

Scottish Net Zero Roadmap

Policy landscape analysis



UNIVERSITY of STRATHCLYDE
**CENTRE FOR
ENERGY POLICY**

www.strath.ac.uk/humanities/centreforeenergypolicy/



Working to ensure transitions to mid-century net zero targets deliver sustainable and equitable prosperity.

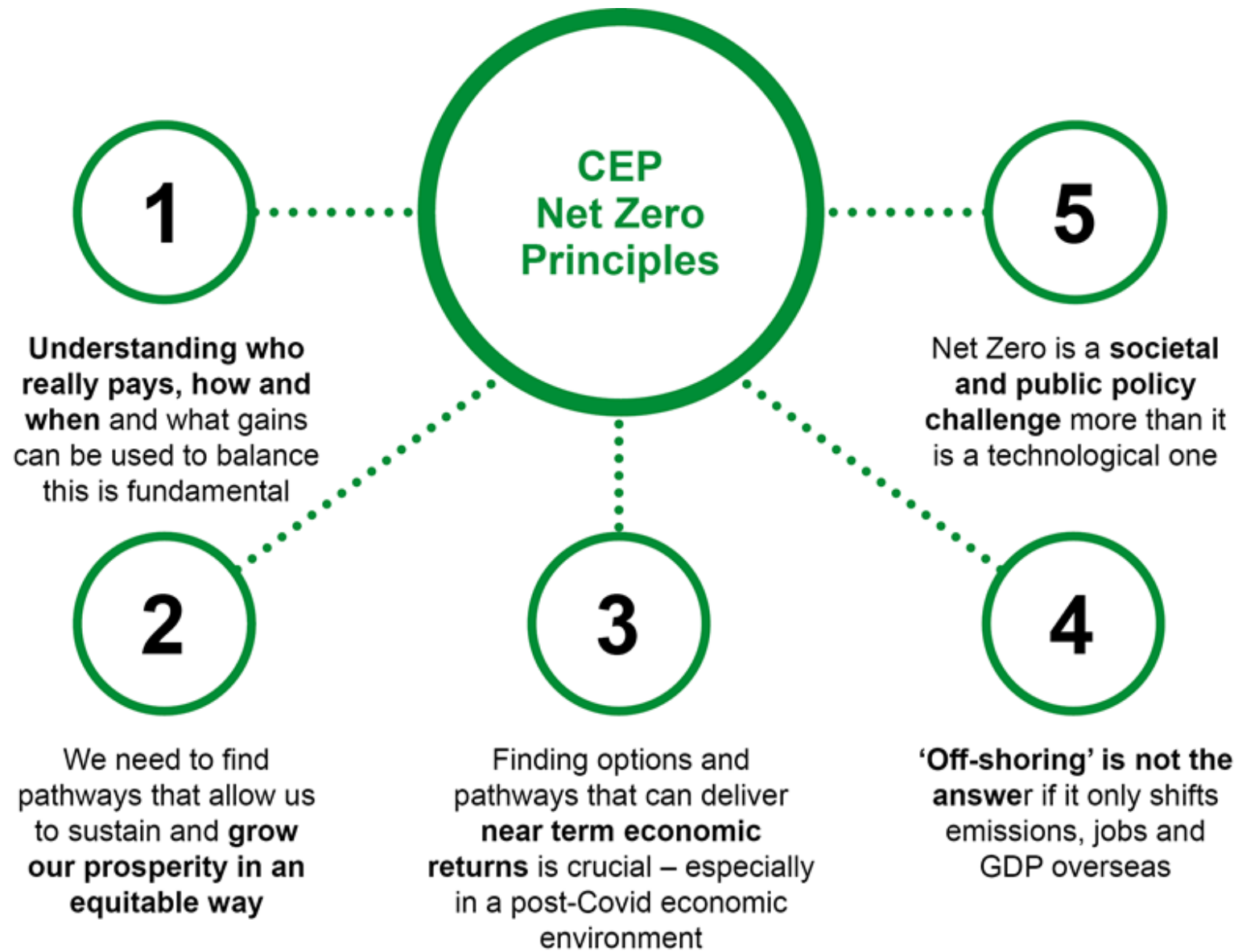


UNIVERSITY of STRATHCLYDE
CENTRE FOR
ENERGY POLICY

Centre for Energy Policy

- The Centre for Energy Policy (CEP) is a multi-disciplinary hub that facilitates and **conducts research**, discussion, the **exchange of knowledge** and **policy engagement** on energy and climate issues.
- Uniquely, we offer a broader perspective on energy and climate policy challenges, going beyond technology-driven analyses to consider how understanding the **wider economic, societal and political context** of decision making can help us unlock solutions and break down ‘policy barriers’.
- We have particular expertise in conducting **wider economy scenario analyses** and **political economy narrative development** to investigate and communicate how different actions and options are likely to impact **across the wider economy**, how and where value is generated, which sectors and regions it accrues, and how this may help us consider questions of ‘who pays’.





Central aim

- To explore the key and emerging societal, economic and policy opportunities and challenges of key elements emerging across the SNZR scenarios
- We draw on CEP's policy expertise and foundation of public policy-facing economic research alongside the early outputs emerging from the SNZR roadmap



Societal

Opportunities

1. Scenarios identified in the Roadmap provide new job opportunities across a range of emerging sectors and wider supply chains
2. Opportunities to deliver against Just Transition agendas – with particular opportunities to transition existing oil and gas sector workers
3. Opportunities to safeguard contribution of existing industries in regions and communities with potential for new regional / community development

Challenges

1. If industrial firms are required to bear the direct cost of decarbonisation ahead of competitors – negative outcomes may emerge across associated regions/communities that may work against Levelling up/ Just Transition agendas
2. Societal and political backing needed for Government subsidy/support for decarbonisation actions
3. Pathways identified rely on emerging technologies and local / regional societal acceptance of them is key (e.g. new pipelines & infrastructure)

