NESO
National Energy System Operator

Hydrogen Market

Market design overview developed by NESO Whole Energy Markets Team

June 2025

Market design guidebook developed by NESO Whole Energy Markets Team

Market design overview:

We have developed market design guidebooks to outline the current market structure and existing policy across each vector. They reflect our deconstruction of holistic market design into its principal component parts, in order to comprehensively represent the status quo design for each vector. This was our first step towards a comparison of holistic market design across the five vectors in our scope to explore opportunities for greater coordination across energy markets. For the avoidance of doubt, the guidebooks' purpose is to depict existing market design and policy, rather than to recommend future changes.

We intend for these vector guidebooks to serve as a point of reference for participants across the energy industry, to share understanding of how markets are structured and outline the latest policy developments as of publication date Q2 2025.

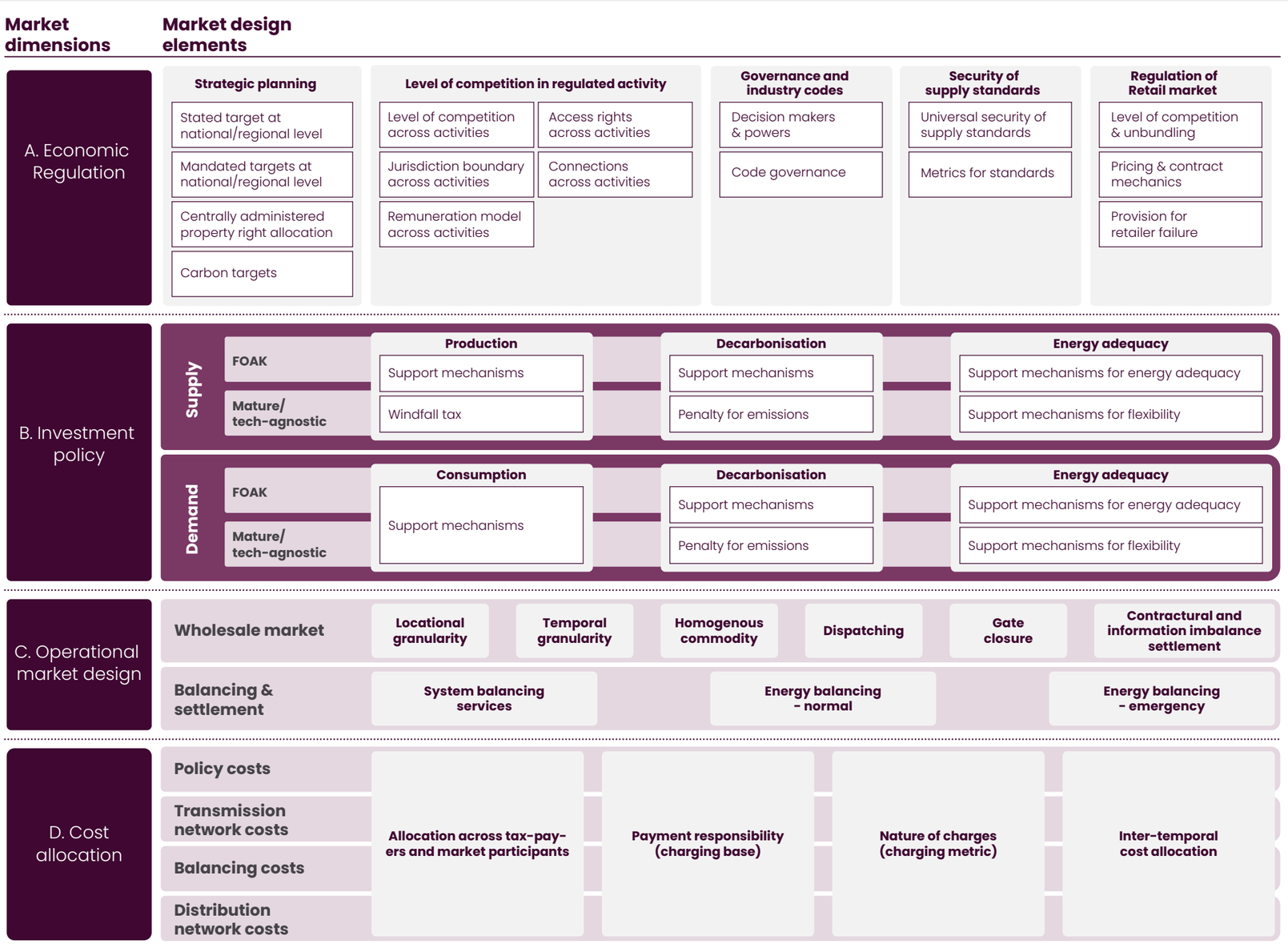
Our Market Design framework is made up of four key dimensions as set out below, and this framework forms the structure of each market design guidebook:

A. Economic Regulation: Structure of the energy market across vectors, value chains and market participants

B. Investment policy: Market interventions employed to achieve specific policy objectives

C. Operational market design: The structure of wholesale and short-term operational energy markets to match physical supply and demand

D. Cost allocation: Cost recovery for networks and investment policy.



Contents

A. Economic Regulation: Structuring of the energy market across vectors, value chains and market participants

Strategic planning:
Level of government intervention in planning of infrastructure, further specified through the existence of regional & national, capacity or production targets, carbon targets, & centrally administered property right allocation.

