Department for Energy Security & Net Zero

Green Industries Growth Accelerator: hydrogen and carbon capture, usage and storage supply chains

Call for evidence on the design of the hydrogen and carbon capture, usage and storage supply chain fund

Closing date: 23 April 2024

February 2024

Any enquiries regarding this publication should be sent to us at:
GIGA.CCUSH2@energysecurity.gov.uk

Contents

Introduction

The Green Industries Growth Accelerator (GIGA) is a £960 million fund to support the expansion of strong and sustainable clean energy supply chains across the UK, including: carbon capture, usage and storage (CCUS), engineered greenhouse gas removals (GGRs) and hydrogen; offshore wind and electricity networks; and civil nuclear. This is part of a wider £4.5 billion package of funding for manufacturing to support private sector investment in strategic sectors across the UK.

The aim of this Call for Evidence is to gather input on the design of GIGA to support the manufacturing supply chain in the CCUS (including GGRs) and hydrogen sectors. The evidence we are seeking to collect from respondents will help us to better understand the manufacturing project pipeline and the issues faced by the supply chain within the CCUS and hydrogen sectors.

This engagement exercise will support us in gauging CCUS and hydrogen market readiness for GIGA funding, ahead of intended scheme launch in the summer of 2024.

The Department for Energy Security (DESNZ) and the Department of Business and Trade (DBT) have been conducting market engagement with the Offshore Wind and Electricity Networks sectors to support the development of their GIGA support schemes. We intend to utilise any cross-sector learnings which could be combined with this Call for Evidence to inform final scheme design.

As announced in the Nuclear Roadmap, through GIGA, HMG will invest £300m in partnership with industry to deliver High Assay Low Enriched Uranium (HALEU) enrichment and deconversion capability in the UK. Further detail will be published in due course.

GIGA will seek to maximise the economic opportunity of the net zero transition for the UK, target support at key strategic elements of the supply chain and sustain quality jobs across the UK. A secure and competitive supply chain in the CCUS and hydrogen sectors will be critical in supporting the UK's deployment ambitions within these nascent industries, as well as supporting the growth of a robust greenhouse gas removals (GGR) industry.

The British Energy Security Strategy, [1] published in April 2022, re-stated the government's ambition to deliver CCUS in four industrial clusters and capture and store 20-30 megatonnes of carbon dioxide ($MtCO_2$) per annum by 2030 and doubled our ambition to have up to 10GW of new low carbon hydrogen production capacity by 2030. The Hydrogen Production Delivery Roadmap[2] published in December 2023 clarified that we expect our first 10GW of hydrogen to come from 4GW of CCUS-enabled hydrogen and 6GW of electrolytic hydrogen. Government analysis suggests the UK hydrogen sector could be worth £900 million and support 12,000 jobs by 2030 across hydrogen production, transport and storage technologies for domestic and export markets.[3]

In December 2023, we also published 'Carbon capture, usage and storage: a vision to establish a competitive market' setting out government's vision for the UK CCUS sector in the 2030s to make the UK a global leader in CCUS.[4] Our approach to establishing CCUS will

[1] https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy
[2] https://www.gov.uk/government/publications/hydrogen-production-delivery-roadmap
[3] Internal BEIS analysis based on Energy Innovation Needs Assessment (EINA) methodology with updated scenarios for domestic and global hydrogen demand; figures consider the direct GVA, and jobs linked to hydrogen production, transport and storage, and include jobs associated with both domestic and global hydrogen demand.
[4] https://www.gov.uk/government/publications/carbon-capture-usage-and-storage-a-vision-to-establish-a-competitive-market

create economic opportunity across the UK with up to 50,000 jobs that could be supported by 2030.[5] In March 2023, the Net Zero Growth Plan reiterated our ambition to enable at least 5 MtCO2e pa of engineered GGR removals by 2030.

To achieve these ambitions for the CCUS, GGR and hydrogen sectors and realise the benefits from the growth of these sectors, public and private investment in UK supply chains will be essential. We welcome views of all interested stakeholders which we will consider as we move forward with the scheme design of the Hydrogen and CCUS GIGA supply chain fund.

[5] https://www.gov.uk/government/publications/carbon-capture-usage-and-storage-a-vision-to-establish-a-competitive-market

General Information

Call for evidence details

Issued: 27/02/24

Respond by: 23/04/24

Enquiries to: GIGA.CCUSH2@energysecurity.gov.uk

Call for Evidence reference: Call for evidence on the design of the hydrogen and CCUS supply chain fund including a request for information about current and future projects related to the hydrogen and CCUS supply chain.

Territorial extent: The scope of this call for evidence is UK-wide. Our preferred approach is to allocate support on a UK-wide basis to support hydrogen and CCUS supply chains across the UK. We will continue to work with the devolved administrations as we develop future allocation processes.

Why we are requesting this information and what we will do with it

The Department is requesting input from stakeholders through this call for evidence to inform scheme design, including the allocation of funding from GIGA to better support the expansion of green manufacturing capacity in the UK.

We intend to use the responses to this call for evidence alongside our own internal analysis, sector engagement, and market intelligence to inform the design of the hydrogen and CCUS supply chain fund element of GIGA.

How to respond

Submit a written response through citizen space

Respond online at: https://energygovuk.citizenspace.com/industrial-energy/proposals-for-the-giga-fund-cfe

or

Email to: GIGA.CCUSH2@energysecurity.gov.uk

When responding, please state whether you are responding as an individual or representing the views of an organisation.

Your response will be most useful if it is framed in direct response to the questions posed, though further comments and evidence are also welcome.

Workshops

We will hold two workshops to give you the opportunity to discuss your views on the call for evidence.

Both workshops will cover the same material and will aim to cover key sections of the call for evidence document.

The registration deadline for both workshops is 15 March 2024, 11:59pm.

Register your interest for the workshops here:

- 21 March 2024, 2pm – 4pm: register your interest in attending the 21 March workshop
- 26 March 2024, 10am – 12pm: register your interest in attending the 26 March workshop

The registration form asks for basic information about your company and interest in GIGA. We reserve the right to limit attendance where workshops are oversubscribed.

Confidentiality and data protection

Information you provide in response to this call for evidence, including personal information, may be disclosed in accordance with UK legislation (the Freedom of Information Act 2000, the Data Protection Act 2018 and the Environmental Information Regulations 2004).

If you want the information that you provide to be treated as confidential, please tell us, but be aware that we cannot guarantee confidentiality in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not be regarded by us as a confidentiality request.

We will process your personal data in accordance with all applicable data protection laws. See our privacy policy . We may share your data with the Department for Business and Trade where that department has a direct interest in the policy on which we are gathering evidence.

We will summarise all responses and publish this summary on GOV.UK. The summary will include a list of names or organisations that responded, but not people's personal names, addresses or other contact details.

Quality Assurance

If you have any complaints about the way this call for evidence has been conducted, please email: bru@energysecurity.gov.uk

Objectives of the fund

The objectives of the GIGA hydrogen and CCUS supply chain fund are two-fold:

1. To kickstart the manufacturing of components necessary to overcome supply chain constraints and deliver our deployment ambitions for the hydrogen and CCUS sectors.
2. To leverage private investment into hydrogen and CCUS (including CCUS-enabled GGR) supply chains to maximise economic opportunities for the UK.

