



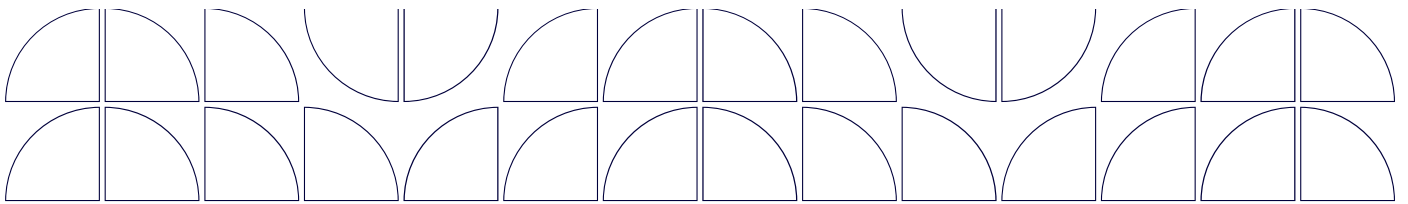
Policy brief: Understanding jobs demand and displacement outcomes of decarbonising UK industry clusters

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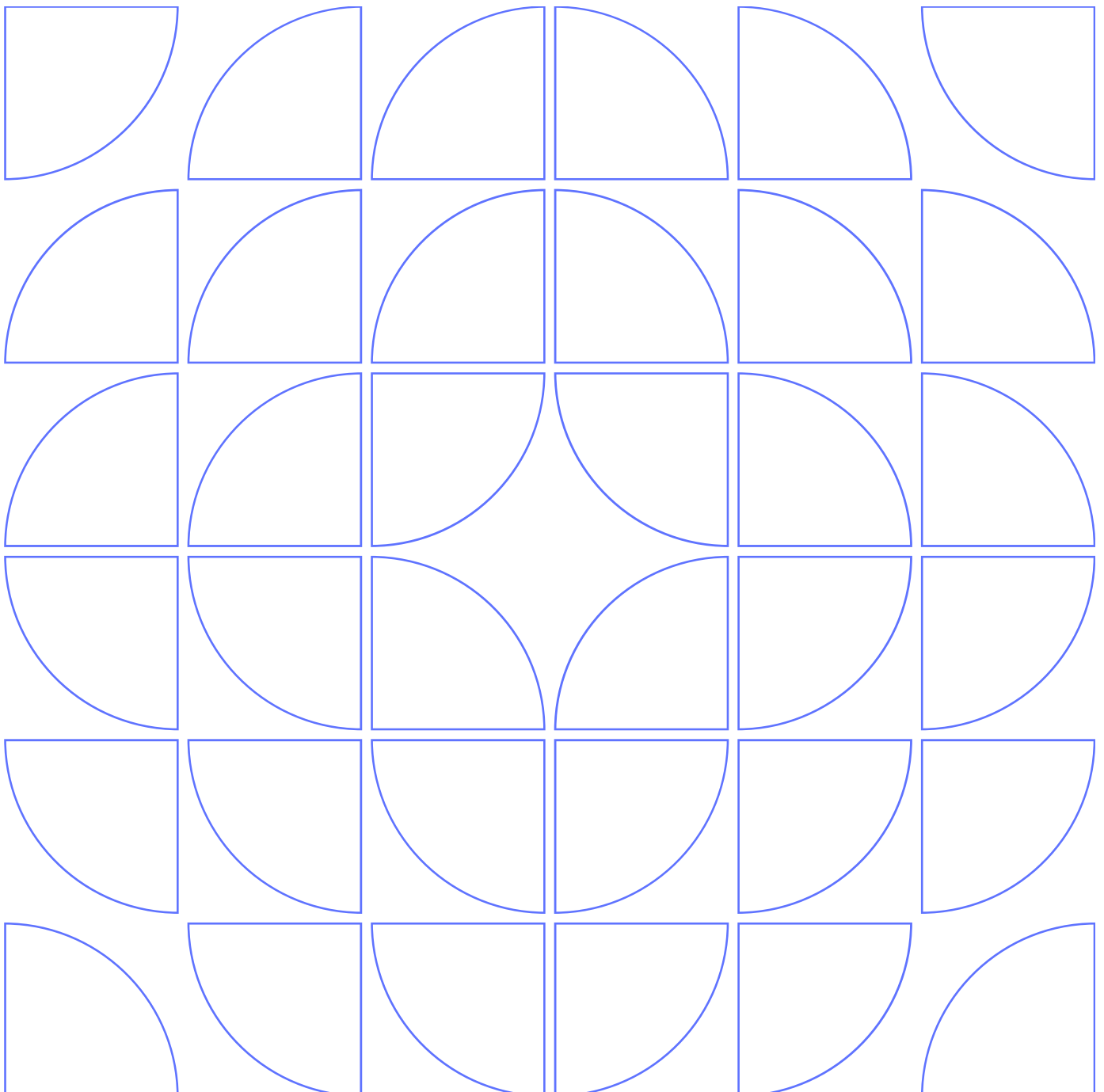