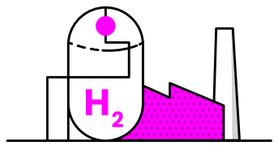
There are a variety of different hydrogen products with different emission benefits. To provide an indication of hydrogen products from most to least emissions as a high-level guide, please see below:

High carbon	**Brown**	Gasification of coal to generate hydrogen
	Grey	Steam reformation of natural cas to generate hydrogen
Low carbon	**Blue**	Steam reformation of natural gas to generate hydrogen with the added process of carbon capture, usage and storage
	Turquoise	Natural gas pyrolysis to generate hydrogen with solid carbon by-product
	Pink	Hydrogen generation powered by nuclear, such as electrolysis (separating water into oxygen and hydrogen) powered by nuclear energy. Nuclear-produced hydrogen can also be referred to as purple or red hydrogen depending on the process
Zero carbon	**Yellow**	Electrolysis powered by solar energy
	Green	Electrolysis powered by wind/hydro energy
Negative carbon	**Bio-Energy with Carbon Capture and Storage (BECCS)**	Gasification of biomass to generate hydrogen, with added process of carbon capture, usage and storage

Brief history of Hydrogen in the UK

In the 1970s, hydrogen infrastructure in Teeside was initiated to support chemical processes. The hydrogen production facility was developed primarily for ammonia production, which is a key component in fertilisers. Teeside has continued to develop its hydrogen production, with projects such as H_2Teeside aiming to develop blue hydrogen production.

The Climate Change Committee (CCC) report on hydrogen in a low carbon economy (2018) assessed the potential role of hydrogen in the UK's low carbon economy. Key recommendations included that significant volumes of low carbon hydrogen should be produced in a carbon capture and storage (CCS) cluster by 2030 to help the industry grow, and hydrogen could complement electrification and replace natural gas as a back up to help reduce emissions.



The ten point plan for a green industrial revolution (2020): The previous government published the Prime Minister's Ten Point Plan which laid out ambitions to drive innovation, boost export opportunities, and generate green jobs. This plan included the ambition to develop 5GW of low-carbon hydrogen production capacity by 2030.

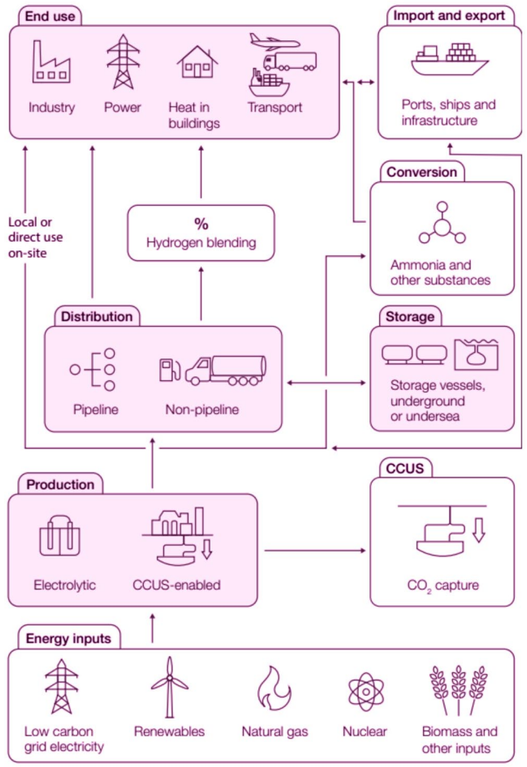
UK Hydrogen Strategy (2021): The previous government's strategy reiterated the ambition is for 5GW of low carbon hydrogen production capacity by 2030 for use across the economy, and set out how to drive progress in the 2020s. The current governments latest Hydrogen Strategy Update to Market (2024) is discussed in the next section.

British Energy Security Strategy (2022): The previous government doubled previous hydrogen production ambitions to up to 10GW by 2030, with at least half coming from electrolytic hydrogen.

Hydrogen Production Delivery Roadmap (2023): The previous government developed a roadmap to set out how government expected the hydrogen production landscape to evolve towards 2035, including hydrogen support mechanisms and ambitions.

UK Hydrogen Strategy, the Hydrogen value chain

DESNZ 2021



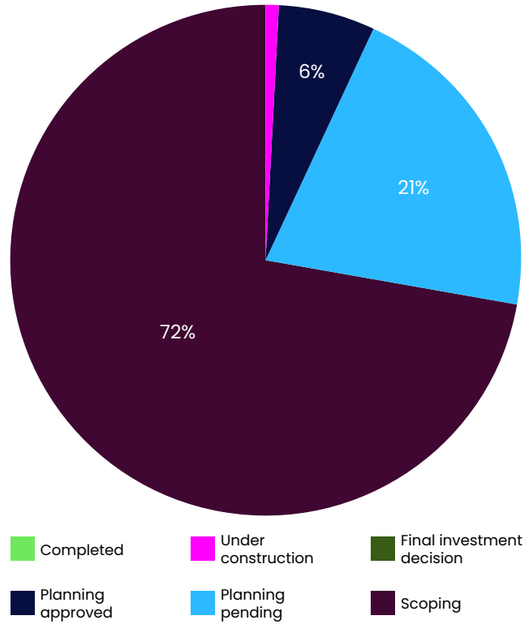
Government national stated production targets by technology

The previous government set ambitions for hydrogen production as part of its strategy to transition to a low-carbon economy:

- By 2025: Ambition to have 1GW of green (electrolytic) hydrogen and up to 1GW of blue (Carbon Capture Usage and Storage (CCUS) enabled) hydrogen either in construction or operational by this time. This target was intended to kickstart the UK's hydrogen economy and establish the foundation for larger scale production
- By 2030: Ambition to have up to 10GW of low-carbon hydrogen production capacity, with at least half of this coming from electrolytic hydrogen. This ambition was subject to considerations of affordability and value for money.
- The most recent Hydrogen Strategy update to the market (2024) confirms the commitment to support hydrogen production, including the aim to publish a shortlist of Hydrogen Allocation Round 2 projects in due course and work towards final investment decisions through the Carbon Capture, Utilisation and Storage Cluster Sequencing Process.

The current status of hydrogen production projects in the UK is illustrated below:

New low-carbon hydrogen production projects by development stage, NESO Future Energy Scenarios 2024



Government regional mandated targets

Currently no regional mandated hydrogen targets exist.

However, the government is continuing to develop their approach to strategic planning for hydrogen transport and storage infrastructure as a priority to help identify and prioritise early strategically significant projects.

