



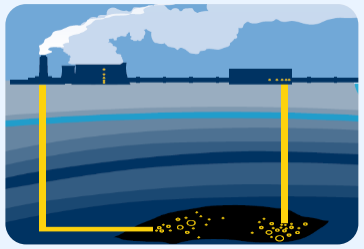



Economic impact assessment for the Scottish Cluster

THE SCO2TTISH CLUSTER

Public summary

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Disclaimer

This study was commissioned by Pale Blue Dot Energy (PBDE) on behalf of the Scottish Cluster.

The analysis was conducted by Element Energy and a reputed economics consultancy which conducted analyses such as the Energy Innovation Needs Assessments for BEIS.

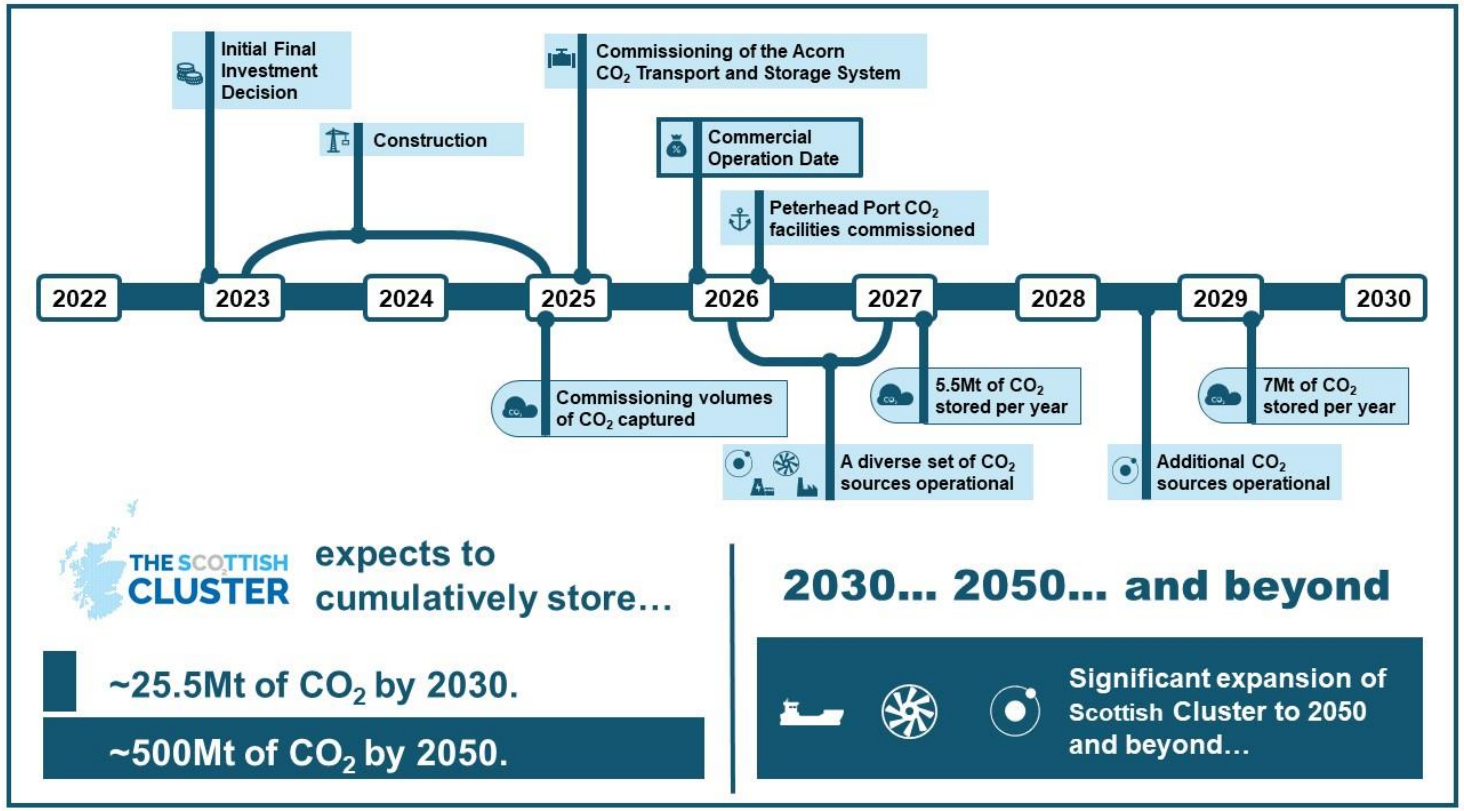
The Element Energy analytical team consisted of Elian Pusceddu and Hans Verschueren, who worked independently processing the cost data received from Pale Blue Dot. The aggregated cost data was then passed to the economics consultancy for generation of the economic benefits shown in this report.