Economic

Opportunities

1. Safeguarding existing industries can protect their contribution to the UK/Scottish economy.
2. Opportunities exist to attract new industry and export services internationally. E.g. CO2 storage, GHGRs, exporting expertise and services for floating offshore wind, and exporting hydrogen are key examples.
3. If firms can gain comparative advantage less government support/subsidy will be needed to support decarbonisation

Challenges

1. Polluter pays approach could risk offshoring the economic contribution of existing industries – which has implications for the public budgets
2. Large scale investment across the economy associated with industrial decarb and net zero could put pressure on labour markets and prices generally
3. Private sector investment cycles and priorities need to align with activities set out in the roadmap

Policy

Opportunities

1. Policies around CCUS and hydrogen business models are at a mature stage
2. Opportunities exist to meet multiple societal outcomes – decarbonisation, regional and national economic development, just transition etc.
3. Markets for ‘green products’ are materialising along with potential for meaningful carbon markets

Challenges

1. Some activities in the Roadmap, such as CO2 shipping, hydrogen transport and infrastructure for dispersed sites have less well developed policy support
2. How to incentivise / regulate energy efficiency and fuel switching?
3. Policy decisions in linked but separate sectors may be a controlling factor in how industrial decarbonisation policy is implemented

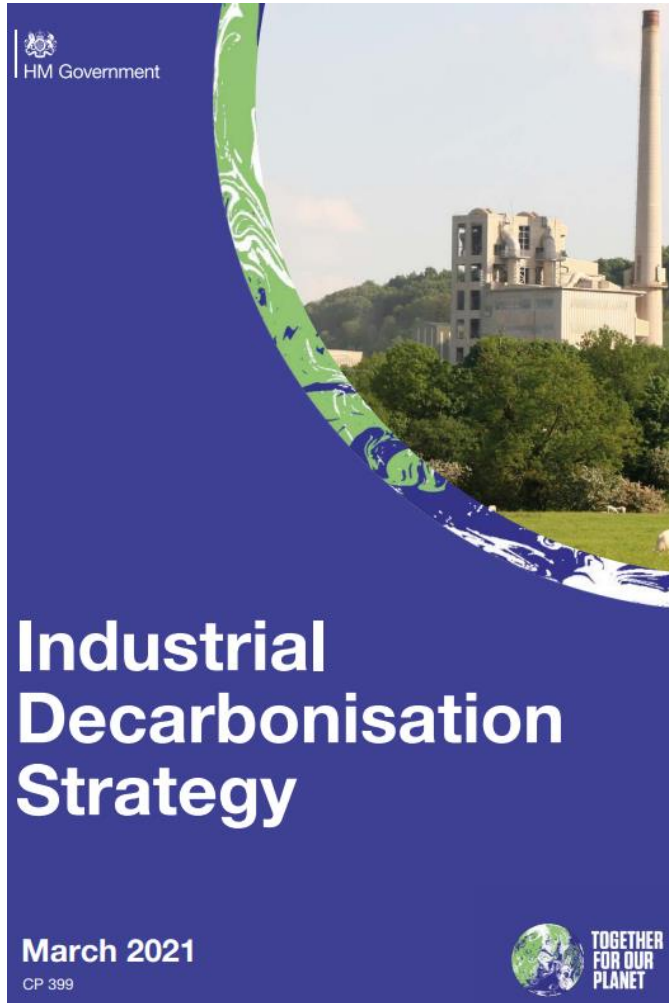
Industrial decarbonisation policy landscape review

Key Decarbonisation Activity	Supporting Policy	Gap / Status	Status (RAG)
Hydrogen production	1,2,3,4,5,12,14,16	Policy frameworks in design/consideration to support commercialisation	Yellow
Hydrogen transport	9,12,14,16	Limited policy support for hydrogen transport. Limited support may be incorporated in gas network company business plans	Red
Co2 capture	1,6,5,8,10,11,14,15	Policy frameworks in design/consideration to support commercialisation	Yellow
Co2 storage	1,5,7,8,10,11,14,15	Policy frameworks in design/consideration to support commercialisation	Yellow
Co2 transport	1,5,7,8,10,11,14,15	Limited policy support/frameworks for CO2 shipping and associated infrastructure	Yellow
Co2 utilisation	1,5,8,14,15	Little policy support for CO2 utilisation – likely to be commercially driven	Red
GHG removals	1,13	Policy support focussed on R&D and not yet commercial deployment	Red
Fuel switching	1,10,12,13,14	Policy development in early stages and reliant on increased supply of hydrogen or electricity	Yellow
Energy efficiency	1,10,14	Policy frameworks in early stages – likely to be commercially driven	Yellow

Key policy documents

Tag	Policy	Published
1	Industrial Decarbonisation Strategy	BEIS, March 2021
2	Design of a business model for low carbon hydrogen (consultation)	BEIS, August 2021
3	Hydrogen Strategy	BEIS, August 2021
4	Hydrogen Policy Statement	SG, December 2020
5	Ten Point Plan for a green industrial revolution	UK Gov, November 2020
6	CCUS Business Models (update) – Carbon Capture	BEIS, May 2021
7	CCUS Business Models (update) – Transport and Storage	BEIS, May 2021
8	Cluster Sequencing for CCUS (phase 2 update)	BEIS, May 2021
9	Scotland's electricity and gas networks: vision to 2030	SG, March 2019
10	Securing a green recovery on a path to net zero: climate change plan 2018–2032 - update	SG, December 2020
11	Scotland Energy Strategy Position Statement	SG, March 2021
12	Draft Hydrogen Action Plan	SG, November 2021
13	Net Zero Review	HMT, October 2021
14	Net Zero Strategy: Build Back Greener	BEIS, October 2021
15	CCUS Economics Impacts Study	SG, November 2021
16	Business Models for Low Carbon Hydrogen Production	BEIS, August 2020

1. Industrial Decarbonisation Strategy (03/21)



Part 1: Foundations to deliver net zero for industry

- Industrial emissions will need to reduce by at least two-thirds by 2035 and by at least 90% by 2050, with 3 MtCO₂ captured through CCUS and around 20 TWh switching to low carbon fuels by 2030.
- Use carbon pricing as a tool to send a clear market signal, providing certainty for industrial sectors.
- put in place funding mechanisms to support deployment and use of CCUS and low carbon hydrogen infrastructure

