiguity and inconsistencies about what is considered permitted development within a pre-existing consent or not permitted development and therefore requiring a new permission.
- Offshore projects: onshore element must go through a TCPA process, offshore covered by marine authorities (additional fragmentation between production and pipeline elements for offshore hydrogen production).
- Projects in Scotland (no DCO process) split across local and national consenting regimes.

Case Study: Whitelee Project, Scotland

Initially presented for EIA screening under the Electricity Act as a single project, Whitelee (combined battery energy storage, solar, and hydrogen production) eventually had to be split over both local and national consenting regimes which significantly complicated progress. The site's hydrogen production element could not be determined under the Electricity Act 1989, so it was submitted under a TCPA application to East Ayrshire Council. However, as solar and battery components exceeded 50 MW, it could not be determined by the Council as part of the project. As a result, it had to be determined by the Scottish Government Energy Consents Unit.

The project is still under application – the first screening request was submitted in October 2020 and at the time of this research was waiting for a further environmental information review.

Applications for completely new sites have several additional challenges

Several developers flagged additional challenges when submitting a planning application for sites with no current development located, compared to planning applications that propose to add additional hydrogen facilities to existing sites. These challenges included the potential need for compulsory acquisition powers, a new relationship to establish with the local authority to build trust and experience working together, and potential additional challenges with a local community if there has not been previous industrial development on the site. Several participants also noted that an Environmental Impact Assessment is more likely to be required within the submission, incentivising the developer to request screening as early as possible to give more time to prepare the assessment. Early engagement was

seen as even more important in applications for completely new sites, but this can be less likely to happen due to a lack of existing relationships in place.

Non-tailored legislation adds additional complexity in planning pathways

Some stakeholders raised the issue of the Gas Act 1986 not including a category of 'licenced hydrogen producer' or similar, as hydrogen is not eligible to gain 'undertaker' status and in their case could not be considered a 'gas transporter' either. This was seen as preventing developers from gaining permitted development rights and/or compulsory acquisition powers for projects, and therefore having to acquire all land rights without these rights/powers before starting the process of seeking planning permission. This is a significant challenge for projects covering large areas and/or multiple local authorities.

Expected and current timeframes

Participants consistently viewed the planning process for hydrogen projects as slow and unpredictable

Timeframes varied enormously across the sample covered. In the experience of participants in this sample, an average project takes around 18 months to be approved under TCPA and more than 20 months under the DCO regime (in some cases taking up to 3 years for larger, more controversial projects). Long timeframes were exacerbated by unexpected delays with little warning or updates to other stakeholders (covered in more detail in the barriers section). These delays reportedly occur throughout every stage of the project process but most significantly at pre-application, before statutory timeframes are activated, and where examining bodies can delay starting the application process:

"Pre-application is probably the biggest cause of delays, because once it gets into a statutory process, they [examining bodies] are obliged to use what resources they have. Once you're in co-examination, there are statutory timelines for them to meet. Pre-app there is still the flexibility to say no, we're overwhelmed and we can't meet and we can't give you that advice." (Stakeholder interview, developer)

However, participants also consistently reported that the currently statutory timeframes are not realistic in many cases and are almost expected to slip (i.e., will be extended just before the deadline by the relevant examining body or statutory consultee). Developers have limited ways to challenge delays: legally challenging the examining authority for not delivering on time was viewed as a 'nuclear option', which could potentially damage the relationship, and delays are likely to result from significant capacity constraints which challenges would not address. When asked, stakeholders generally preferred to follow current statutory timeframes in place rather than update them to more realistic timeframes, preferring to have official deadlines acknowledged and missed rather than slipping becoming a reality.

“Even EIA screening, which should take 21 days… We’ve had examples where it’s been months just for a decision. And no heads up when the decision will be made.” (Stakeholder interview, developer)

These delays create a risk of consents expiring before projects can be brought online. For instance, the wait for grid connections was reported by some participants to be several years (long enough that planning permission would expire). This presents a sequencing issue for projects that cannot rely on timeframes for multiple steps, which would ideally happen in parallel, where the consenting process is a central pillar.

Developers must balance efficiency with sufficient detail in applications

Participants also described the challenge of requiring a level of certainty to submit the application (i.e., sufficiently detailed technical designs), but being unable to commit to detailed designs this early in the process. Design work must happen in parallel with planning permission due to timescales and commercial pressures on projects. However, if designs are not sufficiently well-developed, applications risk more delays in the determination period and/or more conditions post-consent. An additional consideration when deciding what to include in a submission is the ‘precedent’ each submission sets. Several developers highlighted that local authorities have widely varying expectations of what should be included in hydrogen project applications, partly due to lack of experience. Some voiced concerns that as precedents are set, examining bodies would start to ask for more to be submitted, making submissions larger and more resource-intensive to prepare and review.

“There is an analogy with [planning applications for] large solar sites. Early on, the first few sites developed, [and] there was huge variation in what planning applications required. This was often minimal as authorities didn't have experience, but it gradually grew and became… a bigger and bigger checklist. We want to avoid that creeping in by accident with hydrogen” – (Developer, local authority)

5. Barriers identified within the planning process

This section discusses the key barriers identified by participants in the planning process for hydrogen projects.

Potential barriers in the planning process were identified in the first phase of this project. From this point, an initial draft list of barriers was developed to explore further in stakeholder interviews. This section first outlines the barriers which were consistently raised across projects and participants, and then discusses how these barriers impact specific types of projects.

Consistent barriers could be broadly categorised into systemic and procedural barriers:

Systemic barriers were seen as arising from the wider contexts of hydrogen technology and the planning system in the UK:

- Lack of resources in local authority planning departments and other statutory consultees.
- Lack of experience with hydrogen, in local authorities, other statutory consultees, and with developers.
- Public attitudes and opposition to development generally and hydrogen specifically.
- Difficulty co-ordinating involved parties (including regulators, local authorities, and local communities) throughout the process.

Procedural barriers directly related to how legislation applies, specific to the planning process for hydrogen:

- Lack of published guidance for hydrogen planning.
- Challenges around thresholds for planning pathways and regulations.
- Lack of flexibility in the process.
- Inconsistencies across UK nations.

These barriers were seen as interrelated and complicated each other. Participants felt that distinct barriers need to be addressed in parallel, but also saw an opportunity to address multiple barriers together. Each of these barriers are discussed in further detail below.

Most barriers were not seen as unique to hydrogen projects

Participants generally considered most barriers to be broader issues with the planning system rather than unique to hydrogen projects, although some aspects of hydrogen projects impact these projects in specific ways. Lack of published guidance for hydrogen projects, lack of experience within the organisations described above, and regulatory uncertainty were all seen impacting hydrogen in unique ways. Developers also flagged that some specific characteristics of the hydrogen ecosystem in the UK also indirectly impacts

planning considerations. For instance, the small number of projects in local clusters were seen to limit resilience by making individual projects more precarious and limiting the ability to accommodate delays or unexpected costs arising from the planning process. However, most of the barriers highlighted were seen as general issues potentially exacerbated by the nature of hydrogen projects.

"Most of the problems [with the planning process] are not specific to hydrogen. Hydrogen is not inherently new, it's maybe intersecting with a flawed planning process in some new ways." (Stakeholder interview, developer)

Lack of resources

Stakeholders consistently cited overburdened and under-resourced planning teams, particularly among local authorities but also elsewhere (within the Planning Inspectorate and statutory consultees) as the most significant barrier facing hydrogen projects. While not seen as unique to hydrogen projects, the complexity and unfamiliarity of hydrogen projects was seen as a significant challenge when dealing with capable but highly resource-stressed local authorities. Lack of resource within regulatory bodies such as HSE and environmental regulators (EA, SEPA, NRW) was seen to cause significant backlogs and add to time pressures in the consultation process.

Participants acknowledged the significant challenges faced by local authorities in attracting and retaining experienced staff with knowledge of hydrogen projects, particularly in competition with more lucrative private sector job opportunities. Lack of resources was felt to impact every stage of the planning process, including several cases where participants had, at time of interview, delayed submitting an application, having been warned by the local authority that resource constraints meant they were not currently able to begin the planning pathway. Typically, these delays had lasted for several weeks, although this varied considerably (in one example the delay was reportedly up to 6 months and still not resolved). Lack of resources were seen as particularly significant when impacting the ability for developers to engage with local authorities on pre-application discussions or informal meetings which could save time / capacity further down the line.