Kickstart the manufacturing of components

Hydrogen and CCUS are critical technologies in achieving energy security and net zero, with more than 30 countries actively advancing hydrogen strategies and investing in hydrogen production, infrastructure and sector-specific applications.

As the hydrogen and CCUS industries expand, bottlenecks in the supply of core components could risk delays in the rollout of domestic projects. There have been several studies into the capabilities of the UK supply chain for hydrogen and CCUS that have identified areas where the UK currently has limited manufacturing capabilities and where constraints could occur, such as electrolyser packages, high pressure hydrogen compressor packages, and column vessels. [6]

This fund is seeking to facilitate the scale up of core component manufacture to enable the deployment of domestic hydrogen and CCUS-enabled projects and help develop a sustainable, secure supply chain for the UK. We aim to develop competitive supply chains that will provide long term resilience to our hydrogen and CCUS sectors.

Leveraging private investment to maximise economic opportunities

We have strong deployment ambitions for hydrogen and CCUS in the UK. This presents opportunities for UK supply chains in these nascent sectors to build on our strengths in high-end manufacturing, R&D and innovation.

Whilst manufacturers are seeking to expand their facilities and capabilities, we understand there are barriers to accessing the necessary private capital without a guaranteed demand for their products. In addition to the CCUS Vision and Hydrogen Production Roadmap, we are working with industry to raise awareness of the pipeline of deployment and production projects across the supply chain to provide companies with visibility of opportunities in the UK.

However, we recognise that clear trajectories and large-scale project deployment does not necessarily result in industrial development when we consider lessons from the renewable energy sector. Currently manufacturers are still determining where to establish their businesses based on where the biggest projects are located and what relevant incentives are

[6] https://www.gov.uk/government/publications/supply-chains-to-support-a-uk-hydrogen-economy

available. Once the supply chain develops, relocation becomes more challenging and we, therefore, recognise the need to prioritise supply chain support from the outset.

A primary aim of the fund is to leverage private investment into hydrogen, CCUS and GGR supply chain manufacturing in the UK, providing the access to capital that projects need to get off the ground. We will aim to build on existing strengths of the supply chain to maximise the economic opportunities to attract and direct investment into the UK.

This aligns with the core objective to maximise economic opportunity for UK businesses outlined in the Hydrogen Strategy (2021) and subsequent Sector Development Action Plan (2022), and the CCUS Supply Chain Roadmap (2021). The UK also has a strong investment environment; the government has taken numerous steps to support businesses, such as the British Industry Supercharger and the Industrial Energy Transformation Fund, as well as cross-economy measures, such as permanent full expensing. GIGA will help to ensure the UK continues to build strong supply chains and maximises global growth opportunities.

Funding benefits

Depending on the design of the scheme, the delivery of these core objectives has the potential to provide wider benefits to the hydrogen and CCUS sectors by:

- Increasing UK GVA from sales to both domestic and export markets.
- Increasing the security of supply of CCUS and hydrogen supply chain components.
- Reducing lead times for key components.
- Supporting ‘next generation’ technologies, drawing on the UK’s world-leading R&I base to retain the leading edge over the coming decade.
- Safeguarding and/or providing additional, skilled jobs across the UK, in industrial heartlands, and beyond.

Existing funding

While various funds have been made available to support hydrogen and CCUS technologies across the value chain, none of them target the manufacturing supply chain of these sectors. GIGA aims to address this gap to de-risk supply chain investment and enable the roll out of a hydrogen economy, and the deployment of CCUS and engineered GGR projects.

Examples of UK policy support for Hydrogen and CCUS

Innovation	
Hydrogen Innovation Initiative's Seed programme	A collaborative initiative to identify innovation priorities, crowd in investment, pilot innovation support for businesses and generate enabling knowledge and capability. The consortium has been granted £6 million over two years by Innovate UK to kick-start its efforts, referred to as HII's 'seed' programme. [7]
Net Zero Innovation Portfolio	The Net Zero Innovation Portfolio[8] provides funding for low carbon technologies and systems, to help enable the UK to end its contribution to climate change. The £1 billion fund focuses on 10 priority areas, including hydrogen and carbon capture, usage and storage (CCUS). Funding is available for projects across Great Britain and Northern Ireland. Applications are made via the individual competitions that include: **Direct Air Capture (DAC) and Greenhouse Gas Removal (GGR) Innovation Programme** - supports innovation in DAC and GGR Technologies with a total of around £60 million in funding for two phases, design and feasibility and demonstration. The second phase is now underway and is supported by around £55 million to develop the demonstrators to operational status to capture up to 1000t/CO2/yr by 2025. Each project has been awarded up to £5 million. **Industrial Hydrogen Accelerator (IHA)** - supports projects generating evidence on end-to-end industrial fuel switching to hydrogen. **Hydrogen BECCS Innovation Programme** - supports innovation in hydrogen BECCS (bioenergy with carbon capture and storage) technologies with £31 million in funding. £26.2 million of funding was awarded for the project demonstration stage of the programme, with up to £5 million of funding awarded per project. **CCUS Innovation 2.0** - aims to accelerate the deployment of next generation carbon capture, usage and storage (CCUS) technology in the UK to be deployed at scale by 2030. £20 million in grant funding was available over two calls and successful projects were published in June 2023.[9]

[7] https://es.catapult.org.uk/project/hydrogen-innovation-initiative/
[8] https://www.gov.uk/government/collections/net-zero-innovation-portfolio
[9] https://www.gov.uk/government/collections/carbon-capture-usage-and-storage-ccus-innovation-20-programme

Innovation	
	Accelerating Carbon Capture and Storage Technologies (ACT) 3 - an initiative between 14 countries including the UK - aimed at accelerating and maturing CCS technologies through funding research and innovation projects. UK organisations have received a share of up to a total of £5 million to accelerate the development of carbon capture and storage technologies on an international level.[10]
Industrial Decarbonisation Challenge Fund	£171 million awarded for projects preparing for and conducting FEED studies. Over £41 million went to projects with a major focus on hydrogen production, with the rest supporting CCUS infrastructure in industrial clusters across the UK. This infrastructure can enable the development of further CCUS-enabled hydrogen projects. The challenge fund will increase the competitiveness of industry and contribute to the UK's drive for clean growth.
UKRI Hydrogen storage and distribution supply chain innovation competition	Up to £4.35 million from Innovate UK (part of UKRI) for collaborative research and development (R&D) projects related to hydrogen storage and distribution supply chain.

Production / Deployment	
Net Zero Hydrogen Fund	Worth up to £240m of grant funding to support the commercial deployment and development of new low carbon hydrogen production projects.
Hydrogen Production Business Model (HPBM)	Provides revenue support to overcome the cost gap between low carbon hydrogen and higher carbon counterfactual fuels and aims to support multiple hydrogen production routes to enable us to develop low carbon hydrogen rapidly at scale.
Industrial Carbon Capture business models	The Industrial Carbon Capture (ICC) and Waste ICC business models aim to incentivise the deployment of carbon capture technology by industrial users and waste management facilities who often have no viable alternative to achieve deep decarbonisation.
Renewable Transport Fuel Obligation (RTFO)	Aims to increase the use of renewables as a transport fuel. Hydrogen produced by electrolysis using renewable electricity, as well as biohydrogen, for example produced through direct biomass gasification, are supported through the scheme.
Engineered Greenhouse Gas Removals (GGR) Business Model	The GGR Business Model provides a contract for difference (CfD) revenue support subsidy to attract private investment in a variety of GGR technologies, including CCUS-enabled technologies such as direct air carbon capture and storage (DACCS), and bioenergy with carbon capture and storage (BECCS). The power BECCS business model similarly provides a CfD revenue support subsidy; however it is a dual

[10] https://www.gov.uk/government/publications/accelerating-carbon-capture-and-storage-technologies-act-3-grant-funding-winners

	mechanism (a CfDe + CfDc), mutually rewarding the electricity generated and negative emissions produced, and also harnessing the revenue achieved through the sales of both and topping up to two respective strike prices.