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Policy brief: Understanding jobs demand and displacement outcomes of decarbonising UK industry clusters

Summary

The decarbonisation of UK industrial clusters via the development of CCUS networks and supply chains can support jobs and gross value-added (GVA) across multiple sectors of the economy. However, worker and skills shortages have been identified as a common challenge across the UK clusters, as well as more generally in the Net Zero space and for the UK economy. These shortages do not just affect the deliverability of CCUS projects: employment demand rising while shortages persist can affect wider economy outcomes. These labour constraints drive jobs being displaced across sectors and regions with average wage rates increasing as different sectors compete to attract and retain workers from the limited pool of labour available.

Four key messages emerge from our research, which have important implications for both those working in the CO₂ Transport and Storage (T&S) sector and for policy decision-makers.

1. Likely transitory peaks in job creation in the UK construction sector, during the investment phase of enabling a new CO₂ Transport and Storage sector, need to be factored into CCUS deployment and broader Net Zero delivery planning.

Our results suggest that over 7,700 UK full-time equivalent (FTE) construction sector jobs may be supported in the first year of developing Track 1 T&S systems activity (here considering industries and projects around the clusters located at the North East and North West of England)¹, with a second peak of 6,700 jobs in 2027 as work starts on the Track 2 T&S systems (industries linked to the Scottish cluster and in the south of the Humber region, aligned with the Viking CCS project)¹. However, these peaks are transitory. Over time, once transport and storage activity servicing all clusters is operational, total employment supported across the UK economy settles at around 4,120 by 2040, associated with an additional £898million in gross value-added (GVA – GDP as measured by income) per annum. Yet these transitory peaks of job creation in the construction sector could be replicated in other decarbonisation areas, for instance upgrading the electricity network to enable the heat pump rollout². Therefore, it is critical that they are understood and planned for within that broader context.

¹ We characterised the CO₂ T&S requirements based on the emissions and locations identified by the UKRI Industrial decarbonisation challenge. For Track 1 clusters, we consider industrial emitters located around north of the Humber area, Tees Valley, Merseyside and the North West, roughly aligned to CCUS projects identified in those areas (e.g. HyNet, Net Zero North West (NZNW), Humber Industrial Cluster Plan (HICP), Zero Carbon Humber, Net Zero Teesside, etc.). For Track 2, we consider industrial emitters along the North East of Scotland and Grangemouth, and in the South Humber area, roughly aligned to the Scotland Net Zero Roadmap and Viking CCS projects. See <https://doi.org/10.1016/j.ijggc.2022.103695> for full detail on the methodology used to characterise clusters and CO₂ T&S needs.

² See briefing note: <https://strathprints.strath.ac.uk/86820/>

- 2. Addressing worker and skills shortages can help mitigate the risk of job displacement across UK regions and sectors and ensure that the maximum potential positive economy-wide benefits of establishing a new CO₂ Transport and Storage sector are realised.**

Without action on skills and worker shortages, labour demand linked to CO₂ Transport and Storage deployment and operation leads to wage increases as projects compete for limited labour. This ripples out to affect producer costs and labour demand across all sectors, with a risk of displacing employment and activity in other, particularly more labour-intensive and/or higher wage rate sectors (e.g., hospitality, financial services, etc.). This will lead to increased pressures on the cost of doing business in the UK, driving prices up and affect the cost-of-living, and, with people having less money to spend in other goods and services, further displacing employment.

This has important regional impacts. Job losses, peaking at around 4000, are concentrated in sectors such as retail, services and hospitality, particularly in London and other southern regions, where those sectors are concentrated but where there is less direct benefit from the introduction of new CO₂ T&S sector activity.