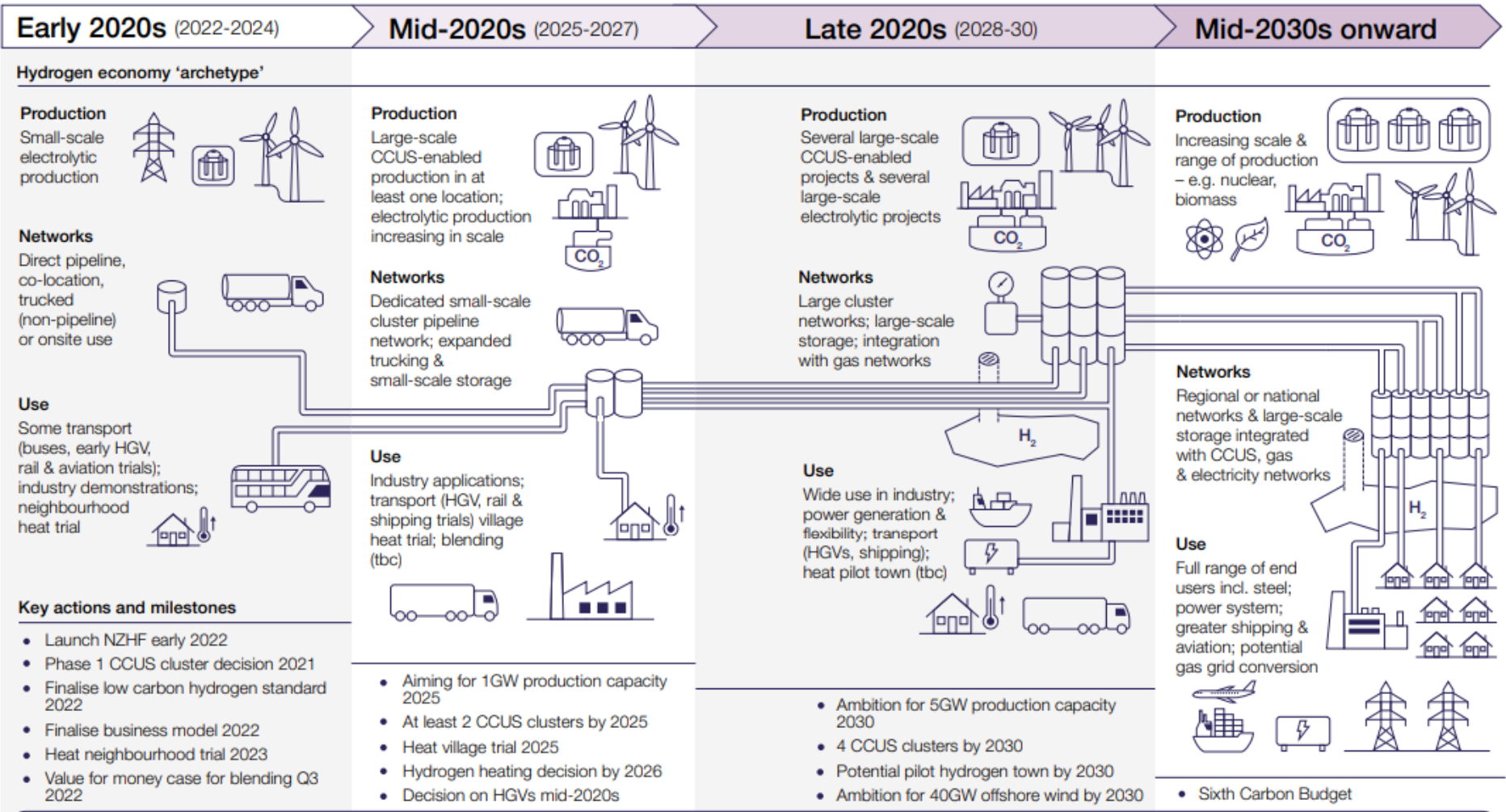
Part 2: Transforming industrial processes

- support deployment of CCUS on industrial sites in clusters to capture and store around 3 MtCO₂ per year by 2030
- improve heat recovery and reuse across sites, particularly in sites with high operational temperatures
- support innovation in fuel switching technologies, including low carbon electricity, biomass and hydrogen

Part 3: Maximising the UK's potential

- support the skills transition so that the current and future workforce benefit from the creation of new jobs
- capitalise on the export opportunities of having a world-leading net zero industry

3. UK Gov Hydrogen Strategy (08/21)



UK Hydrogen Strategy



4. Scottish Government Hydrogen Policy Statement (12/20)

- 'The Scottish Govt. is committed to providing a supportive policy and regulatory environment to support hydrogen production and use and to enable Scotland to take a pioneering role in a growing global industry.'
- **Scotland's hydrogen production capability of at least 5GW of renewable and low-carbon hydrogen by 2030 and at least 25GW by 2045.**
- £100 million funding over the next five years as implemented through our Hydrogen Action Plan, due for publication in 2021.
- Establishing low-carbon hydrogen production at scale by the mid-2020s, linked to Carbon Capture and Storage (CCS).
- Offshore wind to be a key driver of the longer term hydrogen economy in Scotland
- Support the transition and growth of Scotland's existing supply chain, including in the development of skills and manufacturing capacity.