Whilst every effort has been made to ensure the accuracy of this report, neither the commissioners nor Element Energy warrant its accuracy or will, regardless of its or their negligence, assume liability for any foreseeable or unforeseeable use made of this report which liability is hereby excluded.

As much as possible, extensive quality assurance checks have been conducted and warranted in writing by the reputed economics consultancy. Element Energy was not involved in the QA process for the economic assessment and cannot warrant its accuracy and will not assume liability for any foreseeable or unforeseeable use of the economic analysis.

The Scottish Cluster in context (I of II)

- **The Scottish Cluster will enable carbon capture deployment** across a diverse set of emitters and a robust and resilient multi-option Transport and Storage (T&S) System.
- **Investment decisions will commence as early as 2023** leading to commissioning from 2025, capture of 6.7 million tonnes per annum (Mtpa) by 2030 and over 23 Mtpa in the longer term.
- **9 UK emitters will implement CCS between 2025 and 2030**; 8 of them will do so by 2027.
  - Emitters participating in the Scottish Cluster span a variety of high-emitting sectors including industrial sites, power generation plants, new hydrogen generation plants, and the deployment of Direct Air Capture (DAC) technology.
  - **Scotland's biggest emitters** will also be part of the Cluster.

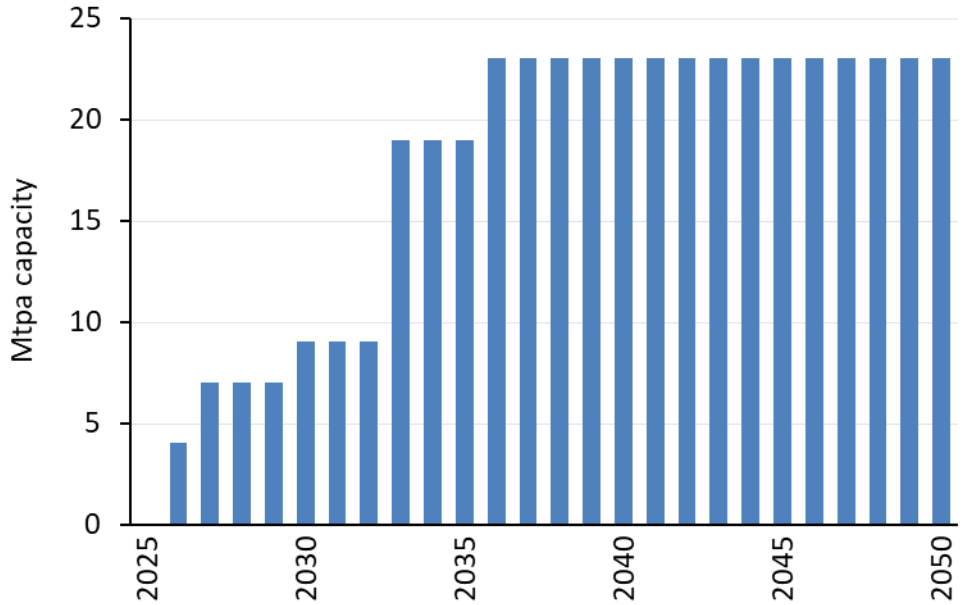


Source: Pale Blue Dot

The Scottish Cluster in context (II of II)

- **Domestic and international shipping customers** will be welcome from the start, with Peterhead Port reception facilities being commissioned in 2026 with around 3 Mtpa of domestic CO_2 shipping expected by 2030 and CO_2 from ship imports through Peterhead Port ultimately expected to reach 9 Mtpa. An additional 1.6 Mtpa of shipped CO_2 will be imported via other Scottish ports and transported to T&Sco via the Feeder 10.
- The Cluster plans for a **significant expansion after 2030** driven largely by CO_2 shipping customers and the expansion of the local DAC and hydrogen projects.
- Overall, the Scottish Cluster is expecting to **cumulatively capture and store 25.5 Mt of CO_2 by 2030** and half a Gigatonne (500 Mt) of CO_2 by 2050.
- By 2050, it is anticipated that the Scottish Cluster will expand further. The current risked view is that approximately 30 Mtpa could be handled by onshore and offshore transport and storage by 2050.
- The infrastructure expansion required to provide additional capture and/or storage capacity would continue to add jobs and Gross Added Value ("GVA") in Scotland, whilst also facilitating further UK decarbonisation projects and safeguarding industrial jobs elsewhere.