Infrastructure	
Hydrogen Transport and Storage Business Models	Hydrogen transport and storage infrastructure will be critical to enabling our hydrogen ambitions and vital to growing the hydrogen economy to connect producers with consumers and balance misalignment in supply and demand.
Carbon Capture & Storage Infrastructure Fund	We have announced £1 billion of investment to establish two CCUS clusters by the mid-2020s (Track-1) and a further two by 2030 (Track-2). The Carbon Capture & Storage Infrastructure Fund (CIF) will provide capital expenditure for CO2 transport and storage (T&S) networks and for industrial carbon capture projects.

End use	
Tees Valley Hydrogen Hub	£20 million competition for industry to harness the power of hydrogen in new transport projects.
Industrial Energy Transformation Fund	£315 million fund supporting the uptake of technologies that improve energy efficiency and reduce the carbon emissions associated with industrial processes. The IETF is in 3 phases. Phase 3 launched in January 2024 to enable hydrogen fuel-switching and CCUS retrofit amongst a range of other decarbonisation technologies.
Hydrogen Vehicle Systems (HVS)	In 2022, a £15 million grant was announced from the UK Government's Advanced Propulsion Centre (APC) as part of a wider funding package to support zero emission transport.
Zero Emission Bus Regional Areas (ZEBRA) scheme	£270 million announced for the financial year 2021 to 2022 to help local transport authorities (LTAs), outside London, to introduce zero-emission buses and the infrastructure needed to support them.[11]

UK Investment landscape

We are at a critical juncture in the development of the hydrogen and CCUS sectors. Both nascent in the UK, development trajectories in these sectors rely on developers and supply chain companies prioritising these projects and giving them access to finite pools of investment, talent, and supply chains. Projects in these sectors may struggle to attract private investment due to the relative novelty of these technologies, perceived uncertainty about their long-term viability and potential for project-specific challenges. In addition, visibility of the market and commercial opportunities is currently limited whilst the pipeline scales up. Low carbon hydrogen, CCUS and engineered GGR projects involve significant up-front investments, and rely on the development of relevant infrastructure.

[11] https://www.gov.uk/government/publications/apply-for-zero-emission-bus-funding

As such, Government can support projects in these sectors through financial incentives and risk-sharing to help to create a stable investment environment. GIGA funding sits within a wider investment environment within the UK that is bolstered by a number of other Government levers, which together make the country an attractive place for hydrogen and CCUS project future growth.

The UK as a global advanced manufacturing hub

The UK is a global hub for advanced manufacturing and aims to be the best place in the world to start and grow a manufacturing business. Our advanced manufacturing strengths are supported by a strong business environment, a world class network of innovation institutions and universities, and a highly skilled workforce. The UK's strategic focus on clean manufacturing is underscored by the Advanced Manufacturing Plan which sets out the country's prioritisation of investment in the long-term future of manufacturing; a focus on international cooperation and the building of supply chain resilience; and a commitment to reduce costs and remove barriers to boost competitiveness.

The UK government has also implemented several tax measures to support these emerging sectors and boost investment. One notable measure is permanent full expensing, whereby companies can write off the entire cost of investment in one go. This means companies can claim 100% of capital allowances on qualifying new main rate plant and machinery, making the UK's capital allowances regime world-leading and encouraging investment in qualifying plant and machinery.

UK Export Finance (UKEF)

UKEF, the UK's export credit agency, has enhanced its support to attract investment into hydrogen and CCUS supply chains and build-export capability. UKEF's mission is to advance prosperity by ensuring that no viable UK export fails for lack of finance or insurance, doing that sustainably and at no net cost to the taxpayer. UKEF helps UK companies to win export contracts by providing attractive financing terms to their buyers, fulfil export contracts by supporting working capital loans and get paid for exports by insuring against buyer default.

In 2022, UK Export Finance provided its first support to the hydrogen sector by providing Johnson Matthey with a £400m Export Development Guarantee to boost research and development in sustainable technologies ranging from metal recycling to green hydrogen. This will support high-skilled UK jobs, with the company employing thousands of people in green jobs in Hertfordshire, Swindon, Lancashire and London.

In the same year, UKEF also provided a £26m working capital facility to support Wrightbus followed by an additional £50m facility in 2023, to open up new markets for the world's first hydrogen-powered, zero carbon double decker bus. This growth will boost jobs in Ballymena, Northern Ireland, as Wrightbus looks to double its workforce in the next three years, creating 1,000 new highly skilled local green jobs.

For more information on UKEF support contact customer.service@ukexportfinance.gov.uk.

The UK Infrastructure Bank ("UKIB")

UKIB is a new, government-owned policy bank. Its mission is to partner with the private and public sector to increase infrastructure investment to tackle climate change and drive regional

and local economic growth across the United Kingdom. The bank recently published hydrogen and CCUS sector updates which set out how the bank will tackle financing problems in the sectors over the next 12-24 months and help amplify government policy. In its unique position between market and HMG, UKIB can play a leading role in overcoming barriers to investment. All projects seeking support from UKIB must meet its investment principles of:

- Supporting regional and local economic growth or helping to tackle climate change.
- Investing in projects relating wholly or mainly to infrastructure (which includes nature-based solutions, technologies and facilities).
- Delivering a positive financial return; and
- Crowding in significant private capital over time.

We encourage all projects to consider discussing their financing needs with UKIB alongside other sources of capital. If an applicant would like more information about potential UKIB support, please contact projects@ukib.org.uk.

Freeports

Freeports are special areas within the UK offering a comprehensive package of measures, such as tax reliefs, customs, business rates retention, planning, regeneration, innovation and trade and investment support. Since 2021, the government has announced 12 freeports, which are projected to create over 200,000 future jobs, many of which will be in the high-innovation, low-carbon technologies of the future. To date, freeports have already attracted a remarkable £2.9 billion of investment, creating over 6,000 jobs.

Freeports are strategically positioned across the UK and locations include East Midlands; Humber; Liverpool City; Plymouth and South Devon; Solent; Teesside; Thames; Felixstowe and Harwich. The Government has also announced freeports in Forth Green and Cromarty Firth, Scotland. More information can be found at https://www.great.gov.uk/international/content/investment/how-we-can-help/freeports-in-the-uk/. If an applicant is seeking further information on freeports, please contact freeports@businessandtrade.gov.uk.

Investment Zones

The Government has established Investment Zones which aim to boost economic activity by offering tax and customs incentives to businesses, encouraging investment, innovation and growth in key industries. The zones facilitate collaboration between business, academia, and government to provide a supportive environment for planning, infrastructure, innovation and skills. 12 Investment Zones have been announced, with 8 in England, 2 in Scotland, and 2 in Wales. More information can be found at https://www.gov.uk/government/publications/investment-zones. If an applicant is seeking further information on Investment Zones, please contact Investment.Zones@businessandtrade.gov.uk.