5. The Ten Point Plan for a Green Industrial Revolution (11/20)

The Ten Point Plan for a Green Industrial Revolution



Point 1
Advancing Offshore Wind



Point 2
Driving the Growth of Low Carbon Hydrogen



Point 3
Delivering New and Advanced Nuclear Power



Point 4
Accelerating the Shift to Zero Emission Vehicles



Point 5
Green Public Transport, Cycling and Walking



Point 6
Jet Zero and Green Ships



Point 7
Greener Buildings



Point 8
Investing in Carbon Capture, Usage and Storage



Point 9
Protecting Our Natural Environment

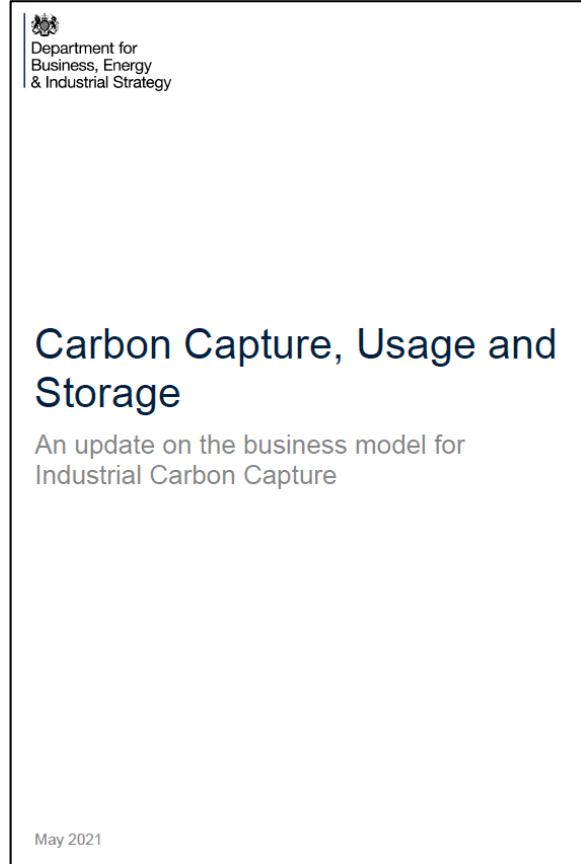


Point 10
Green Finance and Innovation

- Point 1: Offshore wind
 - by 2030, we aim to produce 40GW of offshore wind, including 1GW of innovative floating offshore wind
- Point 2: Low carbon hydrogen
 - develop 5GW of low carbon hydrogen production capacity by 2030
 - £240 million Net Zero Hydrogen Fund
- Point 8: CCUS
 - establish CCUS in two industrial clusters by mid 2020s, and aim for four of these sites by 2030, capturing up to 10 Mt of carbon dioxide per year.
 - £1 billion CCUS Infrastructure Fund will provide industry with the certainty required to deploy CCUS at pace and at scale
- Point 10: Green Finance and Innovation
 - £1 billion Net Zero Innovation Portfolio. Focus on ten priority areas, including: floating offshore wind; nuclear advanced modular reactors; energy storage and flexibility; bioenergy; hydrogen;; direct air capture and advanced CCUS; industrial fuel switching, etc.
 - £100 million investment in brand-new Greenhouse Gas Removals including Direct Air Capture

6. CCUS - An update on the business model for Industrial Carbon Capture (05/21)

- Potential business model for industrial facilities with carbon capture usage and storage (CCUS).
- From the capture side:
 - *'an up to 15-year contract (the ICC Contract) that provides the emitter with a payment per tonne of captured CO₂, which is intended to cover operational expenses, Transport and Storage (T&S) fees and repayment of, and a rate of return on, capital investment in carbon capture equipment; and*
 - *capital grant co-funding for a portion of the capital cost of capture projects, which will be available for initial projects only and is intended to mitigate against certain risks associated with these projects.'* via the Carbon Capture and Storage Infrastructure Fund (CIF).
- Subsidises costs to maintain competitiveness and foster investment (similar to the early years of the renewable sector)
- De-risk investments by providing potential revenue streams to the CCUS industry.



7. CCUS - An update on the business model for Transport and Storage (05/21)

Carbon Capture, Usage and Storage

An update on the business model for
Transport and Storage

- Describes the role of Role of the T&S Company – sets up the ‘rules of the game’, a basis of a regulatory framework for companies to enter in the sector.
 - *‘development, construction, financing, operation, maintenance, expansion, and decommissioning of the T&S network;*
 - *ownership of the onshore and offshore transportation network, and obtaining the licence and permit for the storage site, under the Energy Act 2008;*
 - *operation of the T&S network to ensure the operational parameters are within specified limits, manage network access, perform network planning, and administrate sector specific tasks;*
 - *review of the CO₂ metering and compositional analysis equipment installed by the users at the point of connection¹; and*
 - *ensuring that the transportation and long-term storage of CO₂ is safe, efficient, and compliant with defined requirements.’*

7. CCUS - An update on the business model for Transport and Storage (05/21) (cont.)

Carbon Capture, Usage and Storage

An update on the business model for
Transport and Storage

- Delivery model: private sector.
 - *'it is preferable to develop a regulatory system and a contractual framework to allow the private sector to develop CCUS. Such a model has been effective in driving investment volumes and efficiency in networked industries in the UK over the last 30 years, and we anticipate costs and risks to reduce in the CCUS sector as it matures.'*
 - Support and skills transfer from the UK oil and gas sector
- Business model under an Economic Regulatory Regime (ERR). Seems to be still at early stages, but it will define:
 - allowed revenues;
 - outputs and incentives;
 - uncertainty mechanisms; and
 - duration of the first regulatory period.
- This policy document aims to provide certainty for investment from the private sector.

8. Cluster Sequencing for CCUS (11/21)

- Track-1 Clusters: Hynet and the East Coast Cluster
 - Projects that wish to apply for support as part of Phase-2 must be able to connect to one of the Phase-1 Track-1 Clusters.
- The Scottish Cluster as a reserve cluster if a back-up is needed.
 - A reserve cluster is one which met the eligibility criteria and performed to a good standard against the evaluation criteria in Phase-1.
 - This means that if government chooses to discontinue engagement with a cluster in Track-1, we can engage with this reserve cluster instead.