Acorn CO_2 Transport and Storage System capacity build out



Summary of economic impacts (I of II)

The Scottish Cluster, by deploying CCS, hydrogen and Direct Air Capture ("DAC") technologies in Scotland will support an average of 15,100 jobs between 2022-2050. If chosen for Track 1, the cluster could start supporting jobs as early as 2022. Total jobs will peak at 20,600 in 2031.

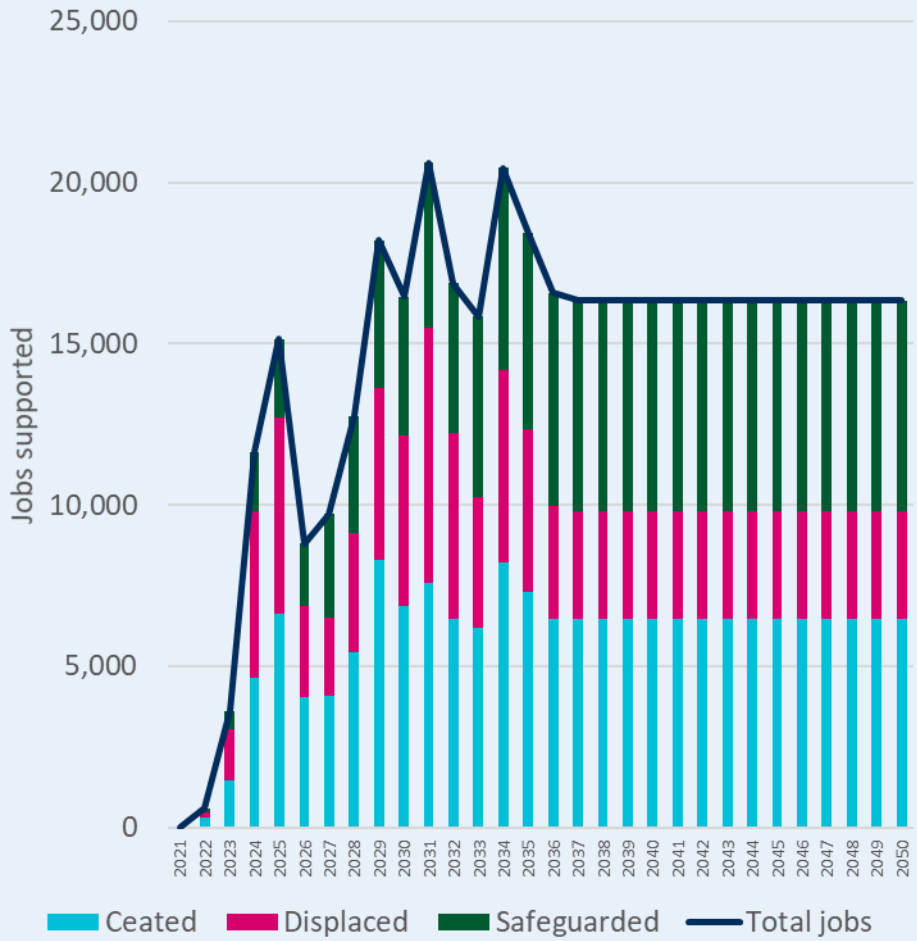
The total jobs can be divided into CAPEX jobs and OPEX jobs.

- The CAPEX jobs will materialise during the construction and development of the new plants and infrastructure. Over 2022 – 2035, the CAPEX period will support on average 3,400 direct jobs and 3,700 indirect jobs annually.
- The OPEX jobs will support ongoing operation and maintenance, commercial activities and administration. Over 2025 – 2050, the OPEX will support on average 4,800 direct jobs and 8,000 indirect jobs annually.

The total jobs also can be divided into direct and indirect jobs, and these can be assigned further to job buckets, such as created, displaced and safeguarded

- Over 2022 – 2050, annually on average, the Scottish Cluster will support around 6,200 direct jobs and 8,900 indirect jobs.
- In direct jobs, annually on average 1,100 jobs will be created, 1,610 displaced and 3,400 safeguarded. Gas consumption in hydrogen production and in CCGTs drives high OPEX safeguarded jobs, whilst the construction and engineering service sectors drive the displaced and created jobs, respectively.