"Resource in local authorities and statutory consultees is by far the biggest challenge we face. If I'm ranking [challenges] there's clear daylight between resourcing and anything else." (Stakeholder interview, developer)

"It's partly our own fault - we hire experienced planning officers [in industry] to work on our side, we're in competition for the same limited pool of skills and experience and it's not being topped up enough." (Stakeholder interview, developer)

Some developers within the sample had previously provided ringfenced funding to help with this resource challenge such as through Planning Performance Agreements (PPAs), and

many were aware of the ongoing consultation[5] around increasing fees for planning applications to alleviate some of this shortfall. Participants saw PPAs as a useful solution in some cases. However, some issues were flagged: stakeholders raised concerns around impartiality, and the availability of qualified experts to help even with funding provided by developers. In some cases, resource pressures were so significant that local authorities had been unable to even provide an estimate for developers of the time required in order to scope a PPA, leading to additional delays.

"We asked them [the local authority] how much time would be required and were happy to look at providing additional ringfenced funding for our application, but they weren't even able to tell us." (Stakeholder interview, developer)

The lack of resources in statutory consultees was also seen as a significant challenge, although not impacting the process as significantly as resource constraints in local authorities. In some cases, developers and regulators have reported using service-level agreements for the developer to provide ringfenced resource (e.g. Natural England and pipeline developers). However, not all statutory consultees have this facility, and, in some cases, reportedly not seeing this as appropriate. One developer gave a current example of requiring input from HSE on hazardous substances consent for a project currently in determination phase of the planning process. The response from HSE to the hazardous substances authority in question (the local authority) was delayed without explanation or indication of when the response would be provided. This meant that at the time of the fieldwork, the project had missed multiple monthly planning committees leading to an unplanned delay of several months.

It is noted that as a statutory consultee to the Hazardous Substance Consent (HSC) process, HSE undertakes the public safety risk assessment, which helps to maintain public safety assurance in the land use planning system and is central to the public acceptance of sites storing large quantities of dangerous substances. This assessment is a complex process and involves assessing the compatibility of the proposal to store quantities of hazardous substances in specific locations against the risks to the offsite population. HSE aims to deliver its statutory advice to HSA's within 13 – 26 weeks, in line with agreements with DLUCH and the Devolved Governments, and these timeframes reflect the detailed assessment work needed. The HSC assessment also enables HSE to produce a three-zone map centred around the proposed HSC site, with zones at an increasing distance from the centre representing a decreasing risk to people which are then used to advise on Town and Country Planning (Development Management) (TCPDM) applications for future development around these sites.

"We absolutely have a challenge around resourcing, we don't have the capacity to do everything local authorities and developers want us to do. I would also add, they very rarely give us a heads up of what is coming to us in the future so we can't get our ducks in a row

[5] https://www.gov.uk/government/consultations/increasing-planning-fees-and-performance-technical-consultation#:~:text=Consultation%20description,25%25%20for%20all%20other%20applications

and try and get resource allocated to it in advance, we have to be reactive." (Stakeholder interview, regulator)

This barrier was consistently flagged as the most significant for hydrogen projects across participants from developers, local authorities, and other consultees. The specific views of local authorities on this challenge are detailed later in this section.

Lack of experience with hydrogen

Participants also highlighted a lack of expertise around hydrogen within all examining bodies responsible for making recommendations and approving projects. This was seen as currently delaying decision-making, and placing more onus on developers to devote time and resources to 'educating' examining bodies on the considerations for their projects. This was particularly significant for local authorities when a hydrogen project is the first of its kind in the area (although participants thought this problem will be alleviated as the wider hydrogen industry matures and local clusters build up). As well as causing delays, a lack of understanding of the environmental impacts of hydrogen projects was felt by participants to make local authorities more cautious around the conditions imposed on consents.

"In local authority planning departments where staff are expected to make decisions ranging from private home extensions to hydrogen production developments, we are going to lack the specific knowledge needed at first; it's on developers to facilitate and provide the right information." (Stakeholder interview, local authority)

"A worry is more that the 'ask list' from local authorities will expand and expand. There needs to be clearer guidelines to give them reassurance of what they might not need to ask for, acknowledging the need for judgement on a case-by-case basis." (Stakeholder interview, developer)

Similarly, a lack of expertise around hydrogen within the external regulators was also seen to lead to slower decision-making processes, although in many cases developers considered this to be reasonable, as work to establish safety cases for new technologies would inherently take longer than for established technology.

A lack of experience within developers was also flagged as an issue by developers themselves and other stakeholder organisations. Participants felt that applicants may have less experience in making planning applications (e.g., ones involving hazardous waste), and also have less access to training which could support better planning applications.

Public attitudes and opposition

Participants consistently stressed the importance of public engagement and being open with local communities where hydrogen projects are located, and saw this as an important part of a successful planning regime. However, many participants reported that public opposition can delay consent at multiple stages of the process, in part due to lack of public

understanding around the benefits and drawbacks of hydrogen, local concerns and, at times, insufficient public consultation.

Several developers could cite time lost undertaking multiple public consultations, including tactical late legal challenges towards the end of the process, adding as much as a year to achieving consent, even if the project addresses any challenges. Public opinion was seen to be shaped around the perception that hydrogen is dangerous and unproven in comparison with other energy sources. Many participants highlighted the challenge of public opposition around hydrogen village trials in the UK. There was a perception that the public do not see the benefits of hydrogen at a national level relating to energy security and reductions of greenhouse gas emissions, and also lack understanding on how local communities would benefit from hydrogen projects in the area. More generally, several developers and other stakeholders felt that communities (or 'vocal minorities' within communities) may be against what they consider 'industrial' style developments, viewing these sites as hazardous with related transport movements, and ugly.

However, some developers did counter this with examples of hydrogen projects located in areas where disruption to local communities is minimal, and extensive public consultation was unnecessary. This was the case in projects which involved or will involve adding hydrogen usage or production to an existing facility (e.g., co-location with an established renewables site), where the footprint of the hydrogen element of a project is relatively small and located in a remote or industrial area away from housing.

"For smaller projects we might not do a pre-application, quite often we would just go straight in… We tend not to do a big public consultation event at this scale of project just because most people aren't terribly interested in them. We just don't deem it necessary." (Stakeholder interview, developer)

Developers also need to navigate providing enough detail for a local community to be aware of the details of a proposed site, in order to be transparent, while acknowledging that detail may not be possible to provide this early. One developer had addressed this by submitting a hybrid planning application for two sites:

Case study: a hybrid planning application combining a full and an outline project submission

One participant described how an industrial cluster involving hydrogen production, CCUS and transport projects had submitted a hybrid planning application under the TCPA for two plants. The hybrid application included a full submission for the first plant (phase one of the project) and an outline submission for phase two, intending to follow this with a full application for the second phase at a later stage. This was discussed in close consultation with the local authority, which had experience with hydrogen and CCUS projects, via strong collaborative relationships from a senior level

down to individual planning officers (also helped by the fact that the local authority planned to be an offtaker of hydrogen to replace diesel HGVs in their fleet).

The benefits of a hybrid planning application included giving the local community greater oversight of the eventual intention to build two plants in the future and a chance to input at an early stage, ideally (from the developer's perspective) minimising concerns and opposition when the full submission is made.

"We spoke with the planning authority and agreed would put in a hybrid application. So it's a full planning application for phase one. And an outline planning application for phase two. It gives the [local] authority and the public the chance to see what the end game would look like, even though we're only actually asking for full permission for the first plant at this time. So later on, once we've done the FEED for phase two we will lodge a full planning application for it." (Stakeholder interview)

Difficulty co-ordinating involved parties

Participants felt that due to the multifaceted nature of hydrogen projects and consenting regimes, there are several barriers which centre around the challenge of coordination and collaboration between stakeholders. Participants reported that as there is currently no country-wide hydrogen infrastructure in place, projects must resolve issues of hydrogen production, storage, distribution and end-use, and a reliable power source, all of which could be handled by different companies. In addition, planning regimes require applicants to coordinate across several different regulators and regimes which all face their own challenges (particularly resource constraints). Several developers described the impact of this as significant. This is because project development, including navigating planning pathways, must move at the pace of the 'slowest mover' with many interlocking elements. In TCPA projects, a significant part of this co-ordination has to be done by local authorities.

"Engagements with local authorities are largely about us teaching them. We're trying to shoehorn complex projects into systems that don't deal well with all these dimensions. There are so many elements to align and relying on a local authority to gather most of it may or may not be that successful. On the NSIP side you have more familiarity with complex projects and less risk of consents falling away." (Stakeholder interview, developer)

Some developers cited a lack of regional forums and organisations in between national efforts and local authorities to help coordinate efforts, although these are beginning to be established. Several participants had direct experience with the regional organisations combining local authorities, developers, end-users, and academic consortia, and described this as making significant progress in the local area which could be used as an ideal 'blueprint' for future regional forums.

