



# Policy Brief

## The potential economic value of increasing Scottish CO<sub>2</sub> Transport and Storage capacity to service overseas export demand

By Karen Turner, Antonios Katris, Abdoul Karim Zanhou, Hannah Corbett and Julia Race

### Summary

A new Scottish CO<sub>2</sub> Transport and Storage (T&S) industry linked to the Acorn CCS project, with capacity to sequester 3.8Mt of emissions from the Scottish cluster and a further 2.6Mt from overseas, could:

- Deliver a sustained uplift in UK GDP of £257m per annum by 2035 and net creation of almost additional 1,100 full-time equivalent (FTE) jobs across the economy, even where labour supply constraints trigger wage competition price pressures.
- Reduce the near- to mid-term public budget implications of intervention to guarantee utilisation of Scottish T&S capacity by 37%, from £171m per annum associated with Scottish cluster requirements to an estimated £108m per annum.

The alleviation of domestic funding requirements is due to generation of additional tax revenues in the order of £131m per annum as the economy expands. However, the positive impact on the public budget is limited (by around £68m per annum) due to the effect of additional Consumer Price Index (CPI) pressures on other government spending requirements.

A crucial feature of our analysis is that we incorporate wider supply-side responses to the introduction of new CO<sub>2</sub> T&S industry activity, particularly in the UK labour market. In short, all these wider economy gains are delivered in the context of increases in wage rates, producer costs and consumer prices. If wage pressures are limited, there is potential for a greater sustained GDP uplift (up to £416m per annum) and substantially greater employment gains (up to 3,900 additional jobs) with almost no displacement of jobs across sectors or CPI pressure.

On the other hand, while the public budget implications of guaranteeing utilisation of Scottish T&S capacity for Scottish needs would be further reduced in the absence of wage pressures (by up to 59%, to £71m per annum), income tax revenue gains would be limited by smaller real wage income gains to UK households.

Our findings emerge for the case of the Scottish Carbon Capture and Storage (CCS) cluster as a result of its potential to exploit overseas export demand as a result of offshore storage capacity and specialised supply chains developed through the Oil and Gas industry. This highlights the importance of identifying and exploiting sources of comparative advantage across the decarbonisation of different industry clusters if we are to ensure an 'economically-efficient' transition to Net Zero.



**Introducing a Scottish CO<sub>2</sub> Transport and Storage industry with an overseas export base could deliver sustained gains in UK GDP, jobs, real take-home pay and income tax revenues."**



## Research and modelling approach

This brief considers the economy-wide implications of exploiting the potential for overseas export demand in relation to a new Scottish CO<sub>2</sub> T&S industry linked to the [Acorn Project](#). The research is underpinned by scenarios where additional capacity (beyond the sequestration needs of the Scottish cluster) is devoted to developing an export base in supplying T&S services to overseas emitters. These scenarios include shipping as well as pipeline transport, based on Scottish plans to ship CO<sub>2</sub> from elsewhere in the UK and/or overseas for storage in North Sea reservoirs. They have also been informed by recent [expert consultation with Scotland's Net Zero Infrastructure \(SNZI\) programme partners and stakeholders](#). This has allowed us to improve and update economy-wide structural (input-output) data, reflecting how a Scottish T&S sector may emerge, using current Oil and Gas industry and supply chain capacity as our industry benchmark, in informing our economy-wide (computable general equilibrium, CGE, model). The research builds on [peer-reviewed](#) work focussed on supply chain and funding requirements of introducing a T&S sector to service proximate Scottish industrial emissions via onshore pipelines.

Table 1 shows the information we have used in informing our economy-wide scenarios regarding the introduction of the Scottish T&S industry. Given the commercially sensitive and evolving nature of information pertaining to the investment requirements and potential capacity of the Scottish and other UK CCS projects, the figures are based on our own estimates, informed by stakeholder consultation (for example, with colleagues working on the Acorn project) and linked [techno-economic research](#). As part of our ongoing work, we will continue to seek input and/or advice to inform these scenarios.