- 3. The simultaneous staged introduction of what are effectively four regional subsectors of a nascent UK T&S sector is likely to exacerbate resource competition across all sectors and, thereby, constrain wider economy gains in the early stages, despite a slight boost in near term job gains.**

Our research has modelled the development, and the potential economic outcomes, of regional T&S sectors emerging linked to the Track 1 and Track 2 CCUS projects, combining to constitute a nascent UK T&S sector. In comparing the additive results of the individual simulations (reported here), with one where the staged investment and deployment of all four is simultaneously simulated we find that, even if the regional T&S subsectors do not compete directly with each other, wage cost impacts act to constrain the wider economic expansion³. The impact is likely to be limited for this CO₂ T&S case and eases over time, due to the relatively small supply-side shock generated by nascent T&S activity. However, this is a key generic finding, pointing to challenges for the wider net zero transition, which will involve many new activities emerging in a constrained economic landscape, with efforts required to ease potential congestion and bottlenecks.

- 4. Consistent assessments of employment requirements and economic impacts across clusters are necessary to inform action on addressing and mitigating labour shortages and other potential negative economic outcomes.**

Current cluster plans show inconsistency in the approach taken to assess their job and skills requirements, and in the way these are accounted for and reported. The UKRI Industrial Decarbonisation Challenge (IDC) recognises that it is necessary to establish a consistent method of modelling workforce and skills needs, and of

³ The detailed analysis of comparing additive vs simultaneous simulation of CO₂ T&S subsectors is not presented here. However, it is part of an upcoming publication and can be made available upon request.

mapping the regional requirements to understand the availability and allocation gaps⁴. A consistent methodology would allow for a better understanding of the opportunities and challenges and allow fair comparisons to be made between projects. Our research speaks directly to this recommendation, providing a peer-reviewed economic modelling approach, which allows for a consistent individual cluster and aggregated economic analysis and employment needs for industrial decarbonisation activity.

Introduction

The UK Government's 2021 roadmap on CCUS supply chains⁵ refers to a 2019 Energy Innovation Needs Assessment⁶ estimate that suggests that CCUS could create up to 50,000 jobs in the UK. Of these, around 10,000 jobs are expected to be associated with the current domestic-facing activity of sequestering emissions from the UK's regional industry clusters. This spans a broad range of activities, including the potential export of sequestration services by what may be termed a UK CO₂ Transport and Storage (T&S) sector, as well as other CCUS-related services and technological developments. However, the timeframes involved are not very clear, particularly as the Track 1⁷ and Track 2⁸ cluster sequencing process will involve a range of activities and different labour demands across an extended and dynamic time frame. Moreover, existing estimates do not give attention to how wage responses in the supply-constrained UK labour market – characterised by both worker and skills shortages – may affect net impacts on total employment through potential displacement of jobs and activity in other sectors and regions.

This policy brief focusses on estimating the national and regional labour market implications of the deployment and operation of CCUS transport networks within and across four of the UK's industry clusters. At this stage, the scope of the study is limited to the investment and emergence of nascent CO₂ Transport and Storage (T&S) sector activity initially to service sequestration demand from industry actors located within the Track 1 and 2 clusters. The aim is to identify and understand the regional employment implications of such nascent sector activity, with particular emphasis on the location and nature of labour demand and how the potential movement of workers may involve displacement of jobs and activity across regions and sectors of the UK economy.

Specifically, the objective is to better understand how the relocation of skilled labour could significantly affect wage rates and labour costs across the CCUS activities and other UK sectors requiring similar skillsets and competing for the same constrained pool of labour. This is important not only in considering the impacts of CCUS deployment – here focussing on CO₂ Transport and Storage - to support industrial decarbonisation, where outcomes will

⁴ UKRI, October 2023, Enabling net zero: a plan for UK industrial cluster decarbonisation, <https://www.ukri.org/publications/enabling-net-zero-a-plan-for-uk-industrial-decarbonisation/>

⁵ DESNZ, 2021, Carbon capture, usage and storage (CCUS) supply chains: a roadmap to maximise the UK's potential <https://www.gov.uk/government/publications/carbon-capture-usage-and-storage-ccus-supply-chains-a-roadmap-to-maximise-the-uks-potential>

⁶ DESNZ, 2019, Energy Innovation Needs Assessments, <https://www.gov.uk/government/publications/energy-innovation-needs-assessments>

⁷ DESNZ, 2021, Cluster sequencing for carbon capture, usage and storage (CCUS) deployment: Phase-1 <https://www.gov.uk/government/publications/cluster-sequencing-for-carbon-capture-usage-and-storage-ccus-deployment-phase-1-expressions-of-interest>