Lack of published guidance for hydrogen projects

Participants highlighted the lack of hydrogen-specific guidance covering UK legislation as a significant barrier for current project applications, although there was a consistent awareness that this is being addressed and most participants expected this barrier to be alleviated in the near to medium term.

Most significantly, the lack of specific detail for hydrogen in the current NPS was highlighted as a significant gap. Being unable to refer to and cite an NPS in planning submissions and decisions was consistently seen as a significant challenge for all parties involved, and in particular was stressed as one of the most significant barriers facing local authorities. Other guidance used by local authorities to review planning applications was also described as insufficiently detailed for hydrogen projects. In particular, the National Planning Policy Framework was described as lacking detail on hydrogen. One participant working with the Planning Inspectorate also highlighted the lack of specific, nationally applicable guidance on what 'good' hydrogen development looks like: although there are principles which examining bodies can refer to (e.g., the National Infrastructure Commission's development principles), these lack specificity to hydrogen projects and are generally seen as broad, making it challenging for examining bodies and decision makers to assess priorities.

"Planning departments are having to work so much harder to make judgement calls on how existing guidance applies to a project, that adds so much to their workload and makes everything more ambiguous." (Stakeholder interview, Planning Inspectorate)

Threshold differences

Some participants reported that the threshold levels which determine the regime a project must be consented under can result in new production projects limiting their size, or being required to follow a consenting pathway, which is not ideal for the project. In some cases, developers have reported being keen to keep projects under the 50MW threshold and therefore within the TCPA regime rather than navigating the DCO planning pathway. Generally, this was determined by wanting a simpler (i.e., shorter and less costly) process for submitting applications, and some developers preferred the TCPA if they had a good working relationship with the relevant local authority already. Stakeholders highlighted the discrepancy that projects below the 50MW threshold can request to be considered under DCO regime rather than TCPA, but this does not apply in reverse. Even if by mutual consent the local authority and developer would prefer a TCPA submission without limiting capacity to below 50MW, there is currently no option for this. This has reportedly resulted in projects being designed to come just under the NSIP threshold if developers prefer to be considered under TCPA, although developers did stress that this would be just one consideration when scoping the size of a project and unlikely to be the only factor.

"While it's a rational decision for each project in isolation, cumulatively those decisions are deliberately choosing to limit capacity of hydrogen production." (Stakeholder interview, developer)

"There's a good reason there are so many 49MW projects out there. If you know you've got to do the other [DCO] permitting process, you'll design the site to be the size below it." (Stakeholder interview, developer)

Other threshold differences also have to be navigated and reportedly play a role in deciding the size of a project, but were not raised as a significant barrier. Some developers described projects having to be kept to under 5MW to receive payments under the Feed-in Tariff scheme. The size of hydrogen storage facilities was also a relevant consideration for hydrogen storage projects (discussed below).

Lack of flexibility

Several participants highlighted the lack of flexibility in DCO planning pathways, particularly in post-consent conditions. This was seen to increase the complexity of submissions with a knock-on impact on time and resources required on both the developers' and examining authorities' side.

As well as a lack of flexibility in which regime a project can go under, stakeholders also highlighted discrepancies in the amount of flexibility post-consent to make non-material amendments. Although developers can make use of the Rochdale Envelope[6], some stakeholders highlighted the lack of flexibility in the DCO process if a small amendment is needed post-consent. This was contrasted with TCPA consents which generally allow greater flexibility for non-material amendments (and even greater perceived flexibility in Scotland to discharge planning conditions).

"With the DCO, changes take a lot longer. Sometimes we have to go out and we consult, you know, just to make a very small non-material change. The facility to make a change in six weeks, 8 weeks is not there [in the DCO] where that does exist to some degree in the TCPA process." (Stakeholder interview, developer)

This has led to submissions needing to include 'worst-case scenarios' for developer flexibility, requiring additional time and resources to prepare submissions:

Case study: lack of post-consent flexibility impacting pipeline planning submissions

One participant had experience submitting a planning application for a hydrogen pipeline under the DCO pathway. The DCO was required as the pipeline crossed six local authorities, rendering it unviable under the TCPA, and also to facilitate

[6] A term derived from EIA case law which seeks to balance the need for flexibility for a development not fully defined with the ability to assess the likely significant effects of such a scheme upon the environment, and any necessary mitigation, and to set these out in an Environmental Statement. A consent must create "clearly defined parameters" within which the framework of development must take place.

compulsory purchase powers as dealing with landowners had been a challenge from the start of the project.

There was a significant perceived gap between the engineering and commercial processes required for pipeline development and the requirements for the DCO submission due to the lack of flexibility post-consent. The planned pipeline included over 1,000 crossings (roads, water etc.) but to do final designs for each crossing, an on-the-ground investigation would be needed to determine the necessary requirements. Because this was not commercially viable to undertake for every crossing before permission was granted (due to cost), the submission had to include multiple options or a 'worst case' scenario for every crossing, significantly increasing the time and resources required to prepare and review the submission and adding an additional barrier to the project.

"At the moment we have to design for two options, when we get to a river crossing we have to put in the works to undertake a micro tunnel and then the works to undertake a horizontal direction drill, so if one can't be done we have a serious option as a backup. It's creating greater concern with stakeholders and the public than we really need to in case we have to move it later on." (Stakeholder interview)

Inconsistencies across UK nations

Participants with experience on projects in multiple UK nations described how discrepancies in regimes across the UK add complexity to projects which crosses borders. This was predominantly seen as a challenge for pipelines crossing national borders. One of these complexities included the DCO process in England authorising a wider range of associated development than the Development of National Significance (DNS) process in Wales does. This means that for one pipeline spanning both nations, separate TCPA applications are required for associated developments along the portion of a pipeline in Wales but not in England.

Stakeholders with experience in multiple nations generally saw the planning processes in Scotland as more efficient and supportive of hydrogen projects. Participants felt that there are more experienced local authorities in Scotland, and also appreciated the facility to refer decisions to ministers under the Electricity Act rather than going through the DCO process to get SoS approval. In Scotland, the lack of the DCO regime and the alternative routes to passing projects 'up' for ministerial approval were generally seen as preferable to the system in England (no participants had experience developing projects in Wales and Scotland to make a comparison between the two). This process was seen as faster, more streamlined and less resource intensive to navigate. Discharging conditions was also seen as considerably easier and simpler in Scotland than in England. In Scotland, developers can discharge some conditions simply by notifying the local authority rather than having to apply for a discharge of each condition via a public process (although this was seen as more transparent than the process in Scotland).

A potential secondary barrier created by these differences is the limit on the ability of cross-learning from different projects. Although this was not flagged as a current significant barrier by participants, this may become more important in the future as the hydrogen industry develops further.

"We were all looking up at our colleagues in Scotland with envy, where they have a much more direct and efficient route to national approval in their process." (Stakeholder interview, developer)

Barriers impact different stages of the planning process

Participants felt that some barriers, including lack of resources, lack of guidance and lack of experience impact every stage of the planning process. Difficulty co-ordinating stakeholders was felt to impact the pre-application stage, hindering or preventing discussions which could save time and resources later on by aligning stakeholders early. Dedicated forums such as Hydrogen Sussex were seen as effective for alleviating this barrier to an extent. The lack of flexibility, inconsistencies between UK nations, and threshold levels were felt to be the most significant barriers at the initial design phase and when discharging post-consent decisions.

"Lack of resource impacts at every single stage of the process, all through the system there just isn't the capacity there. There are highly intelligent experienced people who we know want to help in the abstract but are so constrained." (Stakeholder interview, developer)

Barriers: variations by planning pathway

Each planning pathway was seen as having unique considerations, advantages and disadvantages which impact the barriers. Participants felt that lack of resources, lack of experience, and lack of published guidance were consistent barriers for planning across almost all hydrogen projects. Other barriers apply more to one specific pathway, and only for larger and more complex projects.