**Table 1. Scottish regional cluster emissions sources and interventions/impacts of linked CO<sub>2</sub> Transport and Storage capacity**

	<b>Scenario 1:</b> Domestic transportation via pipelines without exports	<b>Scenario 2:</b> Domestic transportation via pipelines and exports via shipping
<b>Key T&amp;S industry investment and operational characteristics</b>		
Total capital stock created (£m)	494	797
Pre-operation investment (£m) - Staged 10/20/30/40% over 4 years to 2026	582	940
Ongoing additional annual investment (£m) - maintenance/offsetting depreciation	74	120
Total output/demand serviced (£m)	171	285
International shipping services imports (£m)	0.2	23
Direct employment (FTE)	74	116
Value added (GDP) (£m)	108	173
<b>Total industrial emissions serviced (Mt, millions of tonnes of CO<sub>2</sub>)</b>	<b>3.83</b>	<b>6.38</b>

The Scenario 2 figures align with one suggested by colleagues associated with the Acorn CCS Project to consider the potential industry and wider economy picture if 40% of a larger industry capacity involves shipping of CO<sub>2</sub> from outside of Scotland (here, from overseas) for storage in North Sea reservoirs. Crucially, this would involve increased reliance on (imports of) services provided by international shipping operators rather than a proportionate increase in pipeline infrastructure. This reduces the capital intensity of the Scottish T&S industry, and, thus, the additional investment requirements. However, it also reduces the domestic 'multiplier' potential of the new industry, with increased imported content in the supply chain.



## Economy-wide impacts emerging

### *Investing and deploying the Scottish CO<sub>2</sub> Transport and Storage industry shifts the UK economy onto a higher GDP trajectory with sustained employment gains*

Table 2 shows the UK-wide macroeconomic impacts by 2035 of introducing the Scottish T&S industry under the two scenarios in Table 1. We report results for 2035 as a mid-2030s point at which the UK Government may look to the state of the industry and economic landscape in deciding what type of funding model may apply going forward (here we assume the government uses deficit funding to focus solely on the impacts of rolling out the new industry). Figure 1 shows that this is a point where both GDP and employment uplifts have settled on a new sustained trajectory.

**Table 2. Key macroeconomic impacts in the UK by 2035 of introducing the Scottish T & S industry**

	<b>Scenario 1 - Scottish T&amp;S industry services Scottish cluster demand only (3.83 Mt CO<sub>2</sub>) - PIPELINE TRANSPORT ONLY</b>	<b>Scenario 2 - Scottish cluster PLUS and overseas export demand (6.38Mt CO<sub>2</sub>) - INTERNATIONAL SHIPPING FOR EXPORTS</b>
<b>Net public deficit impact (£million), composed of:</b>	-131	-108
<b>Net additional government revenues (£million)</b>	96	131
<b>Direct spending on T &amp; S (£million)</b>	-171	-171
<b>Nominal adjustments to meet real spending commitments (£million)</b>	-56	-68
<b>GDP (£million)</b>	165	257
<b>GDP (% change)</b>	0.009%	0.013%
<b>Employment (FTE)</b>	761	1097
<b>Employment (% change)</b>	0.003%	0.004%
<b>Unemployment (% change)</b>	-0.060%	-0.087%
<b>Nominal wage - index to 1 (% change)</b>	0.013%	0.018%
<b>Real wage - index to 1 (% change)</b>	0.007%	0.010%
<b>CPI - index to 1 (% change)</b>	0.006%	0.008%
<b>Exports (% change)</b>	-0.012%	0.004%
<b>Imports (% change)</b>	0.015%	0.024%
<b>Real household consumption (% change)</b>	0.009%	0.012%
<b>Total investment (% change)</b>	0.015%	0.024%