As part of the responsibilities of NESO, it will develop the Strategic Special Energy Plan (SSEP) to show projected optimal locations for future energy generation and storage, including hydrogen. The SSEP will be supported through regional energy plans produced by Regional Energy Strategic Planners (RESP).

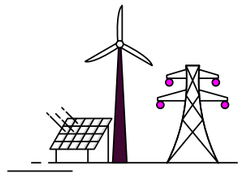
Centrally administered property right allocation

Onshore, there is no central authority that is envisaged for issuing property rights for hydrogen project sites, making land rights acquisition a matter of private negotiation. Major hydrogen projects will likely be considered nationally significant infrastructure projects, necessitating a development consent order under the Planning Act 2008. Smaller hydrogen projects or pipelines may require planning permission through the Town and Country Planning Act 1990. Additionally, hydrogen pipelines, production and storage projects may require an Environmental Impact Assessment, as per the Town and Country Planning (Environmental Impact Assessment) Regulations 2017.

Carbon targets

Currently no direct carbon targets have been set for hydrogen. However, indirect carbon targets exist:

- The Climate Change Act which legally sets targets to achieve net zero in UK by 2050
- Carbon targets across other energy vectors can indirectly influence carbon targets within hydrogen production. For example, the Government's Clean Power by 2030 Action Plan could be supported through the deployment of hydrogen to power. To support the Government's Clean Power by 2030 Action Plan, NESO developed advice on achieving Clean Power by 2030. This included outlining pathways for how Great Britain can reach a clean power system by 2030. The advice included that new dispatchable low carbon technologies, such as using hydrogen dispatchable generation could add significant value to the system. One of the pathways includes new dispatchable plants (totalling 2.7 GW) that could be fulfilled by hydrogen dispatchable generation.



Level of competition in regulated market

Regulated level of competition & unbundling for activities such as transmission, distribution, interconnections, terminals, permanent storage (sequestration), system operations

Transmission network and system operation

There is currently no established hydrogen transmission network in the UK.

The previous government agreed in principle with the strategic case for a core hydrogen network in operation no later than 2035, as recommended by the National Infrastructure Commission (NIC) in 2023.

The latest Hydrogen Strategy update to the market (2024) confirm that 'hydrogen transport and storage infrastructure will be vital to connect producers with consumers of hydrogen and to balance misalignment in supply and demand, and that it will be critical to enable our hydrogen ambitions and to reach our Clean Energy Superpower and Growth Missions, by creating a world-leading hydrogen network across the UK. '

The 2024 Hydrogen Strategy update also includes the Government's aim to publish details for the first rounds of the Hydrogen Transport Business Model and the Hydrogen Storage Business Model in 2025.

Distribution network and system operation

There is currently no established hydrogen distribution network in the UK or distribution network market design framework.

Especially relevant to the potential development of hydrogen distribution networks, the latest Hydrogen Strategy update to the market (2024) includes further clarity on decarbonising home heating, outlining the attention to assess the latest evidence before consulting in 2025 on the role of hydrogen in home heating.

Further key points to note on hydrogen for heat include the previous government's decision not to progress work on a hydrogen town pilot until after 2026, but the continued progression of the hydrogen neighbourhood trial in Fife will demonstrate the feasibility of using hydrogen in a residential neighbourhood setting.

Network remuneration model

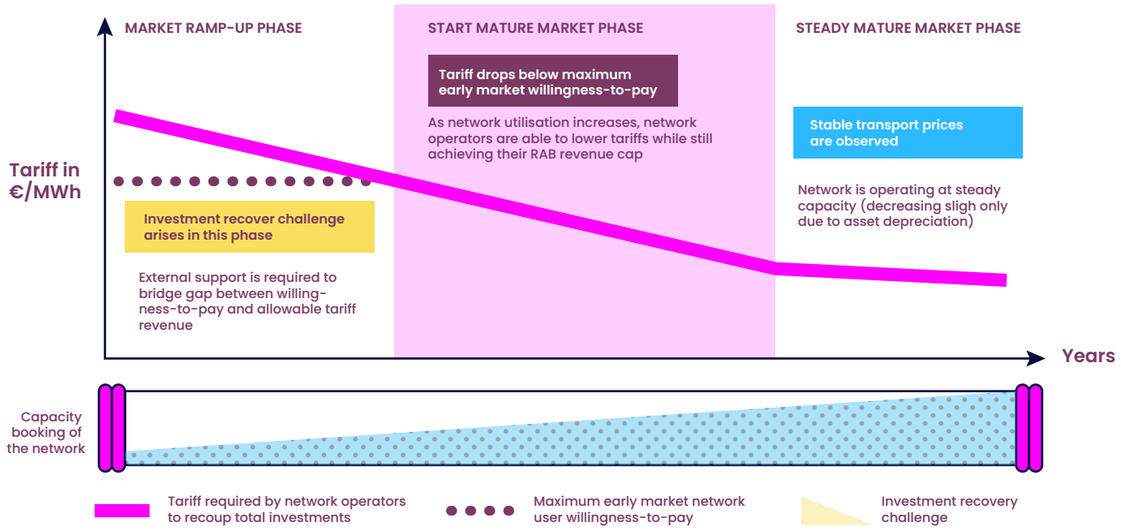
In the British Energy Security Strategy (BESS), the UK Government committed to the design of new business models for hydrogen transport and storage infrastructure by 2025. In August 2023, following a consultation in August 2022, government set out a minded-to position on the high-level design of the Hydrogen Transport Business Model (HTBM).

- The initial focus for the business model will be on large-scale pipeline infrastructure, which transports hydrogen as a gas
- A Regulated Asset Base (RAB) will form the basis of the business model
- An external subsidy mechanism will be created alongside a RAB to ensure that charges to users of the pipeline(s) and/or network(s) are not prohibitive, whilst allowing hydrogen transport providers to make a reasonable return on their investment. The external subsidy mechanism will be delivered through private law revenue support contracts between a counterparty and a hydrogen transport provider receiving the subsidy. The external subsidy mechanism can be used in conjunction with or separately to a RAB.