⁸ DESNZ, 2023, Cluster sequencing for carbon capture, usage and storage (CCUS): Track-2 <https://www.gov.uk/government/publications/cluster-sequencing-for-carbon-capture-usage-and-storage-ccus-track-2>

have wider implications for the ‘levelling up’ and ‘just transition’ agendas of the UK Government and both devolved and regional authorities. The analysis is conducted using our economy-wide UKENVI scenario simulation model of the UK, updating previous fully peer-reviewed work⁹ with new data on the structure of the economy and refining of the scenarios to focus on the now-announced Track 1 and potential Track 2 developments.¹⁰

Research findings

1. Employment impacts of investing and operating CO₂ T&S sector activity associated with the Track 1 and Track 2 T&S systems

Figure 1 shows the simulated employment impacts in the UK of an emerging UK CO₂ transport and storage (T&S) sector that involves a total of £3,274 million invested between 2023 and 2029 across the four Track 1 and 2 clusters.

Our scenario simulations assume Track 1 investment activity began in 2023 (although this could more simply be taken as Year 1 and subsequent years adjusted accordingly)¹¹ with all infrastructure deployment taking place in 4 years. In 2027, the Track 2 clusters (Viking CCS and Scottish cluster) start the deployment of their CCUS infrastructure, which is then completed by 2029 with these clusters becoming operational in 2030. Figure 1 shows the direct employment changes on the T&S sector. Activity in this sector starts once all the infrastructure comes online, which in the case for Track 1 clusters is from year 2027, and for Track 2 clusters from 2030. The level of jobs linked to this sector are smaller but more stable, relative to the construction sector, with around 240 jobs linked to Track 1 T&S systems and about 160 jobs linked to Track 2, which makes a total of around 400 sustained jobs in this sector.

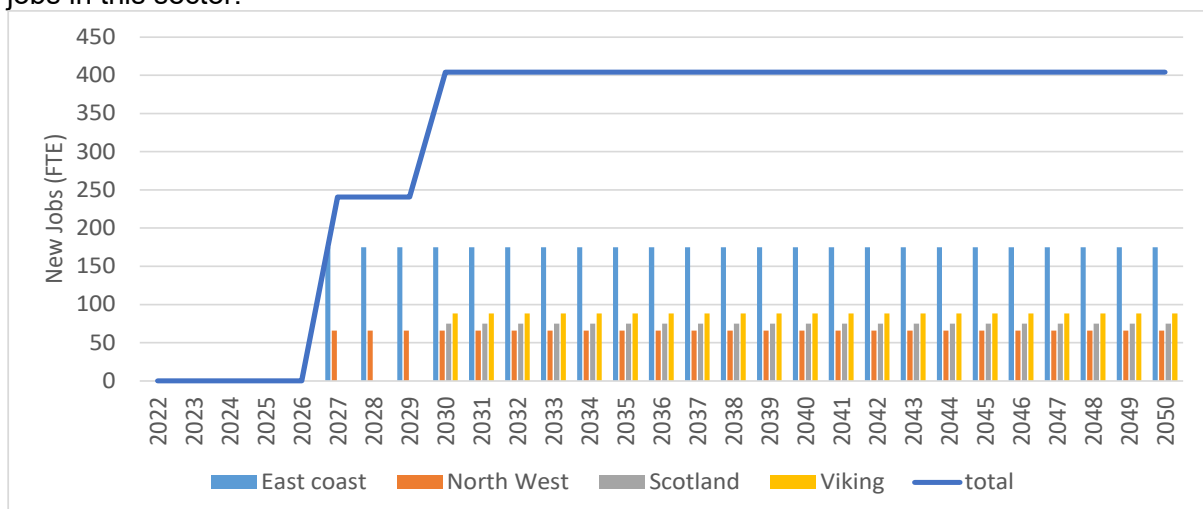


Figure 1. CO₂ Transport & Storage sector employment changes (FTE) for Track 1 and Track 2 T&S activity relative to baseline.