Made Smarter Adoption Programme

This government initiative is focused on digital transformation for SME manufacturers and provides funding for small and medium sized enterprises to help modernise, adopt cutting-edge technology and create new jobs. The programme supports manufacturers in regions including the Northwest, Northeast, Yorkshire, and the Humber, to drive sustainable growth in the manufacturing sector.

For more information, visit https://www.madesmarter.uk/adoption/

British Business Bank

Support is also available for smaller businesses: the British Business Bank (BBB) is the UK Government's economic development bank. Its core mission is to drive sustainable growth and prosperity across the UK, and to enable the transition to a net zero economy, by improving access to finance for businesses.

Recognising that smaller businesses have a vital role to play in the transition to a sustainable and net zero carbon economy, ‘Building the modern, green economy' is one of the Bank's four strategic objectives. It is currently exploring the potential use of its existing products including guarantees to catalyse lending and investment into critical transition themes, continuing to work closely with government departments.

Given the importance of place-based finance, the BBB will also explore green investment issues including through the new Nations and Regions Investment Funds, which support economic growth by leveraging private sector investment across a broad range of sectors and incorporating net zero considerations.

BBB also works with the wider small business and finance market ecosystems to raise awareness of potential solutions. For instance, through the 2022 Green to Grow campaign, the BBB provided information to small businesses from a wide range of sources on the benefits of sustainability, explaining how finance can help and providing case studies that highlight good practices and champions. The BBB is also working with Bankers for Net Zero on solutions to make GHG emissions reporting frictionless for small companies.

More information about BBB can be found at https://www.british-business-bank.co.uk/

Scope of funding

CCUS supply chain

Overview of the supply chain

The CCUS supply chain includes all components and services that serve the capture, usage, transportation, and storage elements of CCUS and many aspects of CCUS enabled GGR projects. These include:

- Carbon capture plant design and engineering, including individual areas of supply chain activity for specific types of capture plants and for different industrial applications (i.e., for paper mills, cement plants)
- Major plant fabrication, equipment design, and manufacture
- Construction and commissioning of carbon capture plants
- Supply and installation of pipework for both onshore and offshore transportation.
- Marine transport of CO2 and marine loading and offloading
- Storage wells, subsurface and reservoir design and engineering
- Marine and subsea contractors and service providers
- Raw materials that enable supply chain activity in the capture, usage, transportation and storage elements of CCUS

With the pace of CCUS activity accelerating across the globe, the UK has been rated amongst the top five nations globally for CCUS readiness.[12] We have progressed rapidly to take forward the development of four CCUS clusters: HyNet (Northwest England and North Wales), East Coast Cluster (Teesside and the Humber, Northeast England), Acorn (Northeast Scotland) and Viking CCS (the Humber).

There is an opportunity for UK supply chains to develop new capabilities and secure a global market share for CCUS and GGR technologies; with a successful UK supply chain being key to creating and sustaining high-skilled, high-value jobs and supporting low carbon growth in our industrial clusters. A recent supply chain report outlined that UK carbon capture and storage could be worth £100 billion to local manufacturing employers.[13] The CCSA estimates that expenditure on Net Zero CCUS (including hydrogen and GGRs) could reach c.£41bn by 2035, with 85% of this value to be found onshore[14].

In July 2023, the CCSA published the CCUS Supply Chain Good Practice Guidance Document[15]. This industry-led strategy, and the commitments within it, was developed in partnership the Supply Chains Working Group of the CCUS Council, led by Lord Hutton of Furness, bringing together trade bodies, Track 1 clusters, engineering procurement and construction companies (EPCs) and key technology developers. The government worked

[12] Statista (2023), 'The Carbon Capture and Storage (CCS) Readiness Index Worldwide in 2023', www.statista.com/statistics/1411813/carbon-capture-and-storage-readiness-index-by-country-worldwide/
[13] The UK Offshore Energies Association (2022), 'CCUS Supply Chain Report', oeuk.org.uk/product/ccs-supply-chain-report-2022/
[14] https://www.ccsassociation.org/resources/download/?id=1191
[15] https://www.ccsassociation.org/all-news/ccsa-news/ccsa-launches-new-ccus-supply-chain-strategy/

closely with industry through the working group to address the key strategic issues to enable UK supply chains to realise the economic benefits of our CCUS deployment programme.

The CCUS Good Practice Guidance Document is intended to ensure the UK can build a domestic CCUS supply chain which maximises the economic benefits the CCUS cluster programme will bring both to the local and national economy. The document set out a series of industry-led commitments, including their approach to promoting UK supply chain opportunities, jobs created and sustained through CCUS projects and investment in training and skills. The guidance also sets out a pathway for delivering UK content ambitions in CCUS projects that are consistent with those put forward in the North Sea Transition Deal (NSTD), including a headline voluntary, industry-led local content ambition of 50%.

In support of this, we published two studies in July 2023 on opportunities for economic growth in the UK's CCUS industry[16] and industrial carbon capture, usage and storage supply chain capabilities[17]. The studies outlined that the onshore equipment cost of delivering our ambition to capture 20 to 30 megatonnes (Mt) of CO_2 per year by 2030 could be in the order of £3 billion to £4.5 billion and that the UK supply chain has significant opportunities to deliver on a significant portion of this spend.

Alongside the opportunities presented in the manufacture of key components, there are significant strengths for the UK in engineering design, construction and construction management services. The UK has a long tradition of providing these services, which make up a significant part of the CCUS supply chain, and the UK has a potential to be one of the world leaders in emerging industries that build on our successes in CCUS sector, such as engineered GGRs. In 2021, the National Infrastructure Commission highlighted that engineered GGRs could become "a major new infrastructure sector for the UK" worth billions of pounds per year by 2050.[18] This therefore represents a major economic opportunity for the UK, playing to a nationwide strength in high value technical design, with a strong skilled workforce and R&D infrastructure for specialist engineering development and bespoke manufacturing[19].

Potential areas of scale up

Existing analysis has identified a number of components in the UK as high value opportunities with the potential for significant domestic capability and capacity. As part of the development of the CCSA's industry led supply chain strategy, the government commissioned a study by Arup into supply chain capabilities in the UK CCUS value chain. The study identified the following components as high value opportunities[20]:

- **Column Vessels**: the largest component in a typical carbon capture plant by both size and cost. Arup concluded that the UK is well placed for an expansion in column vessel

[16] Department for Energy Security and Net Zero (2023), 'Opportunities or Economic Growth in the UK's CCUS Industry', www.gov.uk/government/publications/opportunities-for-economic-growth-in-the-uks-ccus-industry

[17] Department for Energy Security and Net Zero (2023), Industrial carbon capture, usage and storage (CCUS): UK supply chain capabilities', www.gov.uk/government/publications/industrial-carbon-capture-usage-and-storage-ccus-uk-supply-chain-capabilities

[18] National Infrastructure Commission (2021): Engineered greenhouse gas removals

[19] https://www.gov.uk/government/publications/industrial-carbon-capture-usage-and-storage-ccus-uk-supply-chain-capabilities

[20] https://assets.publishing.service.gov.uk/media/64ad6830c033c10010806004/ccs-supply-chain-uk-value-study-arup-pdfa.pdf

manufacturing, given the current capability, readiness, size of market and applicability to other markets.