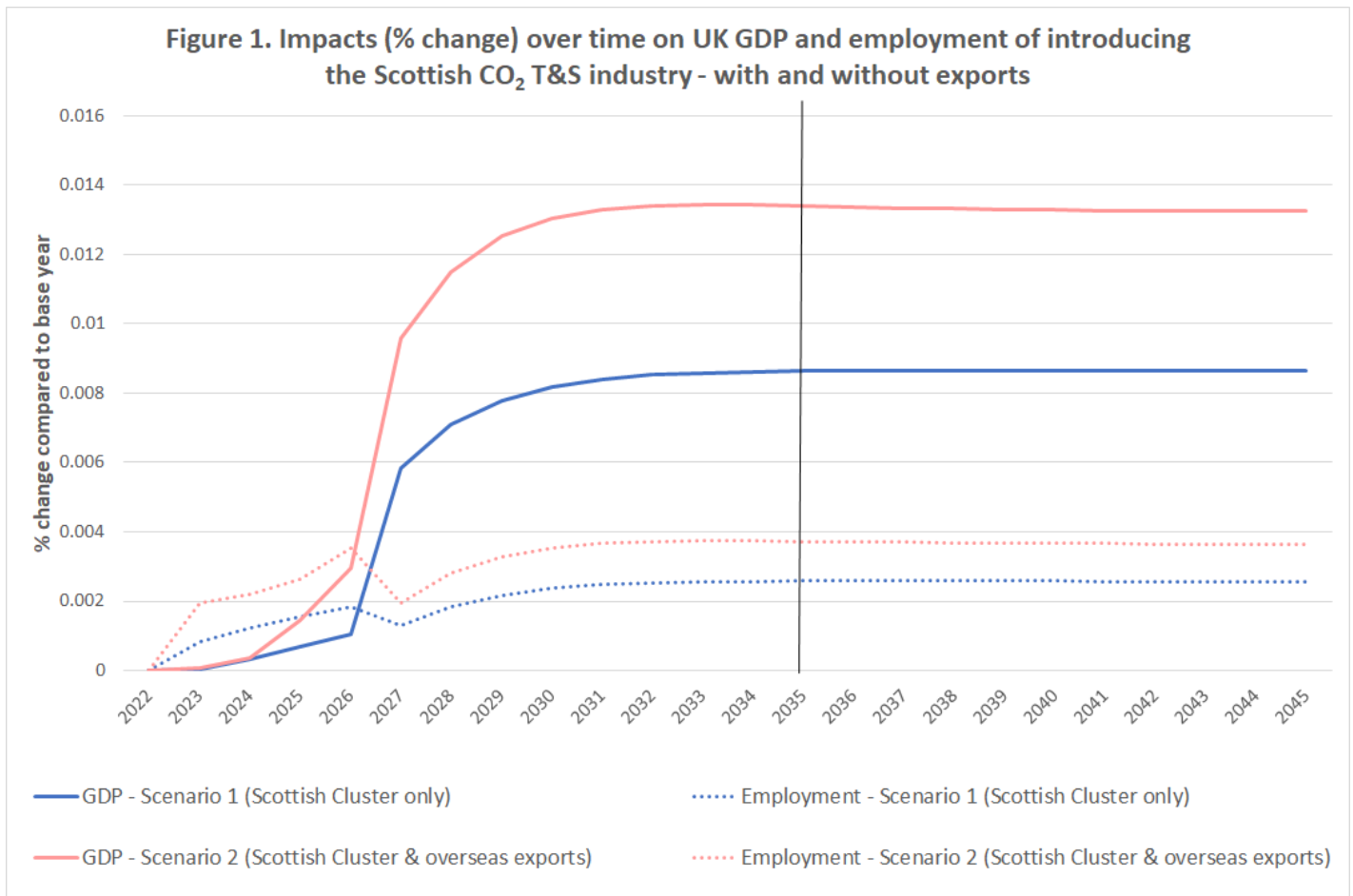
Broadly, the picture is one of the UK shifting onto a higher GDP trajectory than it would otherwise be on with the introduction of the Scottish T&S industry. Figure 1 shows that employment initially grows faster than GDP. This is due to the nature of the activity involved in delivering CCS projects, with the greatest gains to the UK construction industry. However, as the relatively capital-intensive T&S industry rolls out from 2027, the uplift in GDP exceeds that in employment.

Nonetheless, employment gains are realised in all time frames, with up to 761 additional full-time equivalent (FTE) jobs created across the wider UK economy by 2035 if the Scottish T&S industry is only scaled to service the sequestration needs of the Scottish cluster. This increases to 1097 additional jobs if a larger industry is created to service additional overseas demand.

**UK labour supply challenges have an important impact on the nature and extent of the wider economy expansion**

It is important to note that the expansion reported here is limited given that we simulate the roll out of the Scottish T&S industry in the context of a UK labour market characterised by persisting constraints and shortages. The new labour demand requirements associated with the T&S supply chain can only be met by a combination of drawing on the pool of unemployed labour and competing within and across sectors for workers. That is, there is bargaining over increases in real take-home wages between employers and workers across workers.

While sustained real wage and net employment gains do emerge, which enables increased spending/consumption on all goods and services by households, thereby stimulating further rounds of economy-wide expansion, there is some displacement of activity.