Jobs supported by the Scottish Cluster



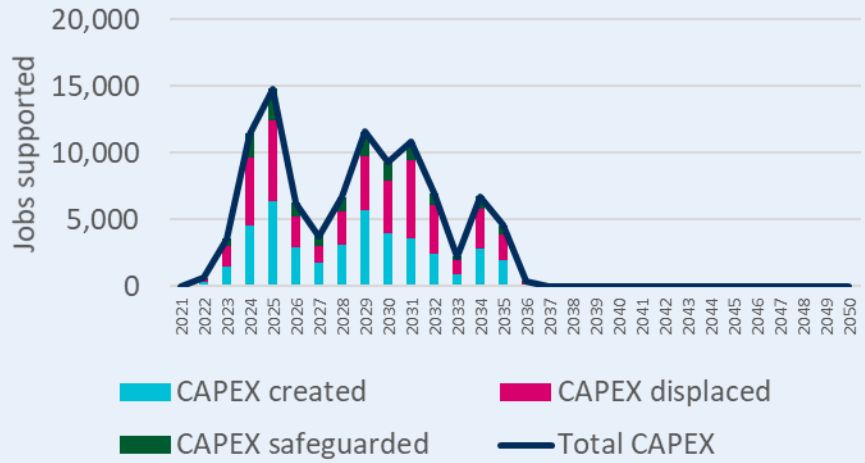
Summary of economic impacts (II of II)

- In indirect jobs, annually on average, 5,000 jobs will be created, 2,240 displaced and 1,700 safeguarded. The electricity generation and transmission, repair and fabricated metals products sectors are the top three sectors where the indirect jobs will be created. The construction, computer programming and engineering service sectors will host most of the displaced indirect jobs. The electricity generation and transmission, gas distribution and crude oil and gas extraction sectors have most of the safeguarded jobs.

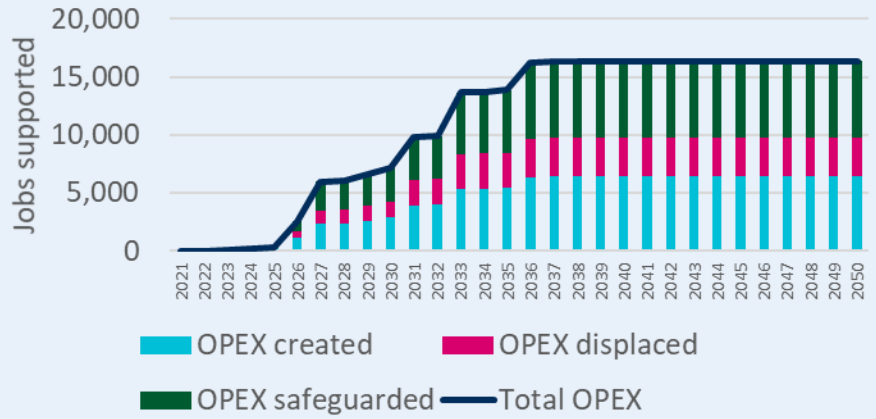
Hydrogen production with a capacity of 3.7 GW will account for the lion's share of the direct and indirect jobs supported by the Scottish Cluster

- On average, it will support around **2,070 direct jobs and 3,300 indirect jobs per year over the 2022-2050 period**. Electricity and natural gas used for hydrogen production will support most of these jobs.
- The jobs supported by the transport and storage (T&S) infrastructure are relatively smaller as it will involve refurbishing of the existing infrastructure, and operation of the infrastructure requires low numbers of personnel.

Jobs supported in the CAPEX phase



Jobs supported in the OPEX phase

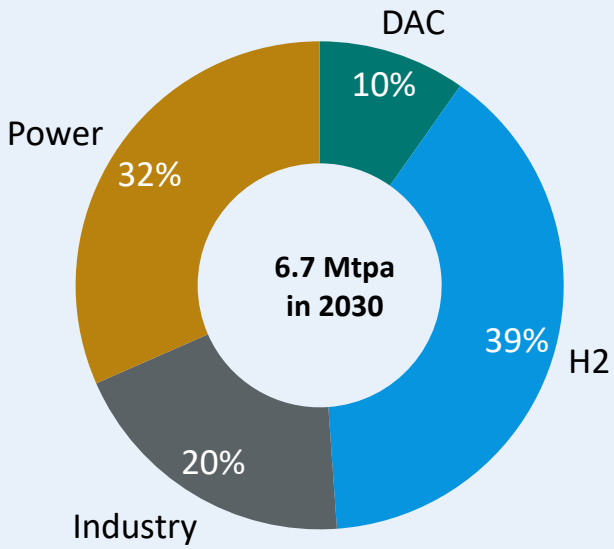


The Scottish Cluster can deliver significant benefits not quantified in this study (I of II)