Table 4: key barriers for different planning pathways

	More relevant to TCPA	Relevant to both planning pathways	More relevant to DCO
Consistently raised across projects	N/A	Lack of resources Lack of experience with hydrogen Lack of published guidance	Threshold levels across regimes and regulations

Problematic for some, but not all projects	Public attitudes and opposition (less relevant for smaller projects)	Difficulty co-ordinating stakeholders (less relevant for smaller projects)	Lack of flexibility Inconsistencies between UK nations

Overall, seeking consent via the DCO process was felt to be clearer, as projects contributing to Net Zero/energy security are prioritised. As the NSIP process can 'roll up' a range of consents and powers that otherwise must be obtained separately, co-ordinating multiple stakeholders becomes a less significant barrier. The process is also not reliant on resource-constrained local authorities, although the additional time required to prepare submissions meant that some of the potential advantages are offset by additional burdens. On the other hand, TCPA applications are more directly impacted by resource constraints and there is greater difficulty co-ordinating stakeholders. Public attitudes and opposition was seen as a more significant issue for TCPA projects. In some cases, developers felt this could result more from local officials' fear of potential public opposition than actual objections from the community, although participants from local authorities did not share this view.

Some participants were aware of the planned consultation[7], (not open at the time of research) for reforms to the NSIP process and were tentatively optimistic towards the UK Government's clear intentions to improve the process. Some participants made reference to the policy paper on Nationally Significant Infrastructure planning[8], but at the time of research no participants felt they were familiar enough with this to discuss in depth in interviews.

There is example of government action for clear and robust processes and guidance. The government has committed to improving the process for Nationally Significant Infrastructure Projects (NSIPs) to make it better, faster, and greener. The NSIP Action Plan sets out 18 actions to achieve this, working to make the system more optimal, as raised here as an issue, while keeping communities and the environment at the heart of decision-making. One of the reform areas in the NSIP Action Plan is to improve system-wide capacity and capability, which includes developing skills and training, and extending proportionate cost recovery by the Planning Inspectorate and key statutory consultees to support effective preparation and examination of NSIPs and build resilience into the system.

Alongside this, as noted above, new drafts of the Energy NPS documents were published for consultation on 30 March 2023. References to hydrogen are now included in the

[7] Operational reforms to the Nationally Significant Infrastructure Project (NSIP) consenting process - GOV.UK (www.gov.uk)
[8] https://www.gov.uk/government/publications/nationally-significant-infrastructure-projects-nsip-reforms-action-plan/nationally-significant-infrastructure-action-plan-for-reforms-to-the-planning-process#reform-area-5-system-capability--building-a-more-diverse-and-resilient-resourcing-model

relevant NPS documents to provide additional guidance on hydrogen planning and development.

Barriers vary by type of project

Participants also described significant variation in the barriers, and resulting complications for hydrogen project, by the planned usage of hydrogen:

Hydrogen storage

Participants reported that there is a lack of clarity and guidance around what are suitable offshore reservoirs for storage for hydrogen (e.g. salt caverns, depleted oil and/or gas fields) and limited established examples to refer to in applications. The department is making progress on this and documents such as the Hydrogen Storage Business Model (HSBM) minded-to position[9] and the HSBM market engagement document will show types of H2 storage the Department deems as investable.

The size of hydrogen storage facilities was also a relevant consideration as hydrogen is a dangerous substance under three tiers of COMAH regulations (5 tonnes lower tier threshold, 50 tonnes upper tier), and as a controlled quantity under the Planning (Hazardous Substances) Regulations over 2 tonnes. Several developers described having to work out the balance of maximising outputs to increase the commercial potential of a project, while keeping under thresholds that would trigger heavier regulation and more complex planning pathways. Planning is also indirectly impacted by uncertainty around future demand for storage, including how much storage, what type, and what location is needed[10]. This makes it difficult for potential projects to submit planning applications, as there is the risk that permissions may expire before there is the requisite demand for the hydrogen.

Pipelines

Participants noted that there is still ambiguity around how hydrogen will be transported in pipelines (as liquid, or what blend of gases), although there was a consensus view that a gas blend is highly likely. This was seen as a significant uncertainty, further complicating planning submissions. Gaining Compulsory Acquisition Powers can be a significant challenge: powers must show that planning permission is in place to be used, but before gaining powers, developers can face a significant challenge to gain all the information needed to make a submission leading to a double bind (for example, landowners are reluctant to disclose certain information about the site). This makes planning permission more difficult to navigate in parallel with other requirements.

[9] https://www.gov.uk/government/consultations/proposals-for-hydrogen-transport-and-storage-business-models

[10] Publications by DESNZ in December, for example the Hydrogen Transport & Storage Networks Pathway, should provide some more information on future storage requirements.

For non-NSIP pipelines, hydrogen projects may have to seek to obtain a gas transporter license to obtain Compulsory Acquisition Powers (none of the sample for this research had direct experience of this). Pipelines can also require interrelated TCPA applications for substations and DCO applications for other elements, which must be navigated in parallel and can hold each other up if one application is delayed for any reason. There was also a reported lack of clarity over whether hydrogen production facilities fall into definition of an EIA development even if pipeline elements do, leading to uncertainty for all parties in how to properly carry out environmental assessment and decision making.

Green hydrogen production

Participants with experience of green hydrogen projects described a lack of clarity around whether green hydrogen sites can be considered “associated developments” to existing primary developments. There was a strong consensus amongst developers that in order to scale up green hydrogen production in the UK, this should be considered the case wherever possible to remove barriers related to planning. For proposed new developments, there was also ambiguity as to whether green hydrogen production facilities can be included in the same planning application as co-located renewable generation (e.g. solar or wind farms) or require separate submissions. The perceived negative impact on local water supply was also flagged as an issue, increasing the risk of public opposition and creating additional concern for local authorities, particularly without being able to refer to specific guidance on water management.

Offshore projects

Onshore and offshore elements were seen as complex in different ways, although generally the sample for this research included more relevant onshore projects. Offshore projects were seen as more challenging due to the varied additional licenses and permits required and more consultees to engage with, but the planning process itself seen was seen as less significant / complex for offshore hydrogen. This was due to less challenging requirements in engaging with local communities and local authorities. Participants noted that one of the most significant challenges for offshore projects can be the only onshore element, such as the connection station, which will often require permission under the TCPA, particularly if this is a new development rather than being added to an existing site.

Local authority views on the barriers

Local authority stakeholders broadly viewed the barriers in similar ways as other stakeholders, noting the same challenges detailed above. As with other participants, they mostly saw lack of resource and the resulting constraints on their capacity as the most significant barrier. However, participants from local authorities did stress that planning departments are used to assessing new types of projects and technologies, as a core part of their remit, and are not uncomfortable with ‘new’ technologies. Some also felt that local authorities can be blamed for challenges and delays which could have been avoided with

more up-front clarification (although these participants also acknowledged that all parties are responsible for facilitating early engagement).

Barriers were seen as easier for local authorities to address or work around in certain conditions. One local authority described subsequent applications after the first hydrogen project in an area as ‘exponentially easier’ to deal with. This is consistent with views from developers, some of whom singled out local authorities (notably in the north-west of England) who have built considerable experience and confidence with hydrogen project submissions. Relatedly, barriers can be reduced if there are good relationships with other authorities, ideally in the same region, who have dealt with a similar project and can provide informal advice and guidance. Local authorities also felt that barriers are easier to address if the authority is using the hydrogen themselves (e.g. is an off-taker using a new electrolyser to fuel a fleet) which allows planning officers to point to direct tangible benefits, and helps to facilitate senior engagement and buy-in. If the local authority has declared a climate emergency, this is also seen as useful assistance to navigate challenges/concerns, especially at the planning committee stage of hydrogen projects.

Role of Department of Levelling Up, Housing, and Communities (DLUHC)

Local authorities mentioned challenges engaging with HSE and other statutory consultees (EA, SEPA) consistently, and this was also the case in interviews with developers who were aware of this challenge. We did not hear any cases of difficulties in engaging with DLUHC directly but heard more about how local authorities felt that DLUHC could provide better guidance to them about how to review planning applications. In particular, a consistent ask was to update the National Planning Policy Framework to include more specific guidance on what planners should be requesting developers consider and include in submissions for hydrogen projects. Participants also highlighted the lack of clarity in what can and cannot be considered an ‘associated development’ within a single application. There is a perceived uncertainty about what falls under ‘associated’ in this context (more detail on this below), and whether a hydrogen production facility itself can be considered an associated development within an application e.g., if being co-located on a new green energy generation project (seen as a question for DLUHC to clarify).

6. Potential solutions to address identified barriers

This section discusses participant feedback on broad indicative solution areas to address the barriers identified previously.