- The business model needs to be compatible with the future gas network price control, and will be designed as such
- Strategic planning will form the basis of the allocation process for the business model, and it will help inform the nature and timing of support for early hydrogen transport projects

The latest Hydrogen Strategy update to the market (2024) from the current Government includes their aim to publish details for the first rounds of the Hydrogen Transport Business Model in 2025.Notably, the HTBM may fund pipeline infrastructure for many early Hydrogen Allocation Round projects that are point to point pipelines not connected to a wider hydrogen transmission and distribution network. These pipelines would be operated by the producer rather than a transmission/distribution network operator.

Illustrative example of RAB mechanism for a hydrogen network, European Hydrogen Backbone 2023



Interconnectors

Currently, no hydrogen interconnectors exist in the UK. However, there are multiple early-stage proposals and projects underway to develop hydrogen interconnectors where the main focus is on utilising offshore wind potential, repurposing existing infrastructure where possible, and creating an integrated European hydrogen transport network. For example, North Sea Hydrogen pipeline proposals include:

- **The AquaDuctus project** aims to build an offshore hydrogen pipeline that would transport hydrogen generated from offshore wind farms located in the German North Sea coast to multiple network users, aiming to become the core of an interconnected offshore infrastructure between Germany and the North Sea countries, including the United Kingdom.
- **European Hydrogen Backbone (EHB) initiative:** Includes a group of 33 energy infrastructure operators [including National Gas Transmission] that aim to accelerate Europe's decarbonisation journey by defining the critical role of hydrogen infrastructure – based on existing and new pipelines – in enabling the development of a competitive, liquid, pan-European renewable and low-carbon hydrogen market.
- **The Scottish government funded Hydrogen Backbone Link (HBL)** is a proposed purpose built pipeline connecting Scotland to mainland Europe.

Terminal

Existence of hydrogen terminals will depend on demand for import (or ambition to export), and the transportation form (as liquefied hydrogen or as derivatives such as ammonia). Given uncertainty on imports/exports and initial focus on development of local production, there are currently no known minded to positions on the regulation for this infrastructure.

Permanent storage (sequestration)

Permanent storage for hydrogen is not relevant.

Governance and industry codes

Decision makers involved in the energy sector & their respective powers, and code governance of the different vectors

Prime Minister and Secretary of State

The Prime Minister and Secretary of State set strategic direction and drive major initiatives such as net-zero targets in addition to formulating key energy policy, including:

- Defining the remit of government departments
- Generating roles and select delivery bodies to fulfil functions
- Driving inclusion of Net Zero into law.

DESNZ

Department for Energy Security & Net Zero

The Department for Energy Security and Net Zero (DESNZ) is responsible for delivering the UK's energy security and to support the transition to a net zero economy. It is mandated to shape energy policy, regulation, and implementation. It plays a crucial role in creating policy frameworks, strategic direction and targets by formulating primary and secondary legislation:

- Primary legislation: DESNZ has significant powers under the primary legislation related to hydrogen. For example, under the Energy Act 2023, DESNZ has the authority to introduce regulations that facilitate the development of hydrogen infrastructure and market. Primary legislation also sets Ofgem's remit.
- Secondary legislation: DESNZ uses secondary legislation to implement detailed rules and regulations. It also sets the remit of additional regulators, like the NSTA and OPRED.
- Subsidy programs: DESNZ administers multiple subsidy programs which provide revenue support to hydrogen producers.

DESNZ develops the policy framework for funding to support:

- Hydrogen production (through the design and allocation of the Hydrogen Production Business Model as well as administration of the Net Zero Hydrogen Fund)
- Transport and storage (through the design and allocation of the Hydrogen Transport Business Model and the Hydrogen Storage Business model)
- Consumption (through the design of the Hydrogen to Power Business Model).

DESNZ is also developing the Design of the Low Carbon Hydrogen Standard and Certification Scheme to ensure that low carbon hydrogen production contributes to decarboni-sation efforts.

DESNZ is also the interim strategic planner for the build out of hydrogen transport and storage infrastructure.

Ofgem

ofgem

Under the 1986 Gas Act, Ofgem is already the independent regulator for hydrogen.

However, Government has not yet made any decisions on the actual configuration of roles and responsibilities between Ofgem and government. In the interim, Ofgem's role in the development of hydrogen transport and storage infrastructure will be to support the UK government and industry to provide early strategic direction. This involves guiding the initial stages of infrastructure build-out until the National Energy System Operator (NESO) can take on a central strategic planning role as set out within the statutory framework provided by the 2023 Energy Act.

NSTA

North Sea Transition Authority

The UK North Sea Transition Authority (NSTA) is to take on the role of offshore hydrogen transport and storage regulator. The move is intended to support the industry by enabling pioneering projects to obtain the necessary licences and move quickly into operation. Legislation outlines that:

- The NSTA will become the licensing/ consenting authority for offshore hydrogen pipelines bringing these under similar arrangements to those currently used for oil and gas pipelines.
- The NSTA will also become the licensing/ consenting authority for offshore hydrogen storage, which will enable the NSTA to issue hydrogen storage licences.
- The NSTA will become a consultee to OPRED on decommissioning and repurposing for both offshore hydrogen transport and storage.

Offshore Petroleum Regulator for Environment and Decommissioning

Offshore Petroleum Regulator for Environment & Decommissioning

OPRED will become the decommissioning and environmental regulator for offshore hydrogen transport and storage.

Treasury

HM Treasury

The Treasury plays a crucial role in shaping financial policies for the energy sector, ensuring alignment with the government's economic and environmental goals. Key responsibilities include:

- Approval and risk management: Departments must obtain Treasury approval for transactions deemed novel, contentious, or repercussive.
- Fiscal oversight: The Treasury oversees public spending on energy infrastructure and initiatives.