Cluster Sequencing for Carbon Capture Usage and Storage Deployment: Phase-2

Background and Guidance for Submissions

Table 1: Phase-2 Cluster Sequencing Timeline

Milestone	Date
Phase-2 Launch – Expression of Interest and call for capture Projects capable of connecting to the Track-1 and reserve cluster T&S Networks	w/c 8 November 2021
Phase-2 - Expression of Interest window closes	3 December 2021
Phase-2 Engagement sessions	w/c 6 December 2021 w/c 10 January 2022
Phase-2 submission deadline	21 January 2022
Phase-2 submission evaluation period	24 January – May 2022
Phase-2 decision – shortlisted Applicants are invited to participate in negotiation/due diligence stage	From May 2022
Decision in relation to allocation of support and Project offers allowing FID to take place	From Q2 2023

9. Scotland's electricity and gas networks: vision to 2030 (12/20)



- **ELECTRICITY TRANSMISSION**
 - A secure and resilient transmission network
 - New transmission infrastructure that ensures we can meet Scotland's renewable energy ambitions
 - New and stronger interconnections between Scotland and our European neighbours
- **ELECTRICITY DISTRIBUTION**
 - A DSO transition which engages and provides opportunities to reward all consumers, manages risk effectively and ensures safety, security, efficiency, openness and flexibility.
 - Demand management, new platforms and technologies, inc batteries
 - Managed charging and successful innovations to help integrate a growing fleet of electric vehicles
- **GAS TRANSMISSION**
 - Develops the evidence base to show the feasibility and costs associated with adapting the network to support regional energy systems based on 100% hydrogen
- **GAS DISTRIBUTION**
 - Blends increasing quantities of low carbon gases with natural gas, including hydrogen, bio methane, bio SNG and hydrogen

10. Update to the Climate Change Plan 2018 – 2032 (Industry) (12/20)

Update to the Climate Change Plan 2018 – 2032

Securing a Green Recovery
on a Path to Net Zero



Scottish Government
Riaghaltas na h-Alba
gov.scot

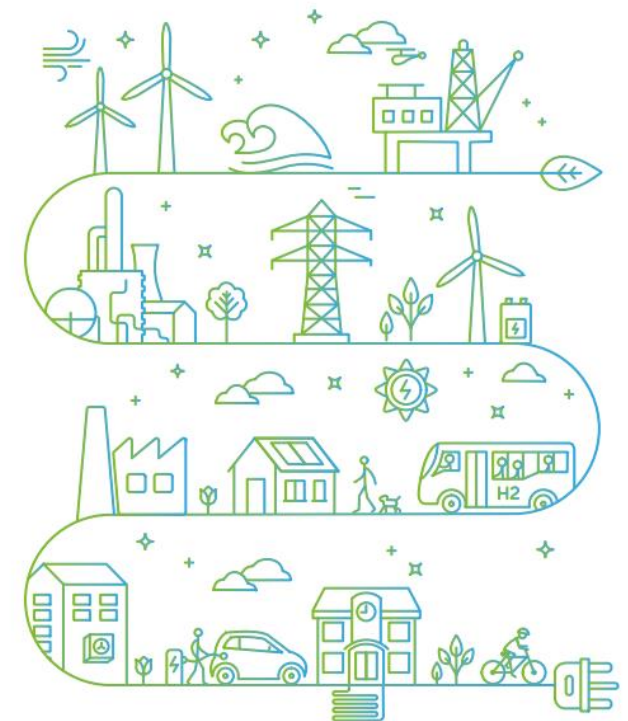
- Emerging Energy Technologies Fund of £180 million that will support the development of hydrogen and CCS
- a £5 million CCUS Challenge Fund to boost early stage work and technologies in this area. (2022 – 2024)
- the Scottish Industrial Energy Transformation Fund commits £34 million for projects at industrial sites for energy efficiency or deeper decarbonisation
- the £26 million Low Carbon Manufacturing Challenge Fund will support innovation in low carbon technology, processes and infrastructure.
- £100 million to help businesses create new, green jobs via the Green Jobs Fund.
- 2024 - Acorn Project Development begins, concluding with Direct Air Capture and Storage operating from St Fergus Gas Plant in 2026.

11. Scottish Government Energy Strategy Position Statement (03/21)

Key priorities for energy

- Decarbonisation of Heat and Energy Efficiency
 - £1.6 billion Heat in Buildings capital funding over the next parliament
 - Establish a new Green Heat Finance Taskforce in early 2021 to provide advice and recommendations to Scottish Government on potential new financing models and routes to market
- Local Energy
 - 2GW of renewable energy being in Local or Community ownership by 2030
- Energy Transition
 - £62 million Energy Transition Fund to support our energy sector as it transitions to net zero
 - Develop and publish a Hydrogen Action Plan during 2021
- Renewables
 - Deliver the actions from our Offshore Wind Policy Statement, published in October 2020
 - Continue to support the marine energy sector
- Consumers
 - work closely with consumer groups, including the independent Energy Consumers Commission, to gather and act on feedback