With input from DESNZ and in consideration of the barriers identified, 8 potential solution areas were developed for discussions in workshops with reconvened interview participants. These discussions took place in June 2023. These solution areas were not presented as specific policy suggestions to stakeholders, but as work in progress ideas to indicate potential directions for solutions to address the barriers identified. These were used as stimulus to prompt further discussions of the role of DESNZ and improvements which could be made to the planning processes for hydrogen projects.

Eight solution areas were developed

- Case studies for local authorities
- Toolkits for pre-application discussions
- Public safety information and resources
- Training for local authorities
- Good design guidance/principles for developers
- Increasing flexibility in the DCO regime
- Opt-outs for the DCO regime
- Central support pool sitting within DESNZ

Consistent feedback across the solution areas

Detail and feedback on each specific solution area is outlined below, but there were several consistent themes which emerged from general discussions. Most importantly, there was an appetite from all participants for significant changes to the planning system, which was described as ‘not fit for purpose’ for hydrogen projects and a significant constraint on developing the hydrogen industry. As discussed below, one consistent theme in the feedback for the solution areas presented was a question whether ideas were ambitious enough to have a transformative impact on the UK hydrogen economy.

“At the moment the planning system is not fit for purpose for the scale of the challenge ahead for UK hydrogen projects.” (Stakeholder interview, developer)

There was also a strong appetite for a balance of short-term and longer-term changes: participants felt there was a pressing need to make urgent changes now for projects which will soon be in pre-application phase, but also wariness around relying on primary

legislation in order to improve the planning process due to the need to act quickly to maintain the UK's competitiveness.

"We have to adapt what we [legislation] have where possible. To create a whole new swathe of legislation for hydrogen will take a lot of time and by doing that, we lose our international competitiveness that's already slipping away to Germany and the Netherlands. We were in front and now we've lost that position because of these delays." (Stakeholder interview, developer)

Participant responses to solution areas

Table 5: Summary of responses to proposed solution areas

Suggested solution area	Barrier(s) to address	Advantages and benefits	Downsides, further considerations
A toolkit or other guidance for pre-application discussions: Develop materials and tools to save time and resources by giving more structure and rigour to pre-application discussions. This could include: hydrogen-specific guidance for developers and local authorities about what to include & not include in applications, checklists, etc.	Lack of experience and guidance, leading to uncertainty on both the developer and planner's sides of what will be required in a submission, causing potential delays and unnecessary use of resources.	Overall this was seen as a positive, practicable solution to (partially) address the barrier of lack of experience. This was seen as something that could give all parties involved more confidence to understand what may not be relevant to include in a submission, as well as what is. This could usefully include: Checklists for the examining body to ensure full understanding of the project. Checklists of issues to cover in submissions (such as noise, traffic disruption, water issues, visual impact, public consultation done already for related projects, archaeology / cultural heritage). Up-to-date lists of regulations and how to determine which apply.	Although generally this was positively received, stakeholders stressed that this guidance / checklist should not be presented as a definitive list of what should be done (to preserve some flexibility and avoiding unnecessary requirements in submissions).

		Guidance on how and where the developer can most effectively engage others (e.g. statutory bodies) in the process.	
Case studies for local authorities: Develop targeted case studies of successful (and potentially unsuccessful) planning applications for hydrogen projects which local authorities without direct experience can access, to help inform and guide the local authority's requests to developers.	Lack of experience: stakeholders from both industry and LAs flagged that the planners do not always know what to ask or raise in early pre-application discussions around what is needed (e.g. timings, which other permits are and aren't required, screening requirements etc.).	This was seen as useful in some cases, but potentially limited: To an extent this is done already by developers, who reported signposting councils to other LPAs with more/relevant experience (although this could be expanded). Case studies were seen as useful to compare similar projects with one or two key variables, or to see the real-world results of a similar decision to one they might be considering.	Individual project circumstances are so specific it would be hard to be useful with a limited case study. Once a significant number of projects have been consented, there would be a higher chance of finding relevant case studies to a new project. Other solution areas, such as guidance or a checklist for LPAs, were seen as more useful for addressing the barrier of lacking experience as these could be more widely applicable and practical.
Developing public safety information and resources: Publicly available resources and potentially campaigns around hydrogen & safety, the	Public concern around hydrogen (e.g. safety concerns, caution about disruption during construction of projects, impact on local area etc) can lead to delays and uncertainty.	Overall, this was seen as useful to address a potential long-term threat to hydrogen in the UK. Stakeholders were positive about the idea of DESNZ providing resources to support public engagement (This was not necessarily seen as public-facing materials on specific projects, but	However, stakeholders did stress that responsibility for reassuring the community for a local project must lie with the developer and local authority / other examining bodies. Some felt that hydrogen projects can 'fly under the radar' if added to an

importance of hydrogen for Net Zero. N.B. this was not presented as a replacement for public engagement with industry: all stressed importance of early public consultation and developers being able to directly engage with communities.	Reassuring communities about the safety of individual projects was seen as the responsibility of developers, but these efforts could be supported by wider central government to improve perceptions and 'normalise' hydrogen in public discourse.	guides for engagement, resources that can be taken/adapted etc). There was a clear long-term need for high-level public education campaigns about the need and benefits for hydrogen, to shape perceptions and public acceptance. This could be best framed as general education, not just solely with safety.	existing facility, and were hesitant about drawing unwanted attention.
Training for local authorities and regulators: Industry-funded training initiatives to upskill local authority planning departments around hydrogen projects. This could potentially combine with knowledge-sharing between local authorities (e.g. industry-funded visits to hydrogen	Lack of knowledge and experience around hydrogen projects in local authority planning departments (especially if the project in question is the first hydrogen project in the region); exacerbated by resource pressures, which result in a lack of time and limited opportunities to upskill.	Stakeholders could see how training programmes, particularly for local authorities, could benefit all stakeholders. This was seen as an opportunity to build on work done already. This could be used to help LPAs/regulators better understand developer perspectives and vice versa. Potentially could be developed and delivered in partnership by an organisation such as the Royal	Some questioned if developing a formal training programme is the best way to address knowledge and experience gaps. Some participants doubted if there would currently be enough demand to develop a specific training programme. Some felt that developers and other stakeholders could address this barrier more effectively and efficiently through more informal meetings, knowledge sharing, collaboration, rather than a training model which

projects in local authorities).	This leads to delays in decision making processes and developers having to answer unexpected extra queries.	Town Planning Institute (RTPI) to increase reach and relevance. Participants felt that this could encompass a broad range of formats, such as events, webinars, funded placements.	would take time to develop and implement (discussed in more detail below).
Good design guidance/principles for developers: Develop a bespoke set of 'good design principles' for developers of hydrogen projects. This could allow developers to refer specifically to how principles have been incorporated into their designs in planning applications to prevent issues surfacing later in the process.	Some stakeholders cited a lack of any formal principles for what 'good design' looks like for hydrogen projects (National Infrastructure Commission has published generic design principles[11] but these often are not applicable). This means developers may design projects without principles to guide, risking potential public / political backlash, and higher costs to alter later in the process.	While potentially useful in some cases, most participants did not see this as a solution to prioritise. Stakeholders did acknowledge there is a gap in design principles. Guidance here would potentially be useful to refer to in planning process and in public consultations, to provide reassurance that development will adhere to established principles.	There were significant challenges for how this could be done in practice, which prevented this being an appealing solution. Participants felt that due to the huge variety of hydrogen projects with so many unique considerations, guidance would either have to be hyper-specific to site types or so broad there is very limited practical definition. Alternatively, guidance could be so specific it could become prohibitive.