Devolved administration

Across the UK devolved administrations are supporting hydrogen initiatives, such as:

- The 2022 Scotland Hydrogen Action Plan aims for 5GW of low-carbon hydrogen production by 2030, which would cover one-sixth of Scotland's energy needs. This initiative is supported by a £90 million Green Hydrogen Fund. The plan envisions Scotland leveraging its potential to become a leading hydrogen exporter, contributing between £5 billion and £25 billion annually by 2045.
- The Welsh Government released a consultation on hydrogen policy in February 2025 that seeks views on their preferred policy position that supports hydrogen in Wales. In developing its understanding of hydrogen, Welsh Government has commissioned and published multiple reports and consultations including:
  - In 2020 the Welsh Government published a Hydrogen Pathway and Action Plan that benchmarked the Welsh hydrogen industry

- Since 2021 Welsh Government has provided £2.8 million for hydrogen feasibility studies through the Hydrogen Business Research and Innovation for Decarbonisation (HyBRID) fund.

- The Northern Ireland Department for the Economy 2023 Energy Strategy action plan report includes the commitment to produce comprehensive energy evidence to inform policy decisions, including on the economics of hydrogen for Northern Ireland.

Local Authority, Town and Country Planning Authority have certain responsibilities for hydrogen projects, such as:

- Regulating the use of land
- Undertaking Environmental Impact Assessment
- Having the role of the hazardous substance authority in relation to storage

NESO

The UK, Scottish and Welsh governments have jointly commissioned the National Energy System Operator (NESO) to create a Strategic Spatial Energy Plan (SSEP) for the energy system, land and sea, across Great Britain (GB). This first iteration of the SSEP will focus on electricity generation and storage, including hydrogen assets.

Currently, the remit of the National Energy System operator NESO, following the 2023 Energy Act includes following roles:

- A system planner providing strategic direction for electricity, gas and future systems (i.e., to include hydrogen).
- Independent advisor providing analysis and information to the Government and Ofgem
- The system operator for electricity.

NESO will promote three objectives as our primary duties:

- Net Zero
- Efficiency and Economy
- Security of Supply.

The Government's ambition is for NESO to formally assume responsibility for strategic network planning for hydrogen transport and storage by 2026.

Code governance

The Gas Act 1986 provides a market framework for the conveyance of gas, which includes hydrogen, through pipes. Through an arrangement of licences and codes, obligations and prohibitions, it allocates roles and responsibilities to market participants and sets out how they must interact with one another.

The government recognises the existing market framework and industry commercial arrangements that would apply to hydrogen may not be conducive to the emergence of hydrogen transport and/or storage infrastructure.

The government is continuing to progress its work on a market framework for hydrogen, with a view to ensuring the market framework is clarified and implemented well in advance of the first hydrogen pipeline networks commencing operations.

Energy security standards

Mandatory security standard metrics for network resilience and energy adequacy, and their statistical approach

Network

There are no established security of supply standards specifically for hydrogen networks.

Energy adequacy

There are no established energy adequacy standards specifically for hydrogen networks.

Regulation of retail market

Specific retail market interventions, including elements such as price caps, mandated or incentivised usage-based and/or time-of use pricing, and mechanisms for guaranteed supply continuity under retailer failure.

A competitive retail market for hydrogen in the UK currently does not exist and is not expected in the immediate future as current and near term hydrogen production and consumption is likely to be largely point to point between hydrogen producers and consumers.

B. Investment policy: Market interventions employed to achieve specific policy objectives

Supply:
Mechanisms to incentivize supply side investments

Production

Mechanisms incentivising or disincentivising investment with production as the key policy objective, via support mechanisms or windfall taxes

Support mechanism for production

Currently, there are no investment support mechanisms driving production of hydrogen that does not meet the low carbon hydrogen standard.

Windfall tax

To date, no windfall tax for hydrogen production exists

Decarbonisation

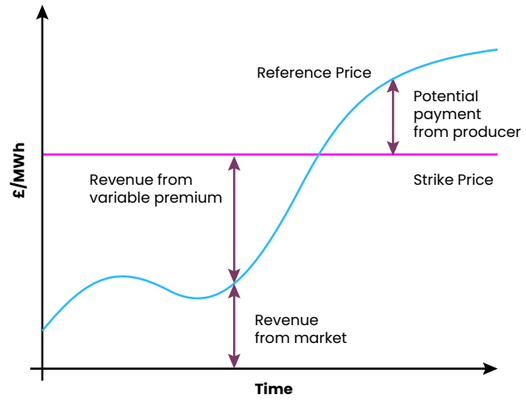
Mechanisms incentivising investment with decarbonisation as the key policy objective, either through support mechanisms or emission penalties.

Support mechanism for decarbonisation

There are two principal mechanisms to support hydrogen, via both initial capex subsidies and ongoing revenue support. The allocation of funding for both mechanisms is handled through the Hydrogen Allocation Round process.

- **Hydrogen Production Business Model (HPBM):** Provides revenue support to a range of hydrogen pathways, including carbon capture utilisation and storage enabled hydrogen production, to overcome the operating cost gap between low carbon hydrogen and high carbon fuels and is intended to incentivise investment in low carbon hydrogen production and use. The Low Carbon Hydrogen Agreement (LCHA) is the contract which underpins the hydrogen production business model ensuring stable revenue for hydrogen producers:
  - The HPBM employs a variable premium price support model where the subsidy is calculated as the difference between a strike price negotiated on a project-by-project basis, reflecting the cost of producing hydrogen, and a market value reference price. This model sets a reference price intended to reflect the hydrogen market price and, in the absence of a market benchmark, is based on the Achieved Sales Price, with a floor at the natural gas price. Additionally, it includes a Price Discovery Incentive aimed at incentivising sales at a higher price, thereby reducing the subsidy needed.
  - The model also provides volume support on a sliding scale, where the strike price (and consequently the subsidy) is higher on a per-unit basis if hydrogen offtake falls. This approach aims to provide a protection against volume risk if volumes unexpectedly fail for producers, ensuring the economic viability of low-carbon hydrogen production.