The Scottish Cluster will enable carbon capture deployment across a very diverse set of emitters

- By enabling capture of 6.7 Mtpa from 9 UK emitters by 2030, the Scottish Cluster would help deliver **2/3rds of the UK Government's target of 10 Mtpa captured by 2030.**
- Carbon capture at existing industrial sites which would help deliver 1.3 Mtpa of capture, or over **40% of the UK Government's aim to capture 3 Mtpa from industrial sites by 2030**.
- Blue hydrogen producers in Scotland and other parts of the UK would contribute 2.6 Mtpa of captured CO_2.
- Power generators in Scotland and other parts of the UK would develop over **1.5 GW of flexible low-carbon generation**, capturing 2.1 Mtpa.
- The Scottish Cluster would enable the **first direct air capture (DAC) project in the UK**, enabling the net removal of 0.5 Mtpa from the atmosphere from 2026 onwards.
  - This represents 10% of the carbon removals from engineered solutions foreseen to occur by 2030 in the CCC's Balanced Pathway.[1]
  - This will also pave the way to broader deployment of this promising greenhouse gas removal (GGR) technology which could be essential to reach net zero.

Sectoral breakdown of the emissions captured in 2030



[1] CCC – The Sixth Carbon Budget.

The Scottish Cluster can deliver significant benefits not quantified in this study (I of II)

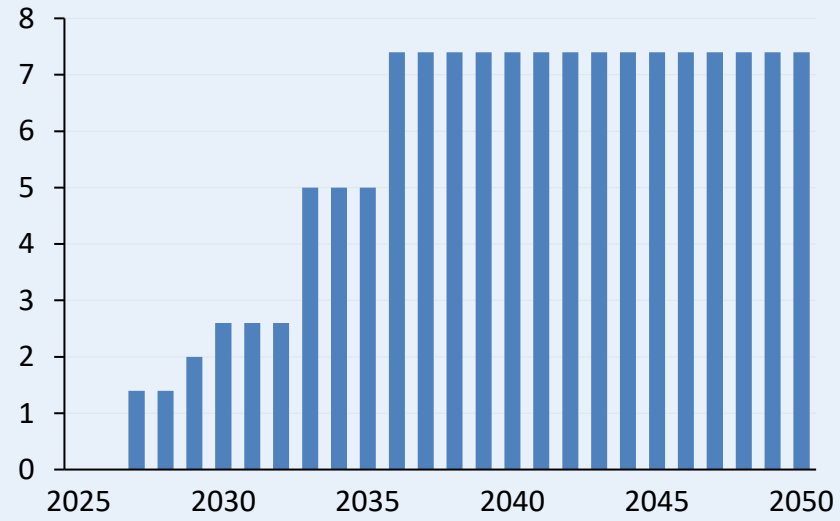
The project is critical to enable and accelerate low-carbon hydrogen deployment

- Without the Scottish Cluster, hydrogen uptake among the Scottish sectors could significantly be delayed.
  - This could affect the timeline for the decarbonisation of the Scottish industrial, heat, and transport sectors.
  - The attainment of the deep decarbonisation pathways for Scottish industries outlined in a previous study by Element Energy for the Scottish Government would also likely be affected.[1]
- 1.3 GW of low-carbon hydrogen production would be built by 2030, and 3.7 GW by 2050. This constitutes nearly over 25% of the UK Government's goal of building 5 GW of low-carbon hydrogen capacity by 2030.

Infrastructure repurposing reduces the cost of CO_2 transport and storage

- The ability of the Scottish Cluster project to repurpose significant infrastructure assets including existing pipeline enables the lowering of transport and storage fees.
- It could also provide rapid access to a large-scale CO_2 transportation and storage solution prior to 2030 for areas without ready access to CO_2 storage.

Emissions captured from hydrogen production (Mtpa)



[1] Element Energy for the Scottish Government – Deep Decarbonisation Pathways for Scottish Industries (2020).