- **Column Internals**: similarly, a large component by cost, this also represents a potential expansion area, however they are less applicable in other non-CCUS markets.
- **Heat exchangers**: Standard exchangers are deemed as low value and low speciality, but gas-gas exchangers and crossover exchangers are considered high value and high speciality component types. The UK has a well-developed manufacturing base for industrial heat exchangers, and the scale and range of the parts being produced demonstrates the capability of the current supply chain.
- **Process controls**: Basic Process Control System is a critical opportunity area due to the central importance of monitoring across the capture, transport and storage value chain, the importance of balancing the demands of the system and communication across the networked assets, and the sensitivity and variability across store types.

Similarly, analysis shows the UK has significant capability in the supply of **measuring, monitoring and verification (MMV)**, holding a comparative advantage internally compared to some of our key competitors[21].

There is also evidence of a gap in the UK supply chain for **compressors** as few international manufacturers currently produce equipment to the scale needed. A report by the Nuclear Advanced Manufacturing Research Centre (NAMRC) recommends addressing this by the UK taking the lead in producing large transportable modules through UK manufacturers or focus on expanding the capabilities of internal centrifugal pump manufacturers[22].

Arup have also identified **modularised carbon capture technology packages** as a further high value opportunity for the UK.[23] This technology is novel and innovative and will be crucial to the CCUS sector as it develops, with several UK companies already identified. We understand this technology will be more likely to have a lower technology readiness level (TRL) than more established components such as compressors and heat exchangers. Given analysis shows this technology could become crucial to the CCUS sector, we are considering whether this product fall in scope of GIGA funding.

Summary table of key components

Component	Description
Column vessels	Column vessels are pressurised steel cylinders and are the largest item in a capture plant by both physical size and capex. Several column vessels are needed for solvent-based capture plants.
Column internals	Column internals are components that are used inside a column vessel to improve mass transfer capabilities. They are designed to help separate different components of a mixture.
Process controls	These include control interfaces and dashboards as well as connected linear monitoring and controls.

[21] In addition, in the December 2023 consultation response to the GGR and Power BECCS Business Model, HM Government outlined our intended position to develop its own high-integrity GGR Standard, lending further credibility to UK MMV competitive advantage and leadership.
[22] https://namrc.co.uk/wp-content/uploads/2022/03/CCUS-supply-chain-intervention-strategy.pdf
[23] https://assets.publishing.service.gov.uk/media/64ad6830c033c10010806004/ccs-supply-chain-uk-value-study-arup-pdfa.pdf

Component	Description
Heat Exchangers	High value and high speciality component types are gas-gas exchangers and crossover exchangers. These are required to cool or heat various streams within the carbon capture plant.
MMV equipment	Consists of optical, photographic, cinematographic, measuring and checking instrumentation and apparatus (e.g., pressure gauges, gas analysers). Crucial across capture, transport and storage processes.
Compressors	Technology to compress CO2 for storage and will be required across the supply chain.
Modular carbon capture packages	Capture plants offered as packages of assembled components on modules/skids, occasionally complemented with offered maintenance and operational services.

Questions:

1. **How important are the following components in overcoming supply chain restraints, delivering our deployment ambitions and maximising economic opportunities in the CCUS sector?**
    - **Column vessels**
    - **Column internals**
    - **Heat exchangers**
    - **MMV equipment**
    - **Process controls**
    - **Compressors**
    - **Modular carbon capture technologies**

    Please rate them one of the following options and explain your rationale: Very important, somewhat important, not important, don't know.

2. **Do you think any additional components should be targeted by this fund? If yes, please suggest which and provide justification.**

Hydrogen supply chain

Overview of the supply chain

The supply chain to the hydrogen economy includes:

- Utilities, providing either raw materials or energy to enable hydrogen production (e.g. methane).
- The supply chain that supports hydrogen manufacture, including the production of hydrogen manufacturing equipment and relevant supply chains (e.g. electrolysers).
- Hydrogen transport, distribution and storage, including pipeline and vessel/vehicle transport, underground (caverns, saline aquifers, etc.). and above ground (tank) storage and fuelling infrastructure.
- Monitoring and control.

- Manufacture of fuel cell components and fuel cells.
- Hydrogen carrier chemicals and materials.
- End user markets.
- Decommissioning and end of life valorisation.[24]

In the UK Hydrogen Strategy and Hydrogen Sector Development Action Plan, government outlined its commitment to promoting the growth of world-class, sustainable supply chains to underpin deployment of early commercial-scale UK hydrogen projects over the 2020s, and to be ready to support expansion of the sector from the 2030s.

The level of ambition for hydrogen in the UK, up to 10GW of production capacity by 2030, presents significant opportunities for UK companies and employees. The UK is already well positioned to grow and develop supply chain capabilities across the hydrogen value chain; covering production, transmission, distribution and storage and a wide range of potential end uses, including industry, power, transport and heat.

However, the nascency of the sector means there remain significant market barriers, including uncertainty around low carbon hydrogen demand and imperfect market information, infrastructure challenges, investor uncertainty, and early mover disadvantage. This means all forms of associated investment in hydrogen may be higher cost and perceived high risk for investors, and many projects may bear the brunt of any technological and commercial risks that come with deploying new technologies.

A government-commissioned review of the UK supply chain[25], published in July 2022, developed our understanding of what is needed to deliver a successful and prosperous hydrogen economy. The research project mapped economic opportunities based on projected demand, and explored existing capabilities, strengths, and gaps in the UK supply chain. The project also developed models to characterise the future UK hydrogen value chain. This showed there is a range of opportunities for UK companies to benefit from the domestic deployment of hydrogen and global export opportunities.

The review found that there are attractive market opportunities, and UK supply chain gaps, in electrolysis package manufacture, reformer package manufacture and high-pressure hydrogen compressor package manufacture.

Delivering more than half of the 2030 production ambition through electrolytic production capacity presents opportunities to draw on leading UK capabilities. Electrolysers are the single largest cost component of the electrolytic production process, potentially representing at least 40% of total capital expenditure (CAPEX) costs. The research has shown that the UK has substantial expertise in electrolysers, and so is well positioned to play a key role in meeting this future demand. This includes being home to a range of developers of electrolyser technologies and a global leader in proton exchange membrane (PEM) electrolysers that are already exported globally. This makes the UK an ideal location for investment in the electrolyser supply chain to address the future global market.

CCUS-enabled hydrogen production, primarily through natural gas reforming combined with CCUS, will play an important role in meeting the production ambition and presents a major opportunity to the UK supply chain. The research showed that the UK has world-leading

[24] 'Supply Chains to Support a Hydrogen Economy', Optimat-Wood, https://www.gov.uk/government/publications/supply-chains-to-support-a-uk-hydrogen-economy
[25] https://www.gov.uk/government/publications/supply-chains-to-support-a-uk-hydrogen-economy

expertise to draw upon – with two of the world's major process licensors for these projects based in the UK – and a mature supply chain to utilise from wider industries such as oil & gas and chemicals. Initial projects as part of the CCUS cluster sequencing process are therefore expected to play an important role in developing our supply chains.