HPBM variable premium price support
DESNZ 2021



- **Hydrogen Allocation Rounds (HAR):** These are national competitive processes launched by the UK government to support the development of non-carbon capture, utilisation and storage-enabled production, such as electrolytic, hydrogen production projects by providing Net Zero Hydrogen Fund (NZHF) capital support and support through the Hydrogen Production Business Model (HPBM). These rounds aim to incentivise the establishment and growth of hydrogen production, ensuring projects meet criteria for affordability and value for money, and contribute to the UK's hydrogen production targets
  - First Hydrogen Allocation Round (HAR1): Launched in July 2022, by December 2023 DESNZ announced 11 successful projects from HAR1. The successful HAR1 projects are estimated to deliver 125MW of new electrolytic hydrogen production capacity. This round will provide over £2bn of revenue support from the HPBM, which will start to be paid once projects become operational. Over £90m from the Net Zero Hydrogen Fund has been allocated to support the construction of these projects.
  - Second Hydrogen Allocation Round (HAR2): Launched following a market engagement exercise, HAR2 hopes support up to 875MW of low-carbon hydrogen production capacity, but the government retains the right to allocate less if not enough projects apply that meet eligibility criteria or that provide sufficient value for money. In April 2025, DESNZ announced that 27 electrolytic projects across England, Scotland and Wales have been shortlisted for Hydrogen Allocation Round 2 (HAR2). A project's inclusion on the shortlist does not guarantee Government support. Projects will need to pass a rigorous due diligence stage in order to progress to the next stage of the allocation process, with decisions based on value for money and affordability.

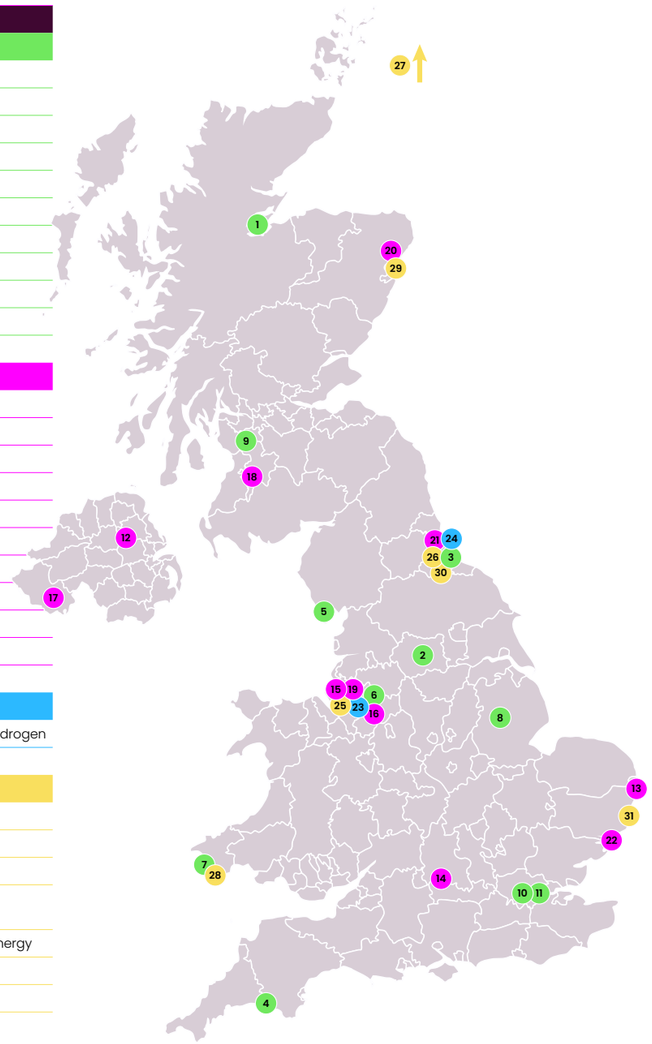
Hydrogen

- Net Zero Hydrogen Fund (NZHF): This fund, worth up to £240 million, aims to support the commercial deployment of new low carbon hydrogen production projects during the 2020s. The fund includes: Strand 1 support for development expenditure for FEED (Front End Engineering Design Studies) and post-FEED studies (up to 50% of eligible costs), and Strand 2 support for capital expenditure (up to 30%) for projects that do not require revenue support through the Hydrogen Business Model.

The map below shows successful bidding projects that were part of HAR 1, NZHF window 1 window 2, as well as CCUS sequencing [as of February 2024]:

Hydrogen Net Zero Investment Roadmap, DESNZ 2024 - Successful Projects

	Project Name	Developer
	HAR1	
1	**Cromarty**	Storegga
2	**Bradford hydrogen**	Hygen
3	**Tees Green**	EDF
4	**Langage Green Hydrogen**	Carlton Power
5	**Barrow Green Hydrogen**	Carlton Power
6	**Trafford Green Hydrogen**	Carlton Power
7	**West Wales Hydrogen**	H2 Energy & Trafigura
8	**HyMarnham**	JG Pears
9	**Whitelee Green Hydrogen**	Scottish Power
10	**Green Hydrogen 3**	HYRO
11	**Hybont**	Marubeni
	NZHF Window 1	
12	**Ballymena Hydrogen**	Ballymena Hydrogen
13	**Conrad Energy Hydrogen Lowestoft**	Conrad Energy
14	**Didcot Green Hydrogen Electrolyser**	RWE
15	**Green Hydrogen St Helens**	Progressive Energy
16	**Green Hydrogen Winnington & Middlewich**	Progressive Energy
17	**Mannock Green Hydrogen Valley**	Mannock
18	**Knockshinnoch Green Hydrogen Hub**	Renantis
19	**Hynet HPP2**	Vertex
20	**Kintore Hydrogen**	Statera
21	**H2 NorthEast**	Kellas
22	**Felixstowe Port Green Hydrogen**	Scottish Power
	CCUS Sequencing	
23	**Hynet HPP1**	Essar Energy Transition Hydrogen
24	**bpH2Teeside**	bp
	NZHF Window 2	
25	**Grenian Hydrogen Speke**	Grenian Hydrogen
26	**Tees Green Methanol**	EDF
27	**Sullom Voe Terminal Green Hydrogen**	Enquest Hydrogen
28	**Pembroke 200MW Green Hydrogen Elecrolyser Phase II**	RWE Generation
29	**Aberdeen Hydrogen Hub**	bp Aberdeen Hydrogen Energy
30	**Tees Valley Hydrogen Vehicle Ecosystem**	Exolum International UK
31	**Suffolk Hydrogen**	Hydrab Power