[11] https://nic.org.uk/app/uploads/NIC-Design-Principles.pdf

Increase the flexibility within the DCO/NSIP process, to: Allow projects to be considered under the TCPA even if above a specific threshold (if developer and LA both agree to the consideration). Bring post-consent changes more into line with non-material amendments permitted under the TCPA.	Projects can be requested to be considered under the NSIP regime rather than TCPA, but this does not apply in reverse – projects have reportedly been designed to come just under the DCO threshold, limiting capacity. Post-consent flexibility: Although developers can and do make use of the Rochdale Envelope, some stakeholders have still highlighted the lack of flexibility in the DCO process if a small amendment is needed post-consent.	Stakeholders with experience of the DCO process did feel that there are significant challenges around a lack of flexibility, and broadly agreed with these suggested changes if feasible. However, there were concerns that this would be a significant legal change to make, and therefore unlikely to help on hydrogen projects which are currently being planned. It was also seen as important that all parties agree to changes / increased flexibility, to balance the need for greater flexibility with caution around developers taking advantage of a new provision.	While this solution did have potential benefits, participants felt this was not the primary issue to address with the DCO process, and would prefer a focus on making the process more streamlined and requiring less detail in submissions, rather than piecemeal changes. If changes are made to the DCO process, these were not seen as the most important things to focus on: updating what is and isn't included as 'nationally significant' was seen as more important (updated NPS and associated development guidance).
A central support pool sitting within DESNZ: A central pool of staff, and/or fund for external consultants, sat within DESNZ which local authorities and others	Lack of resources in local authority planning departments and statutory consultees (e.g., HSE, EA) cause delays beyond statutory timeframes.	Overall, this was seen as the most helpful proposed solution area, with potential to alleviate the most significant barrier seen in the process. Participants were highly positive about the idea of DESNZ providing	While positively received overall, there are some significant practical considerations and potential risks: There is a potential risk of further exacerbating shortages of experienced staff in local authorities if local authorities are having to

could access for support on a hydrogen project application.	Each organisation reported struggling to attract and retain experienced staff with knowledge of hydrogen. While developers can provide ringfenced funding to help with this resource challenge through PPAs, many participants raised concerns around impartiality and the availability of staff even with this mechanism in place.	funding and resource to alleviate pressures. Many felt this would be seen as a signal that resource pressures are taken seriously. Participants also acknowledged that there are consultants already working in the industry but these are often inaccessible by local authorities and other consultees.	'compete' against a central support pool to attract and retain staff (considering the wider shortages of qualified experts in the industry). Some have previously seen challenges in agreements where developers provide ringfenced funding, often not feasible through a lack of experienced staff available to the LPA regardless of payment.

Expanding informal forums for discussion and knowledge sharing

As a short-term alternative to formal training, participants were also positive about the idea of informal discussion forums coordinated by DESNZ. Participants acknowledged there are examples in this area already, but these could be expanded to cover knowledge sharing across developers (where commercially possible), local authorities and other stakeholders at a national level. Participants felt that this could potentially take the form of regular meetings and 'surgery sessions' with DESNZ officials, to discuss and clarify current and upcoming policy changes. This was seen as a useful suggestion and a top priority for several stakeholders, as a short-term solution to address the challenges of a lack of guidance for hydrogen projects and general lack of experience.

"We are all interfacing with government on different levels – but they don't get into detail or involve people in government who are on the ground dealing with this – would particularly benefit from a more in-depth discussions, even regular check-ins." (Stakeholder interview, developer)

Prioritising solution areas

Overall, no single solution area was seen as transformative at addressing the barriers but there is potential to alleviate some of the barriers. The solution areas considered most positive were a central support pool sitting in DESNZ as a longer-term solution; and a toolkit for pre-application discussions and informal forums for discussion and knowledge sharing as shorter-term solutions. Solution areas around public safety information and resources, training for local authorities and statutory consultees, and increasing flexibility within the DCO pathway (including opt-outs to refer larger projects to the TCPA pathway by mutual consent) were seen as potentially useful but not immediate priorities. Case studies for local authorities and good design guidance for developers were seen as the lowest priority solution areas: other approaches were felt to better address these barriers, so these were not considered useful solutions for DESNZ to focus on.

Alternative solutions discussed in interviews and workshops included:

- Updating the energy NPS to cover hydrogen in more detail: this has emerged as a significant theme in interviews, however as there was an ongoing consultation[12] this was not included as a detailed solution area for group discussions.
- Bringing the rest of the UK in line with Scotland to allow planning conditions to be discharged more quickly. This was only discussed by participants with experience in multiple UK nations, but was seen as a highly useful change. However, as it would require significant changes through primary legislation, it was not seen as a short-term priority.
- Tighter time restrictions on local authority deadlines. Participants acknowledged that one potential solution area could be stronger incentives for local authorities to keep to timings, but flagged that this would be very difficult in practice to avoid undesirable

[12] https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-revisions-to-national-policy-statements

knock-on impacts (e.g., fining local authorities and further constraining resources for missing deadlines).

- Government departments (DESNZ or DLUHC where appropriate) taking on some pre-application work e.g., providing baseline data on sites of interest for developers where there is a strong appetite to support local clusters.
- Review & update career pathways into planning to increase resource available. This is beyond the scope of this report but was seen as highly relevant for all planning, including for hydrogen projects.

7. Summary and conclusions

Overall, participants' most significant concern with the wider planning process in the UK was the level of complexity and therefore the time and resources required to prepare and navigate the process, combined with significant resource constraints in examining bodies and other statutory consultees. This was seen as a wider problem with planning in the UK but specifically impacting hydrogen projects in several ways.

The most important barriers for hydrogen projects, consistently highlighted by stakeholders from the range of organisations covered in the research, were a lack of specific policy guidance for hydrogen, and resource challenges facing local authorities and consultees.

Lack of published guidance is a significant current barrier. However, many stakeholders expected that this would be addressed in the updated NPS when the consultation is published, and when the NPPF is updated. This research has shown there is a need to ensure new guidance is easy to put in practice, meaning there is a potential role for DESNZ to help developers, examining bodies and other stakeholders 'translate' the guidance for use in specific cases. This was consistently cited as a significant barrier across almost all projects discussed in the research.

Lack of resource was also frequently raised as a significant barrier across almost all hydrogen projects discussed in the research, resulting in considerable project delays and increased costs. Lack of resource was also felt to cut across and exacerbate most of the other barriers identified in this research. In this context, participants suggested that other solutions can alleviate but don't fundamentally address the most important barrier of a shortage of qualified experts available to review and approve submissions.

Participants felt that some of the potential solutions discussed in this research could at least partly alleviate resource pressures, by making the process more efficient. In particular, participants thought that:

- Toolkits for pre-application discussions could underline the importance of early engagement to making the planning process more efficient, by reducing the risk of unexpected additions or challenges later in the process. These could also strengthen relationships between different parties, and give local authorities more reassurance on what may and may not need to be considered in order to streamline and simplify the application.
- Informal forums for discussion and knowledge sharing could alleviate resource pressures by allowing local authorities with limited experience to leverage the experience of others and tap into informal support where needed.
- In the longer term, a central support pool potentially sitting within DESNZ could further alleviate pressures on local authorities and other consultees by increasing their capacity to advise on and review submissions. However, it is worth noting that some participants also considered this a 'sticking plaster' and an ideal solution would be local authorities

and regulators with sufficient funding to access this capacity themselves (in-house or through hiring consultants) rather than relying on central support to facilitate this.

- Changes to the DCO regime and addressing public concerns could also help address barriers, although these do not fundamentally address the most crucial systemic challenge in the planning process identified by participants.
- Allow developments to ‘opt-out’ of the DCO (where appropriate and by mutual agreement with the relevant local authority) could help to reduce the reported ‘49MW’ ceiling on hydrogen projects.

Public safety information and resources were seen as an important activity for UK Government at a broader national level, but less relevant for developers and examining bodies for individual hydrogen projects to consider. Most participants felt there was a clear long-term need for high-level public education campaigns about the need and benefits for hydrogen, to shape perceptions and public acceptance.

The barriers around a lack of experience in local authorities and difficulties co-ordinating was seen as being likely to improve as the hydrogen ecosystem develops, and there are potential solutions to help address this. A training programme for local authorities, regulators and other relevant stakeholders was an interesting longer-term solution to address knowledge gaps, potentially in combination with an industry association or the RTPI. However, some questioned if developing a formal training programme is the best way to address knowledge and experience gaps, and considering the urgent need for changes to improve the planning process for hydrogen projects, did not consider this a priority.

Overall, there was a considerable appetite among participants from the entire range of organisations covered in the research for ambitious changes to the planning process for hydrogen projects and many felt that changes are highly necessary for the UK’s nascent hydrogen industry to remain competitive.

Annex 1: Full sample

To protect participants confidentiality, the organisation names have been removed from the below sample list. Please note that 'category' includes participants' past experience with planning processes as well as projects related to their current role.