Developing the compressors needed for high-pressure transmission of hydrogen also presents a significant opportunity. There is currently a global shortage of suppliers for high-capacity compressors for hydrogen and this is a potential market that could be met by UK suppliers in the future, drawing upon existing UK capabilities in smaller-scale compressors and wider strengths in high-value engineering. Since Summer 2023, Hydrogen UK has been leading work, overseen by the Hydrogen Delivery Council's jobs, skills and supply chains working group, to identify high value opportunities and areas of future potential in the UK supply chain. We are grateful for industry's leadership and welcome the initial analysis and outline voluntary commitments to UK content they are setting out. We look forward to seeing the full findings and analysis which will be valuable evidence to help further guide the development of this fund.

We are interested in hearing from stakeholders on whether the three overarching areas of the supply chain identified above are the right priorities for hydrogen in the short term. The hydrogen economy is nascent so we will monitor and evaluate developments to ensure we continue to focus on the right areas as the economy develops.

Questions

3. **How important are the following components in overcoming supply chain restraints, delivering our deployment ambitions and maximising economic opportunities in the Hydrogen sector?**
    - **Electrolyser packages**
    - **Reformer packages**
    - **Compressor packages**

Please rate them one of the following options and explain your rationale: Very important, somewhat important, not important, don't know.

4. **Do you think any additional components should be targeted by this fund? If yes, please suggest which and provide justification.**

Funding stages

Technologies across hydrogen and CCUS supply chains will be at differing levels of maturity, and we are seeking to target developed technologies that will maximise the impact of GIGA funding. There are different stages in a technology's development cycle, where funding support may be needed:

- **CAPEX:** investment in physical assets e.g. infrastructure, machinery, equipment. This type of funding would be most useful to projects producing well established and mature technologies. CAPEX will have an immediate impact in helping companies overcome key barriers being early movers in a nascent market.

- **DEVEX:** costs associated before project build such as feasibility and front-end engineering and design (FEED) studies. Devex would target projects struggling in the gap between innovation and commercial deployment, and therefore may enable broader range of projects to come forward. However, the impacts on advanced manufacturing will likely be in the medium term to long term, rather than the more immediate impact made by CAPEX.
- **R&D:** funding allocated for scientific and technological research activities to foster innovation. This is key for driving advancement in tech and innovation and would likely capture the largest number of projects in the supply chain, however, will have limited immediate economic impact and the overall benefits will be much more difficult to ascertain.

To achieve GIGA's core aims and objectives and scale up manufacturing of key components, it is likely that companies will have to overcome barriers such as the high CAPEX required to invest in physical assets. We therefore believe CAPEX support is best situated to help deliver GIGA's key objectives, given compared to other types of funding it will have most impact on manufacturing overall and will be most effective in scaling up manufacturing in key technologies. We understand the critical role of R&D funding in the UK supply chain for CCUS and hydrogen as the most effective way to aid technological development. This is why the government has made a number of funding pots available for R&D (full list found pages 8,9 and 10) for new CCUS and hydrogen technologies. The UK continues to be a world leader in the innovation of new technologies.

However, we do also acknowledge that given the nascency of the hydrogen, CCUS and GGR sectors, some technologies within the sector that will likely become critical elements in the value chain may not currently be commercially ready. For example, modularised carbon capture technologies will be critical to the widespread rollout of CCUS, and the UK is well positioned to be a world leader in this market with a number of UK companies already operating in this space. However, these technologies are highly innovative, and companies are at different stages of development.

Given these nuances, we will likely determine whether a project is at a mature enough level to be applicable for GIGA funding through **technology readiness levels (TRLs)**. These are used to understand maturity of a technology, ranging from 1 (basic research) to 9 (fully mature and deployed technology). We propose using the definition of TRLs consistent with the Net Zero Hydrogen Fund as appropriate for any scheme we design for this fund[26]. For a technology to be ready to scale advanced manufacturing capacity, it should be in the later stages of development, demonstrating successful integration at system level, having undergone testing in relevant environments. A TRL of 7 or higher indicates relatively mature technology proven in a realistic operational environment.

We intend to gather information through our request for information on the technology readiness levels of projects in the pipeline and use this data to inform our scheme design.

[26] https://apply-for-innovation-funding.service.gov.uk/competition/1540/overview/9c2c00ea-5749-42af-abd5-c7026d0e4f64?_ga=2.27652924.1870850959.1706636167-2124172519.1676366876#supporting-information

Fund Design

Overview

The fund will be set up to support the expansion of strong clean energy supply chains for the UK, including carbon capture, usage and storage (CCUS), electricity networks, hydrogen, nuclear and offshore wind. Therefore, where possible, we will aim to be consistent in the design of the funds' application and evaluation processes across the different sectors.

The funding for hydrogen and CCUS supply chains will be available from 2025/26 over a five-year period. This call for evidence and further market engagement will be essential for us to understand the market readiness to receive the funding from 2025. If there is a sufficient appetite from credible applicants, we intend to launch an application round in the summer of 2024 with further applications rounds to follow. This would allow the initial round of successful applicants to begin to drawdown their funding from 2025.

Ahead of launching an application round, we will publish full application guidance that will set out the assessment process, including all evaluation criteria. As the fund aims to provide vital support to the CCUS and hydrogen supply chains at the earliest point, we will seek to minimise administrative burden of the assessment processes where possible and work closely with applicants to support their progress throughout. Any scheme will be designed to ensure it complies with all international obligations and subsidy control requirements.

Request for Information

As part of our call for evidence process, we are looking to build a clear picture of the project pipeline in the UK for CCUS (including CCUS-enabled GGR) and hydrogen manufacturing projects through the below request for information. The questions are intended to identify future projects that will expand the manufacture of components within the CCUS and hydrogen supply chains in the UK.

If you are a manufacturer of products or equipment in the CCUS, CCUS enabled GGR and/or hydrogen value chains or are looking to pivot towards CCUS, CCUS enabled GGR and/or hydrogen component manufacturing, please provide answers to the below questions. **We want to hear from all future projects, regardless of its stage of development, even if the project is currently only at a hypothetical or conception stage.** We ask that you please fill out the below to the best of your ability.

Given the nascency of the CCUS and hydrogen sectors in the UK, we want to build a clear picture of the pipeline of projects that exist to expand the manufacture of CCUS, CCUS enabled GGRs and hydrogen components. Therefore, your answers will allow us to further our understanding of both sectors and the pipeline of projects that exists within that, to ensure the fund is designed in the optimal way to serve the industry, meaning the more information that is provided, even if from projects at early stages of thinking, will enable us to best design the CCUS and hydrogen GIGA scheme to benefit for the sectors.

Please note the below questions are a request for information and are not a formal expression of interest or application for GIGA funding. Therefore, an inability to answer or provide a detailed answer to all questions will not mean your project will be viewed unfavourably or prevent any future applications. The information provided will be used to develop our internal understanding of the CCUS and hydrogen manufacturing project pipeline, and we aim to follow up with projects that are of particular interest to us for further information.

Questions

5. Introductory question

How would you describe your interest in GIGA?

- A manufacturer of components or technology provider within the hydrogen and/or CCUS [27] supply chain **with** a current, future or potential project you believe would be applicable for GIGA funding (please answer sections 6-14. You are also welcome to offer views in section 19-21).
- A manufacturer of components or technology provider within the hydrogen and/or CCUS supply chain **without** a current, future or potential project you believe would be applicable for GIGA funding (please answer sections 15-18. You are also welcome to offer views in section 19-21).
- Non-manufacturer who will hold an interest in GIGA, e.g., Project developer; engineering, procurement and construction (EPC) company; trade association; end user of components, or other non-manufacturer in the hydrogen and/or CCUS supply chains (Please answer sections 19-21).