- Net Zero Innovation Portfolio (NZIP): The Net Zero Innovation Portfolio provides funding for low carbon technologies and systems, to help enable the UK to end its contribution to climate change. The Net Zero Innovation Portfolio is a £1 billion fund to accelerate the commercialisation of low-carbon technologies, systems and business models in power, buildings, and industry. NZIP is focused on 10 priority areas, including hydrogen production.
- Future support mechanisms for hydrogen production in the UK include:
  - Future Hydrogen Allocation Round: Aim to further support non-carbon capture, utilisation and storage-enabled hydrogen production projects.
  - Expansion of the Net Zero Hydrogen Fund: Strand 4 is planned to provide capital support to support the development of carbon capture, utilisation and storage enabled low carbon hydrogen production plants which have been selected through the Track-1 cluster sequencing programme.

Please note: The Hydrogen Production Revenue Support Regulations 2023 specify that for a project to qualify for government support, hydrogen must be produced in accordance with the Low Carbon Hydrogen Standard (LCHS).

Energy adequacy & flexibility

Mechanisms incentivising investment with energy adequacy and/or flexibility as the key policy objective, through support mechanisms.

The mechanisms supporting hydrogen production for decarbonisation contribute to supporting hydrogen supply adequacy and flexibility.

Demand:
Mechanisms to incentivise demand side investments

Consumption

Mechanisms incentivising investment with consumption as the key policy objective, through support mechanisms for consumption.

Although the mechanisms supporting hydrogen production for decarbonisation contribute indirectly to supporting hydrogen consumption, there are no specific mechanisms to incentivise consumption itself.

Decarbonisation

Mechanisms incentivising investment with decarbonisation as the key policy objective, either through support mechanisms or emission penalties

Currently, several hydrogen consumption support mechanisms exist in the UK, such as:

- **Industrial Energy Transformation Fund (IETF):** Provides funding for industrial manufacturers seeking to deploy decarbonisation technologies, including hydrogen fuel switching projects. The IETF launched in 2020, and is in 3 phases with £500 million of funding **available up until 2028.**
- **Net Zero Innovation Portfolio (NZIP):** Funding for the development and demonstration of fuel switching and fuel switch enabling solutions, to help industry move to lower carbon fuels including hydrogen. NZIP is a £1 billion fund, some examples of NZIP competitions relevant to hydrogen consumption include:
- Red Diesel Replacement Competition: Allocated £26 million for hydrogen solutions to develop and demonstrate low-carbon alternatives to red diesel, focusing on hydrogen as a replacement fuel for off-road vehicles and machinery.
- **Industrial Hydrogen Accelerator:** Allocated £17 million to support projects that demonstrate end-to-end industrial fuel switching to hydrogen, covering the entire technology chain from hydrogen generation and delivery infrastructure to industrial end-use.
- **Industrial Fuel Switching Competition:** Phase 1 included c. £3m of support for hydrogen focused projects. Encourages industries to switch from high-carbon fuels to low-carbon fuels including hydrogen, focusing on demonstrating and scaling up fuel-switching technologies.
- A number of support mechanisms for hydrogen transportation consumption have been developed, including:
- **Clean Maritime Demonstration Competition (CMDC) Rounds 1-4:** Supports the development and demonstration of clean maritime technologies, including hydrogen-based solutions for shipping and port operations.
- **Zero Emission HGV and Infrastructure Demonstrators:** Supports the deployment and demonstration of commercially available zero emission HGVs, including hydrogen-powered heavy goods vehicles (HGVs) and the necessary refuelling infrastructure.
- **Tees Valley Hydrogen Transport Hub Fund:** Phase 1 allocates £2.6 million and Phase 2 up to £15 million to support the establishment of a hydrogen transport hub in Tees Valley, focusing on hydrogen production, distribution, and end-use in transportation.
- **Zero Emission Flight Infrastructure Project:** Allocated £4.2 million to fund the development of infrastructure necessary for the deployment of hydrogen-powered and other zero-emission aircraft.
- Additionally, government has consulted on **hydrogen to power (H2P)** and the market design interventions needed to enable H2P to decarbonise and secure the energy system. The minded-to position details a hydrogen to power business model (H2PBM) design based on elements of the dispatchable power agreement (DPA) but adapted to suit the needs of H2P.

Penalty for emissions

UK ETS for regulated activities includes hydrogen production and costs are passed on to consumers

Energy adequacy & Flexibility

Mechanisms incentivising investment with energy adequacy and/or flexibility as the key policy objective, through support mechanisms.

There are currently no support mechanisms specifically designed to remunerate hydrogen supply adequacy and/ or flexibility.

C. Operational market design: Market design elements that match supply and demand and enable stable and reliable day-to-day operations

DESNZ is continuing to progress work on the development of a hydrogen market framework, with a view to ensuring the market framework is clarified and implemented well in advance of the first hydrogen pipeline networks commencing operations.

Wholesale market

Operational market design related to facilitating the matching of supply and demand

Currently, no national wholesale market for hydrogen exists due to its nascent stage and the absence of a national backbone. As a result, hydrogen prices are currently site-specific. Dispatch is self-managed through bilateral agreements between producers and consumers.