Scotland's Energy Strategy Position Statement

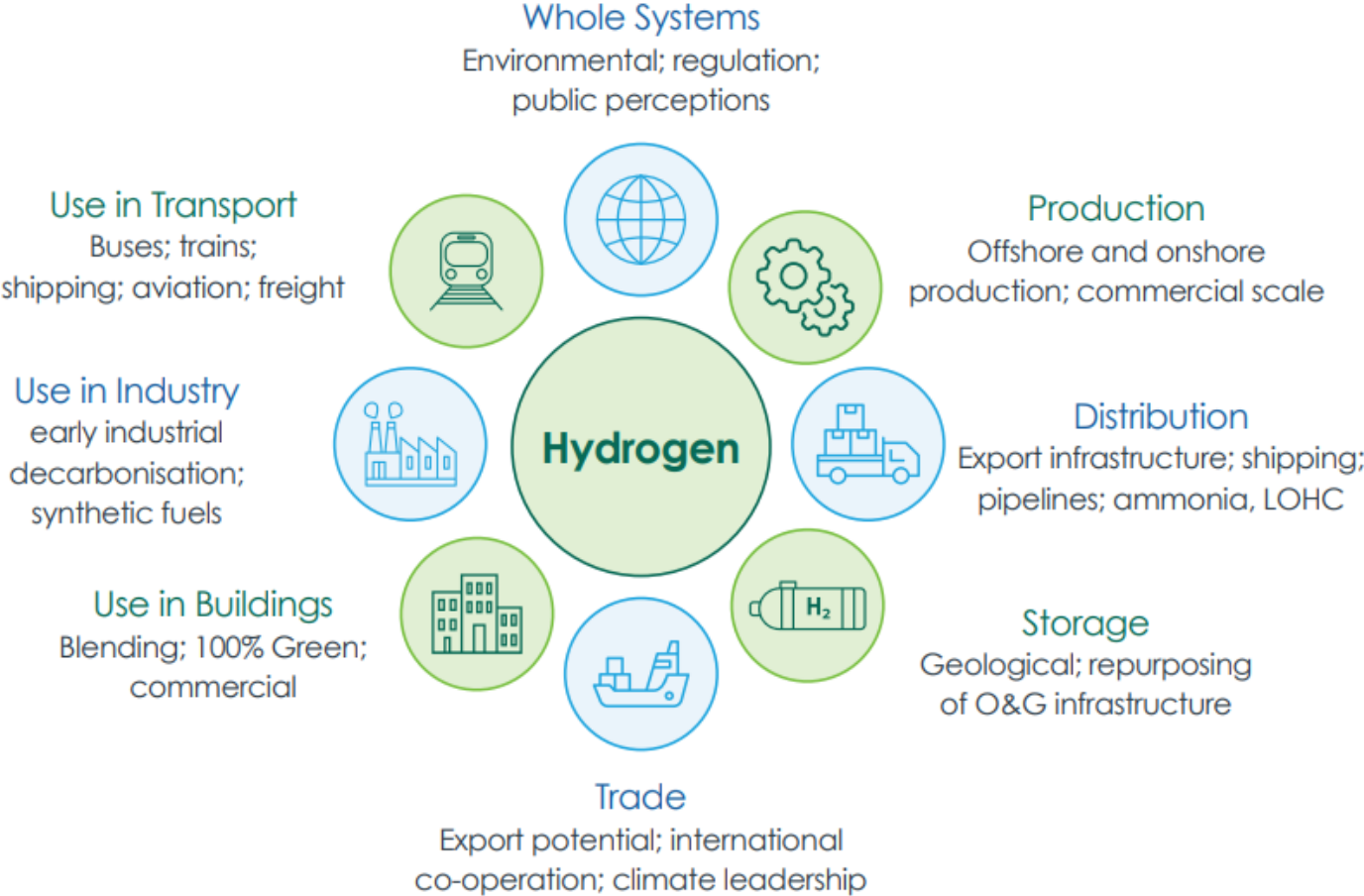


12.Draft Hydrogen Action Plan (11/21)