Table 6: Full sample achieved

Type of organisation	Category (including past experience)	Attended reconvened workshops
Developer	Production Storage	
Developer	Production Storage Transport	YES
Developer	Production	
Developer	Production Transport	YES
Developer	Production Storage Transport	
Developer	Production Transport	
Developer	Production	
Developer	Production Storage Transport	
Developer	Transport	
Local Authority	Local Authority	
Local Authority	Local Authority	
Developer	Production	YES
Developer	Transport	
Developer	Production	

Developer	Production	YES
Developer	Industry association	
Developer	Production	
Developer	Transport Storage	YES
Developer	Undetermined at time of interview	
Developer	Production	
Developer	Production	
Developer	Production Transport	YES
Developer	Production Storage Transport	
Developer	Production	
Developer	Production	YES

Annex 2: List of sources for adjacent country review

Table 7: List of sources for the adjacent country review

Title	Author	Link	Country(ies)
Contrasting European Hydrogen pathways: An analysis of differing approaches in key markets	Institute of Energy Economics at University of Cologne The Oxford Institute for Energy Studies	https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2021/03/Contrasting-European-hydrogen-pathways-An-analysis-of-differing-approaches-in-key-markets-NG166.pdf	France, Germany Italy, Netherlands, Spain, United Kingdom,
Facing the Future of Hydrogen: An international Guide	CMS Law	https://cms.law/en/media/expert-guides/files-for-expert-guides/the-promise-of-hydrogen-an-international-guide	International
Communication from the commission to the European Parliament, the council, the European Economic and Social Committee and the Committee of the Regions. A hydrogen strategy for a climate-neutral Europe	European Commission	https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0301&from=EN	EU
Energy systems integration >Hydrogen	European Commission	https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen_en	EU
REPowerEU: A plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition	European Commission	https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131	EU
Fit for 55 package	European Council. Council of the European Union	https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/#:~:text=The%20European%20climate%20law	EU

		%20makes,EU%20climate%2Dneutral%20by%202050	
Hydrogen Law, Regulations & Strategy in Germany	CMS law	https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/germany	Germany
Germany Hydrogen Grid Infrastructure Development	International Trade Administration	https://www.trade.gov/market-intelligence/germany-hydrogen-grid-infrastructure-development	Germany
Comparative analysis on similarities and differences of hydrogen energy development in the World's top 4 largest economies: A novel framework	Pingkuo, Xue 2022.	https://www.sciencedirect.com/science/article/pii/S0360319922000659	China, US, Japan, Germany
Hydrogen Action Plan Germany 2021-2025	National Hydrogen Council	https://www.wasserstoffrat.de/fileadmin/wasserstoffrat/media/Dokumente/EN/2021-07-02_NWR-Hydrogen_Action_Plan.pdf	Germany
The Netherlands: Fuelling a Green Hydrogen Future	Hydrogen Central	https://hydrogen-central.com/the-netherlands-fueling-a-green-hydrogen-future/	Netherlands
Hydrogen roadmap for the Netherlands	Dutch National Hydrogen Programme (NWP)	https://nationaalwaterstofprogramma.nl/documenten/handlerdownloadfiles.ashx?idnv=2379389	Netherlands
Hydrogen Strategy for Canada. Seizing the Opportunities for Hydrogen. A call to Action	Government of Canada	https://natural-resources.canada.ca/sites/nrcan/files/environment/hydrogen/NRCan_Hydrogen-Strategy-Canada-na-en-v3.pdf	Canada

Hydrogen Delivery. Hydrogen and Fuel Cell Technologies Office.	Office of Energy Efficiency & Renewable Energy	https://www.energy.gov/eere/fuelcells/hydrogen-delivery#:~:text=Infrastructure%20includes%20the%20pipelines%2C%20liquefaction,the%20process%20of%20delivering%20fuel	Canada
Hydrogen Roadmap: Policy, Regulation, and Prospect for Future Developments in Alberta	Fitch, Barbero, Wasylenchuk	https://albertalawreview.com/index.php/ALR/article/view/2726	Alberta, Canada
HyLAW National Policy Paper - Germany	HyLAW 2018	https://www.hylaw.eu/files/2018-12/20181217_National%20Policy%20Paper%20DE%20en%20Final_0.pdf	Germany
HyLAW National Policy Paper - Netherlands	HyLAW 2018	https://www.hylaw.eu/files/2019-03/HyLAW_National%20Policy%20Paper_Netherlands.pdf	Netherlands
HyLAW - EU Policy Paper HyLAW – EU regulations and directives which impact the deployment of FCH technologies	HyLAW 2019	https://www.hylaw.eu/files/2019-06/EU%20Policy%20Paper%20%28June%202019%29.pdf https://www.hylaw.eu/files/2019-02/D4.4%20-%20EU%20regulations%20and%20directives%20which%20impact%20the%20deployment%20of%20FCH%20technologies_0.pdf	EU
HyLAW – Cross-country Comparison	HyLAW 2018	https://www.hylaw.eu/files/2018-11/D.4.1%20-%20Analysis%20of%20commonalities%20and%20differ	Cross-country – EU & UK

		ences%20between%20countries.pdf	
Hydrogen Knowledge Base	NWP	https://nationaalwaterstofprogramma.nl/kennisbank/default.aspx	Netherlands
RVO Netherland Hydrogen	RVO – Government of the Netherlands	https://www.rvo.nl/onderwerpen/waterstof https://mijn.rvo.nl/home	Netherlands
Natural Resources Canada Energy Sources & Distribution	Government of Canada	https://natural-resources.canada.ca/our-natural-resources/energy-sources-distribution/clean-fuels/24736	Canada
Impact Assessment Agency of Canada	Government of Canada	https://www.canada.ca/en/impact-assessment-agency.html	Canada
Canada Infrastructure Bank	Canada Infrastructure Bank	https://cib-bic.ca/	Canada
Canada Hydrogen and Fuel Cell Association documents	CHFCA	https://www.chfca.ca/	Canada

Annex 3: Interview discussion guides

The interview structure is summarised below. These interview guides, were used flexibility throughout the semi-structured interviews, following relevant themes and topics as they arrived.

Table 8: Interview discussion guide schedule

Topic area	Time (approx.)
Introduction & context	10 minutes
Experience with planning process (general and specific to Hydrogen)	10 minutes
Review of the planning process: walkthrough process map, map barriers	20 minutes
Solutions mapping & prioritisation	15 minutes
International comparisons (where relevant)	*5 minutes
Wrap up	

Introduction and context (10 minutes)

MODERATOR INTRODUCTION

- Introduce the session
- Introduce moderator and Kantar Public
- Research is being conducted on behalf of DESNZ
- Aim of the discussion is to discuss the planning process for hydrogen projects in the UK, any barriers and potential solutions
- Interview length – 60 minutes
- Research is voluntary – free to pause or end at any time
- Any questions?
- Recording

Ask participant for permission to record, then start recording and confirm consent [Note: Kantar shall ensure that recordings of groups or depth interview responses are only conducted with consent and only used for the purposes for which the consent was given].

PARTICIPANT INTRODUCTION

- Ask participant to introduce themselves & their organisation:
- Participant to introduce themselves: name & role
- Key responsibilities in their role
- How their role engages with / influences planning processes
- Organisational context: strategic objectives around hydrogen, current involvement in hydrogen projects
- Within hydrogen projects, establish what type of hydrogen (green/blue/etc); which areas of hydrogen industry are they involved in (supply / storage / transport / end use), do they/the organisation work across multiple types of project

Experience with the planning process (10 minutes)

To understand the participants' personal experience dealing with planning processes for hydrogen projects, to contextualise findings in later sections.

Moderator to explain in each interview: we understand that there are financial or strategic challenges - and the government is separately working on developing a regulatory and policy context to address these - but in this work we are focused specifically on the process of acquiring planning permission. Given limited time we are keen to keep this interview focused on the planning process as far as possible.

If participants' relevant experience is specific to hydrogen projects only, skip this and move to the next section.

- Explore the participant's experience with the planning process for infrastructure projects
- Listen for:
- Types of infrastructure/technology area worked on other than hydrogen
- Size and scale of these projects
- Which planning regimes these were under
- Outcomes of planning applications
- Other relevant regulations covered by their application
- Does the participant have any experience with international planning regimes (if not, can spend longer on sections 4&5 and light touch final section)

EXPERIENCE WITH THE PLANNING PROCESS FOR HYDROGEN PROJECTS

Throughout this section, moderator to note any current challenges and barriers mentioned spontaneously to return to and explore in the next section.