Sections 6 – 15: for manufacturers of components or technology providers within the hydrogen and/or CCUS supply chain with a current, future or potential project you believe would be applicable for GIGA funding.

6. Organisation overview

a) Please can you provide an overview of your organisation and your involvement to date in the hydrogen and/or CCUS market **(max 100 words).**

b) Is this your first entry into the hydrogen and/or CCUS market?

- Yes
- No
- Prefer not to say

c) [*If yes*] What are your existing hydrogen and/or CCUS supply chain investments, both in the UK and globally? **(max 100 words)**

[27] Where CCUS is referred to it is also applicable to CCUS-enabled greenhouse gas removal (GGR) projects.

d) Do you have previous experience delivering on projects that you think would be applicable for GIGA, for example, building a gigafactory?

- ☐ Yes
- ☐ No
- ☐ Don't know

e) [*If yes*] Please provide some detail on your experience **(max 100 words).**

7. Project overview

a) Please can you give an overview of your project and how it relates to the manufacturing of components used in hydrogen production or CCUS systems, and, if applicable, what components you plan to produce **(max 200 words).**

b) Where will the project be located? Or which locations are you considering?

c) Is this a new project or an expansion on an existing project?

- ☐ New project
- ☐ Expansion on an existing project

d) What will be the capacity of the project (e.g., how many of x component will it produce annually, sold at y price?) **(max 100 words).**

8. Project timeline

a) Please provide detail on the expected timelines of your project, including what stage of planning you are currently at **(max 100 words).**

b) Expected timings for financial investment decision (FID) **(max 50 words).**

c) Anticipated time for construction and completion, and commercial operation dates **(max 50 words).**

9. Project finance

a) Please provide details on how you intend to finance your project and how GIGA funding sits within your plans **(max 100 words).**

b) How important is the availability of GIGA funding for your decision on whether to invest in the UK? **(max 100 words).**

c) What would happen to the project without GIGA funding? **(max 100 words).**

d) What proportion of the project cost would you expect GIGA to fund? [%]

10. Project costs

a) Please give an outline of the project cost breakdown as per the below. Please leave blank costs are not applicable to your project or are unknown:

   i. CAPEX:
   ii. OPEX:
   iii. DEVEX:

b) How confident are you that this will be the final cost of the project?

- ☐ Very confident
- ☐ Somewhat confident
- ☐ Don't know
- ☐ Not confident

c) If you expect the final cost will change, what do you think would be the main reason for the change? **(max 100 words).**

11. Project economic impact

a) What is the expected turnover once the project is fully operational? [£ /annum]

b) Do you expect to sell domestically or export?

- ☐ Domestically
- ☐ Export
- ☐ Both

c) [*If both*] can you provide an anticipated split between the two?

d) How many jobs do you estimate the project will support if your full deployment ambitions are realised?

e) What will be the most common skill level requirement for the jobs supported by the project? Explanations of the levels can be found here.

- ☐ Level 1
- ☐ Level 2
- ☐ Level 3
- ☐ Level 4
- ☐ Level 5
- ☐ Level 6
- ☐ Level 7
- ☐ Level 8

12. Potential barriers

a) Please provide details on potential barriers that you anticipate could harm your project deployment ambitions and the primary obstacles you believe could cause delays to the development of your project (max 200 words).
b) Please can you provide details of any challenges you anticipate that could harm the economic sustainability of the project in the UK throughout its lifetime following grant funding **(max 100 words).**

13. Component factors

a) What is the technology readiness level (TRL) of the product you would be manufacturing?

- ☐ **TRL 1 – Basic Research.** Scientific research begins to be translated into applied research and development.
- ☐ **TRL 2 – Applied Research**. Basic physical principles are observed, practical applications of those characteristics can be 'invented' or identified. At this level, the application is still speculative. There is not experimental proof or detailed analysis to support the conjecture.
- ☐ **TRL 3 – Critical Function or Proof of Concept Established.** Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
- ☐ **TRL 4 – Laboratory testing, validation of Components or Processes.** Basic technological components are integrated - Basic technological components are integrated to establish that the pieces will work together.
- ☐ **TRL 5 – Laboratory Testing of Integrated or Semi-Integrated System.** The basic technological components are integrated with reasonably realistic supporting elements so it can be tested in a simulated environment.
- ☐ **TRL 6 – Prototype System.** Verified A representative model or prototype system, tested in a relevant environment.
- ☐ **TRL 7 – Integrated Pilot System Demonstrated.** Prototype near or at planned operational system, requiring demonstration of an actual system prototype in an operational environment.
- ☐ **TRL 8 – System Incorporated in Commercial Design**. Technology is proven to work - Actual technology completed and qualified through test and demonstration.
- ☐ **TRL 9 – System Proven and Ready for Full Commercial Deployment.** Actual application of technology is in its final form - Technology proven through successful operations.

b) What sectors will the component you will produce be able to serve? Please tick all that apply.

- ☐ CCUS
- ☐ Hydrogen
- ☐ Oil and gas

- ☐ Greenhouse Gas Removal (GGRs)
- ☐ Other

c) [*If other*] Please specify.

d) Please provide detail of your view of what the market in the UK looks like for this component, including, if possible, the number of UK manufactures and estimated UK production capacity **(max 200 words).**

e) Please provide detail on the global production capacity of this component **(max 100 words).**

14. Other information

a) Please provide any other information you think relevant regarding your project **(max 250 words).**

Sections 15 – 18: For manufacturers of components or technology providers within the hydrogen and/or CCUS supply chain without a current, future or potential project you believe would be applicable for GIGA funding.

15. Organisation overview

a) Please can you provide an overview of your organisation and your involvement to date in the hydrogen and/or CCUS market **(max 100 words).**

16. Current operations

a) Please provide detail on your current hydrogen and/or CCUS manufacturing operations **(max 200 words).**

b) Please provide details on any hydrogen and/or CCUS projects you are currently serving or are contracted with **(max 100 words)**.

c) Please provide details on the demand you are currently experiencing for the components you are manufacturing, including how full your orderbook is currently **(max 100 words)**.

17. Future project plans

a) Do you think you would plan to make any investments in the hydrogen and/or CCUS manufacturing market in the future? If so, what components would you begin to manufacture, or expand current manufacturing capacity of? **(max 200 words)**

b) Has the introduction of GIGA changed your business planning?

- ☐ Yes

☐ No

c) [*If yes*] Please provide detail on how GIGA has changed your business planning **(max 200 words)**.

d) Please provide details, if possible, on your timelines for deciding whether to make new investments in the UK hydrogen and/or CCUS manufacturing sector **(max 100 words)**.

e) Please provide details, if possible, on costs for any future project you may decide to deploy **(max 100 words).**

18. Other information

a) Please provide any other information you think relevant **(max 250 words)**.

Sections 19 – 21: Questions for non-manufacturers, such as developers, EPCs, trade associations or end users of manufactured hydrogen and/or CCUS components. Manufacturers are also welcome to offer views on the below.