Draft Hydrogen Action Plan

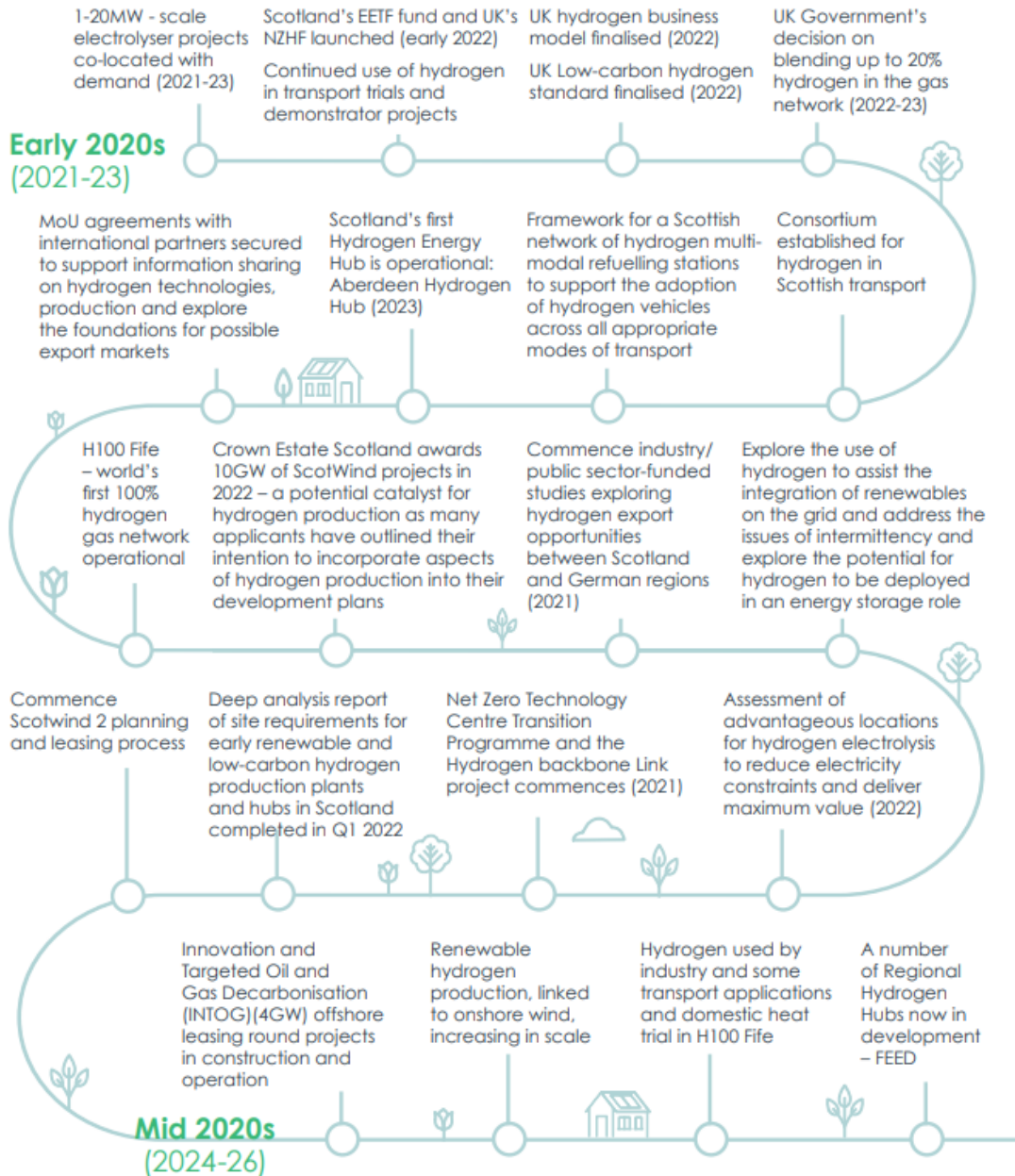


Hydrogen Economy in Scotland

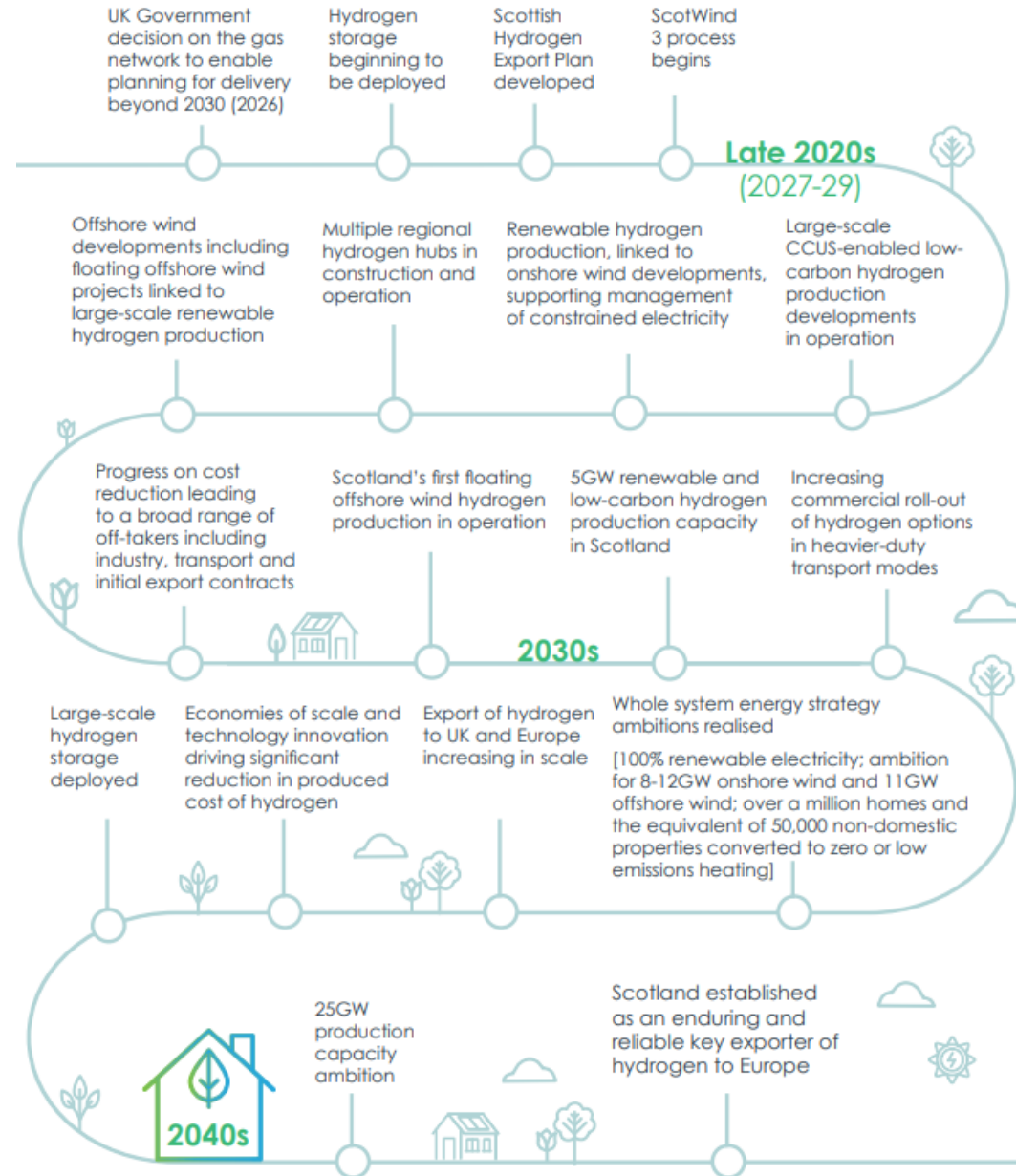


Part 1 – Hydrogen Economy: Route Map to 2030 and 2045

The Hydrogen Economy Journey



The journey to net zero



13. HMT Net Zero Review (10/21)



Net Zero Review

Analysis exploring the key issues

October 2021

- Global action to mitigate climate change is **essential to long-term UK prosperity**
- UK action **can generate benefits to businesses and households** across the country.
- Current economic analysis could **understate the economic cost** to the UK as the climate heats up.
- **Household characteristics** drive a household's exposure to the net zero transition – (and industry e.g. higher carbon footprint = greater exposure to carbon price)
- Policy to support the transition can help **make the most of the opportunities and keep costs down**
- The transition has implications for **current and future taxpayers**