- Explore the participant's experience with the planning process for hydrogen projects
- Talk through examples from their experience (past or current), probe to understand:
- Current stage this project is at

- Type and scale of project
- Location (including as relevant which nations within the UK: explore what impact this has/had on the process if relevant)
- Timeframes for the planning application
- Ultimate decision reached or expected (and reason for this)
- Note and explore if not mentioned: which planning regime? NSIP vs TCPA vs any other – focus on relevant regime for stimulus in next section accordingly
- Explore different roles within the planning process:
- What was the participants' own role and their team's role in the process
- Which other parties were involved in the application (developers, regulators, consultees, other parties), when were they involved
- Who was responsible for different stages of the planning application
- Any other stakeholders in the project
- How, if at all, this might change for future projects?
- Any future hydrogen projects the organisation is likely to be involved with, how would they expect this process to be different

Barriers in the hydrogen planning processes (20 minutes)

To understand barriers in the current hydrogen planning process, using the process map and findings from stage 1 as prompts (and building on these where relevant)

UNPROMPTED EXPLORATION OF BARRIERS

- Recap challenges and barriers already mentioned, and discuss any others
- What was/were the barriers they/their organisation faced
- What stage of the process did this occur
- What impact did this have
- What did they have to do/are having to do because of this
- What, if anything, would help with this (Note to explore later in solutions discussion)
- For those who have worked on other kinds of projects: which of these challenges are common/unique to hydrogen projects?
- For those who have worked on projects across multiple nations within the UK: how does this vary across projects in England/Scotland/Wales/Northern Ireland?
- At what stage of the process, if anywhere, are there particular challenges?
- Prompt with whether they faced any barriers prior to starting the planning process, exploring their perceptions of the difficulty, effort, and success rate of the process
- Note responses to return to with the process map later in this section.

PROCESS MAP WALKTHROUGH

Moderator note: Participants were sent the process map drafts in advance of the interviews so may have already seen and engaged with them, ask if they have had time to look at them already and if so only show, explain more briefly and ask of there is a need for any clarifications before moving onto the review of the process.

Moderator to explain: as part of this research, we are currently developing a process map of the different stages and parties involved in hydrogen project planning processes. This map is a work in progress which is being developed and refined through the research, as there is nothing centrally collated at the moment.

Moderator to show and explain both process maps (NSIP and TCPA) – stimulus slides 2-5, refer to whichever regime the participant has more experience with for this discussion. Show detailed map (slide 3/5) on-screen for enough time to allow participant to review and take in. If time, cover the other process map briefly to capture any knowledge they have of this process.

- Review and explore the current process map(s)
- At a glance – is this map accurate for the processes they have been through
- Were any of these stages / boxes not included or not relevant to projects in their own experience
- Is anything missing/inaccurate
- Could they provide an estimate of the time taken – for each stage as well as the process as a whole (for both the NSIP and TCPA regime if they have experience of both)
- Does their organisation have anything similar to this
- If so, would they be happy to share with DESNZ for the purpose of this research?
- Clarify the role of other regulators in the process from their experience
- Moderator to show slide 6 on screen – role of environmental & safety consenting regimes
- What was the role of HSE/EA in their projects (was involvement separate to planning process, or were they involved e.g. as statutory consultees in planning application)
- If contributed to the planning process: how did your organisation work with them
- Are there any additional permits or consents that you needed to apply for
- Note specifics – name, regulator, time taken, why it was needed
- Note whether this varies depending on the type of hydrogen (green/blue) or stage in the value chain (production, transport, storage, end-use)
- Note – listen out for mentions of decommissioning regulations, relevant to offshore (led by OPRED) or onshore (led by local authority) transport and storage hydrogen projects. Explore familiarity, considerations, how it relates to the planning process.
- Listen for any challenges/barriers specifically relating to working with (other) regulators

- Explore in depth any mentions of specific types of regulations that have been a challenge for them
- If none within their own projects, prompt with whether they have heard of challenges/barriers experienced by other operators' within their field

MAPPING BARRIERS USING PROCESS MAP

- Walk through application process to pinpoint barriers at each stage
- Moderator to show slide simplified process map on-screen again
- Thinking of the different stages of the process:
- What are the key barriers at this stage of the process – any mentioned already, any new barriers prompted by the map
- For new barriers: what caused this, who/what was responsible for this barrier
- What impact did this have (including knock-on impact for other stages of the planning process)
- What actions had to be taken to rectify it
- If time, prompt with whether they have heard of any other specific challenges/barriers experienced by other operators' within their field
- What could be done in future to improve this? (note to recap in next section)
- Overall, where in the process are the barriers most significant?
- Which, if any, stages of the process are particularly 'smooth'
- Which, if any, are most problematic
- Where are the key bottlenecks in a planning application and what causes these
- Spontaneous first then prompt: resource pressures, input needed from multiple directions, lack of clarity who is responsible, anything else
- Ask them to comment based on their own experience but also what they have heard from other operators' within their field

PROMPTED REVIEW – LIST OF BARRIERS

Moderator to show slide 7 on screen, explain that this is a list of barriers identified in a previous stage of the research. (Moderator can refer to but do not show slide 10 with additional detail on barriers if requested by the participant).

- How well does this list describe the barriers faced in planning applications for hydrogen projects?
- Explore list of barriers: thoughts on each, how much this applies in their experience
- Is anything missing from this list (Add on to slide if so)

- Which if any are more/less relevant in their experience
- Which are more/less significant (cause major delays/friction)
- Explore with reference to previous (non-hydrogen) experience: how much are these unique barriers for hydrogen projects, versus true of other projects in their experience, How & where does hydrogen present unique challenges

Solutions – ideation, mapping & prioritisation (15 minutes)

To explore potential solutions to barriers identified in the previous section, map where in the planning process interventions could be targeted, conduct a prioritisation exercise.

SOLUTIONS FOR BARRIERS IN THE CURRENT PROCESS

Moderator to explain: we will now talk more about some potential solutions to these barriers we've identified. First of all we will focus on solutions which could help you work with the current planning processes, then we will talk about how these processes could change to tackle barriers.

- [Unprompted] In the participant's experience, what solutions could there be to these barriers?
- Recap any solutions mentioned so far and explore further: how could these work in practice, where in the process could this be implemented?
- Are they aware of solutions to these types of barriers from other industries, jurisdictions, technology areas, etc?

Moderator to show slide 8 on-screen and explain this is a list of some potential solutions which emerged from a previous stage of research.

- How do they feel about these potential solutions to the barriers faced in planning applications for hydrogen projects?
- Explore list of solutions: thoughts on each, how much this applies in their experience
- Is anything missing from this list (add on to slide if so)
- Which if any are more/less relevant in their experience
- Which have higher/lower potential for impact:
- Explore with reference to previous (non-hydrogen) experience: have they seen examples of these solutions in other projects in their experience? How could these be adapted for hydrogen projects
- Explore what these solutions would look like in practice:
- Explore in general, how these solutions would ideally be implemented, who by?
- Solution-specific probes:
- Improved guidance: what could guidance focus on, what format, how should this be developed and accessed? Moderator note – a key focus for the research so explore this in as much detail as possible.
- Education and training: who would receive and deliver this education/training? What specifically should be covered, what formats are ideal?
- Public persuasion: who would develop and deliver campaigns around this? Who are the ideal 'messenger' organisation(s) for this?

- Better collaboration: what would this look like in practice? Who are the ‘lead’ organisations/individuals on partnerships or collaborations?

MAPPING SOLUTIONS AND CHANGES TO THE CURRENT PROCESS

Moderator to return to simplified process map on screen.

- Where in the process would these solutions be most effectively implemented?
- What else could change about the planning process, to tackle the barriers we have discussed?
- What should change, what would the impact of these changes be
- What should not change Exercise for participants to rank barriers/solutions in importance and explore rationale “Like this”

International comparisons (5 minutes*)

To explore any participant suggestions for any other countries implementing good practices or innovative approaches.

*Length of time spent on this section will be flexed up/down according to the level of experience and familiarity each participant has of hydrogen planning regimes in other countries, which will be identified in the context discussion in the first & second sections.

- Compare planning regimes for hydrogen projects in the UK versus other countries
- Explore any participant suggestions for any other countries implementing good practices or innovative approaches
- Which countries could the UK learn from, if any
- How the UK compares to other countries in their experience
- Which specific barriers & solutions are most relevant to learn from

Wrap up

Collect any final thoughts and bring the session to a close.

If short of time – prioritise first question.

- We would like to invite some of the participants from this research to a follow-up discussion in a few weeks time, to continue this conversation and further develop the ideas that have emerged from this current stage.
- Would you be happy to take part in another discussion?
- If yes: are you happy for us to contact you again, by email, to arrange this?
- Ensure verbal consent – and pass on to project co-ordinator after interview
- Of everything discussed, what is the most important thing that could improve the planning process for hydrogen projects.

- Is there anything else relevant to this discussion/for DESNZ that hasn’t currently been covered?
- Thank & close session

This publication is available from: www.gov.uk/government/publications/hydrogen-projects-planning-barriers-and-solutions

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