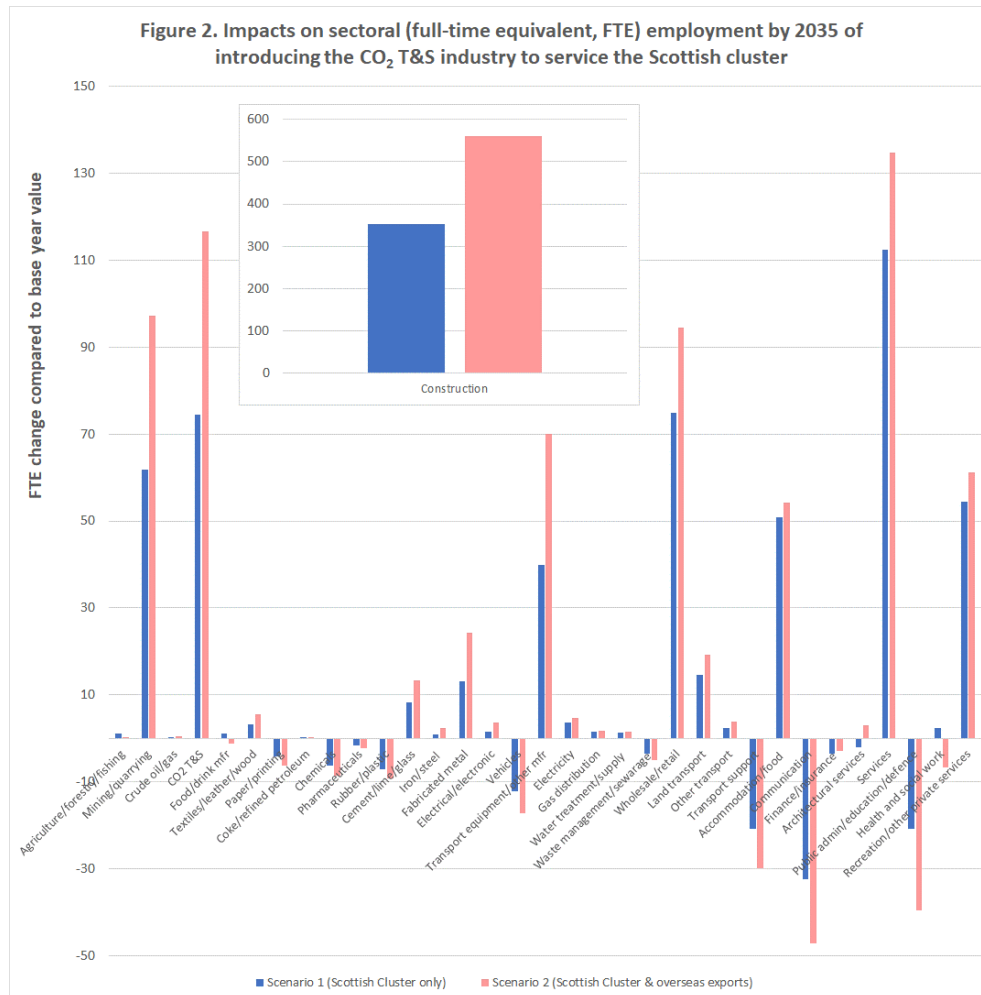
This is reflected in some the marginal losses in total UK exports in the Scenario 1 results in Table 2 and the sectoral employment results in Figure 2. However, note that while the displacement of activity is more extensive in Scenario 2, where the Scottish T&S industry is larger, the new exports associated with that industry are sufficient to more than offset losses in other sectors, with net UK exports enjoying slight but sustained net growth by 2035.

We have tested just how important wage competition in the supply constrained UK labour market is by re-running our scenarios with real wage rates fixed – i.e., ‘turning off’ the wage competition and worker bargaining responses triggered by increased labour demand discussed above. The outcome is virtually no job displacement across the economy and a much larger boost in FTE employment (up to 3,900 additional jobs per annum in Scenario 2), entirely associated with a larger reduction in UK unemployment. This is more like a straightforward employment multiplier outcome, with no wage-driven producer cost and consumer price pressure. This would be associated with a larger sustained uplift in GDP (£416m per annum) and negligible competitiveness loss in other UK exports.



**On balance, introducing a new Scottish T&S industry is a ‘good news’ story for the UK economy, even in the presence of wage-cost pressure**

In practice, persisting labour supply constraints across the UK labour market are likely to trigger some extent of wage competition and cost-price pressure. Introduction of any new activity in such a context will inevitably bring some trade-offs. The key point that there are still likely to be net increases not only in activity but the real wages, incomes and employment levels of UK workers and households in both our scenarios.