19. GIGA supply chain prioritisation

a) Please provide details of your view of where GIGA funding would be best targeted within the hydrogen and/or CCUS supply chain **(max 250 words).**

Examples of information we would like to see, if possible, include:

- *What components do you believe GIGA funding should support scaling up manufacturing.*
- *Your assessment of key areas of priority in each sector.*
- *Your assessment of where key opportunities lie for UK plc in each sector.*

20. Supply chain bottlenecks and barriers

a) Please provide details on your view of the key bottlenecks currently in the hydrogen and/or CCUS supply chains **(max 250 words).**

Examples of information we would like to see, if possible, include:

- *Any particular components you are currently struggling to procure.*
- *An assessment of procurement timelines across the sectors for key components.*
- *How far do you think these bottlenecks will harm your deployment ambitions?*

b) To what extent could the costs of components across the hydrogen and/or CCUS value chains could be a barrier to deployment across the sector? **(max 100 words)**

c) Are there any other key supply chain barriers that will harm deployment across the hydrogen and/or CCUS sectors? **(max 200 words)**

21. UK supply chain capability and capacity

a) Please provide details of your view of any components in the hydrogen and/or CCUS supply chains where the UK holds significant capacity and/or capability **(max 250 words).**

Examples of information we would like to see, if possible, include:

- *Any components you feel the UK does not have capacity in manufacturing.*
- *That a lack of UK capacity and capability in these components will be a barrier to deployment across the sector.*
- *Whether you are looking to source components for your own projects in the UK, and detail on the difficulty of doing so.*

Next Steps

A response to this call for evidence will be published once the government has analysed all the data. Further information on the next steps will be outlined in that response document, ahead of the intended launch in the summer of 2024.

If you need a version of this document in a more accessible format, please email GIGA.CCUSH2@energysecurity.gov.uk Please tell us what format you need. It will help us if you say what assistive technology you use.

This call for evidence is available from: https://www.gov.uk/government/calls-for-evidence/green-industries-growth-accelerator-hydrogen-and-ccus-supply-chains

Call for Evidence Questions

List of questions

Please find below a full list of the call for evidence questions within this document for your consideration:

1. **How important are the following components in overcoming supply chain restraints, delivering our deployment ambitions and maximising economic opportunities in the CCUS sector?**
   - **Column vessels**
   - **Column internals**
   - **Heat exchangers**
   - **MMV equipment**
   - **Process controls**
   - **Compressors**
   - **Modular carbon capture technologies**

2. **Do you think any additional components should be targeted by this fund? If yes, please suggest which and provide justification.**

3. **How important are the following components in overcoming supply chain restraints, delivering our deployment ambitions and maximising economic opportunities in the Hydrogen sector?**
   - **Electrolyser packages**
   - **Reformer packages**
   - **Compressor packages**

4. **Do you think any additional components should be targeted by this fund? If yes, please suggest which and provide justification.**

Introductory Question:

5. **How would you describe your interest in GIGA?**

Project specific request for information: questions for manufacturers:

Sections 6-14: Projects with a current, future or potential project.

6. **Organisation overview**

a) Please can you provide an overview of your organisation and your involvement to date in the hydrogen and/or CCUS market (max 100 words).

b) Is this your first entry into the hydrogen and/or CCUS market?

c) Is this a new project or an expansion on an existing project?

d) What will be the capacity of the project (e.g., how many of x component will it produce annually, sold at y price?)

7. Project overview

a) Please can you give an overview of your project and how it relates to the manufacturing of components used in hydrogen production or CCUS systems, and, if applicable, what components you plan to produce.

b) Where will the project be located?

c) Is this a new project or an expansion on an existing project?

d) What will be the capacity of the project (e.g., how many of x component will it produce annually, sold at y price?)

8. Project Timeline

a) Please provide detail on the expected timelines of your project, including what stage of planning you are currently at

b) Expected timings for financial investment decision (FID)

c) Anticipated time for construction and completion, and commercial operation dates

9. Project finance

a) Please provide detail on how you intend to finance your project and how GIGA funding sits within your plans.

b) How important is the availability of GIGA funding for your decision on whether to invest in the UK?

c) What would happen to the project without GIGA funding?

d) What proportion of the project cost would you expect GIGA to fund? [%]

10. Project costs

a) Please give an outline of the project cost breakdown as per the below. Please leave blank costs are not applicable to your project or are unknown.

b) How confident are you that this will be the final cost of the project?

c) If you expect the final cost will change, what do you think would be the main reason for the change?

11. Project economic impact

a) What is the expect turnover once the project is fully operational? [£ /annum]

b) Do you expect to sell domestically or export?

c) [If both] can you provide an anticipated split between the two?

d) How many jobs do you estimate the project will support if your full deployment ambitions are realised?

e) What will be the most common skill level requirement for the jobs supported by the project?

12. Potential barriers

a) Please can you provide detail on potential barriers that you anticipate could harm your project deployment ambitions, and the primary obstacles you believe could cause delays to the development of your project.

b) Please can you provide detail of any challenges you anticipate that could harm the economically sustainability of the project in the UK throughout its lifetime following grant funding.

13. Component factors

a) What is the technology readiness level (TRL) of the product you would be manufacturing?

b) What sectors will the component you will produce be able to serve?

c) [If other] Please specify.

d) Please provide detail of your view of what the market in the UK looks like for this component, including, if possible, the number of UK manufactures and estimated UK production capacity (max 200 words).

e) Please provide detail on the global production capacity of this component (max 100 words).

14. Other information

a) Please provide any other information you think relevant regarding your project (max 250 words).

Sections 15 – 18: Projects without a current, future or potential project

15. Organisation overview.

a) Please can you provide an overview of your organisation and your involvement to date in the hydrogen and/or CCUS market.

16. Current operations.

a) Please provide detail on your current hydrogen and/or CCUS manufacturing operations.

b) Please provide detail on any hydrogen and/or CCUS projects you are currently serving or are contracted with.

c) Please provide detail on the demand you are currently experiencing for the components you are manufacturing, including how full your orderbook is currently.

17. Future project plans.

a) Do you think you would plan to make any investments in the hydrogen and/or CCUS manufacturing market in the future? If so, what components would you begin to manufacture, or expand current manufacturing capacity of?

b) Has the introduction of GIGA changed your business planning?

c) [If yes] Please provide detail on how GIGA has changed your business planning.

d) Please provide detail on your timelines for deciding whether to make new investments in the UK hydrogen and/or CCUS manufacturing sector.

e) Please provide detail, if possible, on costs for any future project you may decide to deploy.

18. Other information.

a) Please provide any other information you think relevant.

Section 19-21: Questions for non-manufacturers

19. GIGA Supply Chain Prioritisation.

a) Please provide detail of your view of where GIGA funding would be best targeted within the hydrogen and/or CCUS supply chain.

20. Supply chain bottlenecks and barriers.

a) Please provide detail on your view of the key bottlenecks currently in the hydrogen and/or CCUS supply chains.

b) To what extent could the costs of components across the hydrogen and/or CCUS value chains could be a barrier to deployment across the sector?

c) Are there any other key supply chain barriers you think will harm deployment across the hydrogen and/or CCUS sectors?

21. UK supply chain capability and capacity.

a) Please provide detail of your view of any components in the hydrogen and/or CCUS supply chains where the UK holds significant capacity and/or capability.

This consultation is available from: www.gov.uk/government/calls-for-evidence/green-industries-growth-accelerator-hydrogen-and-ccus-supply-chains

If you need a version of this document in a more accessible format, please email alt.formats@energysecurity.gov.uk. Please tell us what format you need. It will help us if you say what assistive technology you use.