14. UK Gov Net Zero Strategy – Industry (10/21)

CCUS

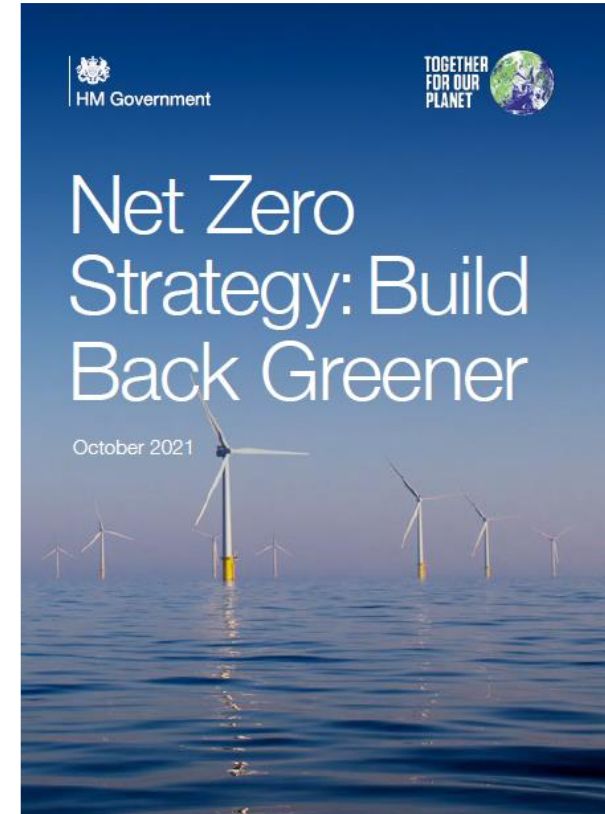
- Ambition to deliver **6 MtCO₂ per year of industrial CCUS by 2030**, and 9 MtCO₂ per year by 2035.
- Set up the **Industrial Decarbonisation and Hydrogen Revenue Support (IDHRS)** scheme to fund our new industrial carbon capture and hydrogen business models.
- Support the deployment of CCUS through the **£1 billion CCS Infrastructure Fund**.
- Following Phase 1 of the **Cluster Sequencing** process, the Hynet and East Coast Clusters have been confirmed as Track 1 clusters.

Energy efficiency & fuel switching

- **Support the installation of energy efficiency and on-site decarbonisation measures** through the £315 million Industrial Energy Transformation Fund (IETF)
- Support the increased requirement for **fuel switching to low carbon alternatives**, with an ambition to replace around 50 TWh of fossil fuels per year by 2035.
- Develop several **Resource and Energy Efficiency (REEE) measures** with ambition of achieving the anticipated requirement of 11 MtCO₂ e worth of savings by 2035

Carbon markets & dispersed sites

- Incentivise cost-effective abatement in industry at the pace and scale required to deliver net zero, **through the UK ETS by consulting** (in partnership with the Devolved Administrations) on a net zero consistent cap.
- Explore opportunities for **faster decarbonisation of dispersed sites** in the 2020s.



15. CCUS Economics Impacts Study

Delivering a roadmap for growth and emissions reductions for Scotland (11/21)

- CGE model (Vivid Economy-Wide (ViEW) model) to analyse 4 CCUS rollout scenarios:
 - Core, soft start (delay in infrastructure, more shipping), ambition, carbon management (shipping instead of on-shore pipeline)
 - Compared against a baseline without CCUS, but also achieving net zero (via green hydrogen and more electrification).
- The main economic findings:
 - the CCUS value chains considered in the scenarios would require between £9bn and £30bn in total cumulative investment up to 2050
 - Under the scenarios assessed in this study, CCUS uptake has a positive impact on the Scottish economy.
 - 'In 2045, Scottish Gross Domestic Product (GDP) can be 1.3-2.3% (£3.8bn - £6.7bn) higher than hypothetical and generally not credible scenarios which meet Net Zero but do not have access to CCS' (according to the CCC's 6th Carbon Budget).
- At the sector level, higher GVA growth does not necessarily translate to higher job creation.
 - Energy intensive and lower emissions industries become more capital intensive over time and decrease their labour intensity, leading to job losses despite GVA gains.
 - At the national level, decreases in employment in sectors with decreasing GVA are counterbalanced by employment gains in other sectors. E.g. counterbalancing between the electricity and fossil fuel production and services sectors.

16. Business models for low carbon hydrogen production (08/20)

- General overview of how a hydrogen production business model should look like
- Aims: incentivise producers, instil confidence to investors, limit costs to tax payers, practical and simple, compatible with wider value chain, subsidy free overtime.
- The report assess four high level business models (see figure)

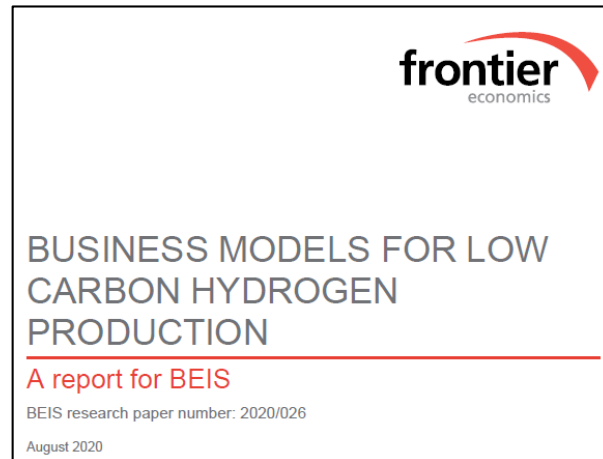


Figure 5 Business model category filter

	Contractual payments to producers	Regulated returns	Obligations on suppliers	End user subsidies
Technology-specific support (in the near term only)	Yes – support can be allocated separately to different technologies	Yes – support can be allocated separately to different technologies	Yes – obligation certificates can be banded ⁵	Difficult – while an end user subsidy could be designed to be technology specific, this would add significant complexity
Transfer of demand risk away from investors	Yes – support payments can be made regardless of demand (either through a backstop or split payment) ⁶	Yes – returns on fixed and capital costs can be gained regardless of demand	Difficult - A 'split' payment is not possible. While a backstop could be applied, this would be very complex ⁷	No – demand for low carbon hydrogen is driven partly by availability of alternative abatement options and by the level of the subsidies (which could be adjusted or removed)
Reduce risk of policy change	Yes – contracts cannot be changed by policy-makers ex post	Yes – length of price control or cap and floor periods can be set to a level that reduces this risk	No – obligations can be adjusted over time by policy-makers	No – end-user subsidies can be adjusted over time by policy-makers
Reductions in support for successive investments	Yes – support payments can be reduced over time for successive investments	Yes – regulated returns can be reduced over time for successive investments	Yes – obligation certificates can be banded by vintage	Difficult – while an end user subsidy could be designed to reward plants of different vintages separately, this would add significant complexity

Source: Frontier Economics