**Increasing Scottish T&S capacity to develop an export base has important tax revenue and public budget impacts**

It is worth emphasising the public budget outcomes. Here, perhaps one of the key findings emerging from our scenario simulations is that if Scottish T&S industry capacity is scaled to exploit the opportunity to export sequestration services to overseas emitters, this generates substantially greater tax revenue gains to the UK public purse (£131m per annum by 2035, compared to £96m under Scenario 1). While the larger stimulus does involve greater cost and price pressures - so that the cost of maintaining real government spending rises by more (£68m per annum compared to £56m) - the outcome is a smaller net deficit impact on the UK public budget overall (£108m per annum compared to £131m without exports).

Moreover, it is important to understand the sources of revenue gains involved. When we rerun our scenarios ‘turning off’ wage competition and responses, the greater sustained GDP gain noted above (£416m per annum uplift by 2035 compared to £257m in the core Scenario 2) is associated with a further reduction in the net deficit impact on the UK public budget (to from £108m to £71m). However, this reduction is almost entirely due to the absence of cost-driven CPI pressure. The uplift in tax revenues is actually reduced, from £131m to £102m, because there is no uplift in real wage rates associated with (greater) employment gains, reducing gains in income tax.



## Conclusions and next steps

The key finding is that introducing a new Scottish CO<sub>2</sub> T&S industry linked to the Acorn CCS project, with capacity to sequester 3.8Mt of emissions from the Scottish cluster and a further 2.6Mt from overseas, could deliver a sustained uplift in UK GDP of £257m per annum by 2035 and net creation of almost 1,100 jobs. These gains could be larger if labour supply constraints could be eased and/or wage competition reduced.

Moreover, developing an overseas export base for Scottish T&S services would limit near- to mid-term public finance intervention to guarantee utilisation of capacity created to an estimated £171m per annum implied by Scottish cluster sequestration requirements. Indeed, additional government tax revenues generated through the expansion triggered by the introduction of Scottish T&S are in the order of £131m per annum, which will reduce the net impact of domestic funding interventions on the public purse. Income tax gains associated both increased employment and higher average wage rates are an important component of the sustained increase in government revenues accruing. However, additional CPI pressure triggered by introducing new industry activity in the context of a challenging labour market conditions would negate around £68m of the revenue gains.

A crucial point emerging is that investing and deploying any new industry activity in a constrained economic context will inevitably trigger price pressures. Here, our scenario simulations for investing and deploying the Scottish CO<sub>2</sub> T&S industry focus on the impacts of the persisting UK labour supply challenges. In particular, we highlight the trade-offs emerging as wage competition triggers a range of cost and price pressures across the economy, but also increases the real wages and income taxes paid by those workers who benefit. Here, we find that there is likely to be some displacement of employment, particularly in more labour-intensive service sectors of the economy, as average UK wage costs rise, and some displacement of other exports. Moreover, the consequent pressure on the CPI will not only impact the public purse as noted above, but also constrain the real income and spending gains of many UK households.

Nonetheless, the overall picture is a positive one, with average real wage and income gains that exceed additional cost-of-living pressures so that the sustained GDP and employment results reported above do equate to an uplift relative to what would be the case in the UK economy without the new Scottish T&S industry. Moreover, net gains are realised from the outset, during the upfront investment phase, with the greatest price pressures offsetting benefits found at that early stage, where substantial infrastructure investment activity brings the most competition for scarce resources.

Generally, the message emerging is one of the importance of identifying and exploiting sources of comparative advantage – such as the new export potential associated with enabling Scottish T&S through the Scottish cluster and Acorn CCS project - in the decarbonisation of different regional clusters.

Going forward, other scenarios must to be considered. For example, what would the economic costs and benefits picture be in delivering the same level of emissions reduction if T&S capacity in England were used rather than Scottish T&S? Moreover, how will this be affected by decisions made on which clusters receive UK Government support and the characteristics of different CCS networks and their ability/capacity to service these needs? Are there important challenges in balancing competition and coordination across clusters in delivering the best outcomes for the UK economy, especially in the context of an emerging international market for CCS services?

In what is now the final year of our work on SNZI, and linking to a new project funded by IDRIC, our research will seek to answer such questions, setting our analysis of the Scottish CCS cluster in the context of how T&S capacity may develop in other regions of the UK. Such a focus can inform ongoing efforts to decarbonisation industry clusters and is essential if we are to ensure an 'economically-efficient' transition to Net Zero.

---

## Acknowledgements and contact

- This brief was produced as part of the [UK Research and Innovation \(UKRI\) Industrial Strategy Challenge Fund Scotland's Net Zero Infrastructure programme](#)
- CEP@strath.ac.uk, The Centre for Energy Policy, School of Government and Public Policy, Humanities and Social Science, McCance Building, 16 Richmond Street, Glasgow, G1 1XQ