Balancing and settlement

Processes and mechanisms to manage and reconcile discrepancies between supply and demand and ensure operability of the system.

System balancing services

Mechanisms and contractual arrangements employed by system operator to facilitate real-time system operation, including sub-settlement period energy balancing (to resolve short-term discrepancies between supply and demand), and ancillary services to maintain system stability and security

In the previous Government's minded-to position on hydrogen transport and storage infrastructure business model designs, hydrogen storage was viewed as key to addressing imbalances in hydrogen production and demand. A number of roles for hydrogen storage were listed including:

- Managing within-day network balancing when there is a mismatch between entry and exit volumes in hydrogen networks, and
- Allowing hydrogen producers to better manage demand and production mismatch, particularly for electrolytic producers.

Energy balancing – normal

Routine processes and mechanisms to ensure balance of supply and demand under typical operating conditions, further specified through the primary balancer, residual balancer, dispatch mechanism and gate closure where applicable.

Currently users (producers and consumers) of hydrogen networks are the primary balancers of hydrogen networks as to date hydrogen networks are limited and site specific in GB

Energy balancing – emergency

Procedures and mechanisms implemented to address severe imbalances between supply and demand that threaten the stability and reliability of energy system, further specified through the central balancing function, wholesale market closure, balancing notice and load shedding merit order.

Due to the nascent, site-specific nature of hydrogen production, no universal emergency balancing services currently exist.

D. Cost allocation: Allocation mechanisms of various costs

Policy costs

Costs incurred from providing policy support to achieve specific government objectives, generally for investments

Allocation on taxpayer and market participants

The Energy Act 2023 enables two options for funding the Hydrogen Production Business Model (HPBM): a levy on gas shippers (the Gas Shipper Obligation (GSO)) and government funding.

The Government launched a consultation in January 2025 seeking views on proposed design choices of the Gas Shipper Obligation (GSO). The Gas Shipper Obligation is intended to be the long-term funding mechanism for initial hydrogen production projects funded through the Hydrogen Production Business Model. It may also fund further hydrogen projects, subject to future decisions on the hydrogen programme and the funding of future hydrogen production projects.

The Government expects to introduce the GSO in 2027, subject to legislation being in place. Prior to the GSO's implementation, HPBM payments are intended to initially be funded by Government. The GSO will initially be placed on licensed gas shippers in Great Britain only.

Charges (levies), charging base and basis

The Energy Act 2023 provides powers to introduce revenue support for hydrogen production, transport, and storage, through either levy or government funding. However, Government has not yet decided on the long-term charging arrangements for hydrogen policy cost recovery.

Transmission network costs

Costs incurred to remunerate network transmission companies to account for investment, operational & maintenance costs for transportation over long distances

DESNZ is continuing to progress its work on the development of a hydrogen market framework, with a view to ensuring the market framework is clarified and implemented well in advance of the first hydrogen pipeline networks commencing operations.

The Energy Act 2023 provided the legislative framework that will underpin the delivery of the Hydrogen Transport Business Model. Government's initial focus for the hydrogen transport business model is onshore pipelines transporting hydrogen as a gas.

The Energy Act 2023 enables two options for funding the Hydrogen Transport Business Model: a levy on gas shippers (the Gas Shipper Obligation (GSO)) and government funding. It is possible that the GSO will fund hydrogen transport business models in future. However, Government has not yet decided on the long-term funding arrangements for this business model.

Inter-temporal cost allocation

The minded to government position on the Hydrogen Transport Business Model (August 2023) includes a Regulated Asset Base (RAB) to form the basis of the business model with an external subsidy mechanism to ensure that charges to initial users of the pipeline(s) and/or network(s) are not prohibitive, whilst allowing hydrogen transport providers to make a reasonable return on their investment. Stakeholders noted a RAB framework would be the most appropriate model in a steady state of the hydrogen economy, to address the barriers and challenges associated with large-scale infrastructure including high upfront capital costs and difficulties in recovering revenues over a long period of time.

Balancing costs

Costs incurred by the system operator to ensure real-time balance between supply and demand, including the procurement and deployment of balancing services

There is currently no market design framework for allocation of hydrogen transmission network balancing costs. The minded to government positions on the HTBM (August 2023) references it is government's intention to keep the hydrogen market framework and industry commercial arrangements under review.

Distribution network costs

Costs incurred to remunerate network distribution companies to account for investment, operational & maintenance costs for for final stage transportation to end users

Allocation on taxpayer and market participants

DESNZ is continuing to progress its work on the development of a hydrogen market framework, with a view to ensuring the market framework is clarified and implemented well in advance of the first hydrogen pipeline networks commencing operations.

The Energy Act 2023 provided the legislative framework that will underpin the delivery of the Hydrogen Transport Business Model. Government's initial focus for the hydrogen transport business model is onshore pipelines transporting hydrogen as a gas.

The Energy Act 2023 enables two options for funding the Hydrogen Transport Business Model: a levy on gas shippers (the Gas Shipper Obligation (GSO)) and government funding. It is possible that the GSO will fund hydrogen transport business models in future. However Government has not yet decided on the long-term funding arrangements for this business model.

Payment responsibility (charging base)

Allocation of network and balancing costs across market participants, including allocation between supply (producers) and demand (consumers), and any exemptions or discounts for specific groups/technologies

DESNZ is continuing to progress its work on the development of a hydrogen market framework, with a view to ensuring the market framework is clarified and implemented well in advance of the first hydrogen pipeline networks commencing operations.

Charging metric (charging basis)

Metric used to charge market participants for network or policy costs, generally either on an energy or capacity basis, including those designed to allocate costs to usage or capacity at specific times of the day or year.

DESNZ is continuing to progress its work on the development of a hydrogen market framework, with a view to ensuring the market framework is clarified and implemented well in advance of the first hydrogen pipeline networks commencing operations.

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Distribution network costs

- Please see above references

NESO
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System Operator