⁹ See for example: <https://doi.org/10.1016/j.ecolecon.2022.107547> and <https://doi.org/10.1177/02690942231203932>

¹⁰ In our most recent work using the UKENVI model, we explore the economy-wide implications of introducing a new CO₂ T&S sector under different circumstances regarding the UK labour market constraints. The peer-reviewed paper is available at: <https://doi.org/10.1016/j.jclepro.2023.140084>

¹¹ Note that we selected year 2023 as year 1 in our analysis, as this was the year where the underlying analysis took place. Also, the CO₂ T&S deployment timeline was adjusted to match the UK Government target set to ‘establish CCUS in two industrial clusters by mid 2020s, and aim for four of these sites by 2030’ (see <https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution>)

Figure 2 and Figure 3 respectively show the simulated total UK employment impacts and jobs in the construction sector. The year 2023, year 1 in our simulations, constitutes the peak in activity associated with the Track 1 T&S systems, where employment demand is driven by the large investments introduced in the economy to implement the T&S infrastructure. The Track 1 T&S activity drive substantial employment requirements in the construction industry (see Figure 3), reaching over 7,700 FTEs in 2023, before gradually falling back in subsequent years. Net total employment across the economy (Figure 2) shows a similar peak, but of a smaller scale (around 3,600 jobs). This reduced overall employment is a result of job losses in other sectors of the economy (such as ‘accommodation & food service activities’ and ‘information & communication’), driven by wage pressures from the high demand for construction jobs.

In 2027, the Track 2 CO₂ T&S systems start the deployment of their CCUS infrastructure, driving a peak in construction jobs supporting almost 6,700 FTEs (see Figure 3), again tailing off until construction activity is completed by 2030. Once again, the net peak in total UK employment peak is smaller by 2027, with just over 4,000 jobs supported across economy, as job displacement across other sectors offset the increased employment opportunities in construction.

From 2030 onwards, around 400 CO₂ T&S and 1,900 construction sector jobs are sustained through the operation of the new T&S sector. Furthermore, as labour constraints relax, some of the sectoral job losses are reversed and other supply chain linked jobs (such as in ‘transport equipment/other manufacturing’ and ‘finance/insurance’ sectors) and across the wider economy are supported in the long-term, reaching an increase of around 4,120 sustained jobs relative to the baseline (see Figure 2).

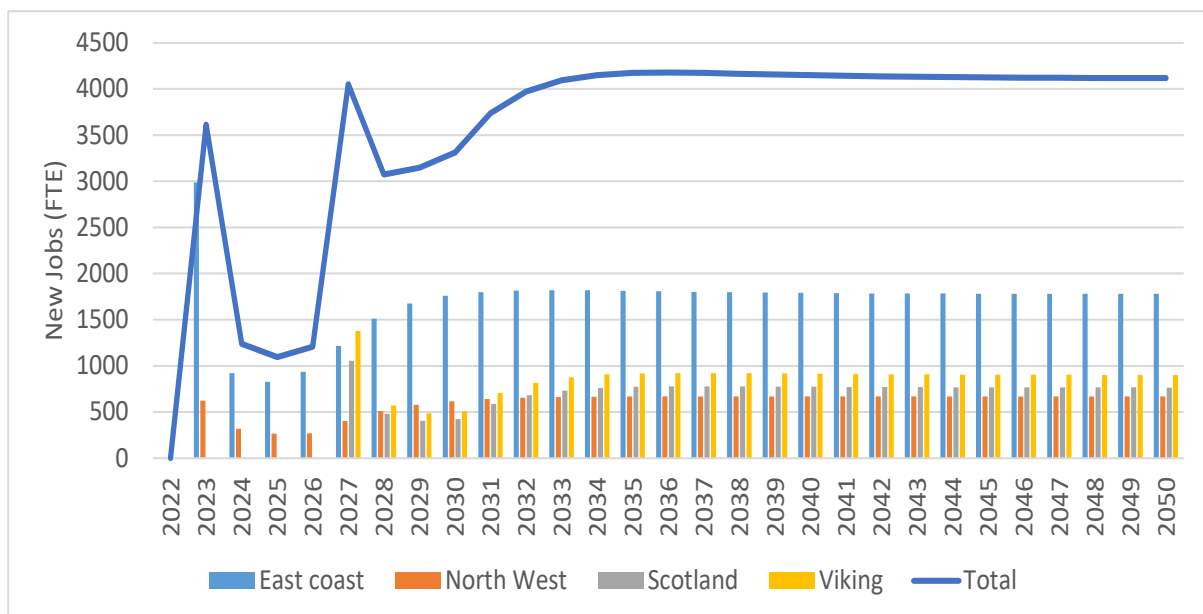


Figure 2. Economy-wide employment changes (FTE) for Track 1 and Track 2 T&S activity relative to baseline.

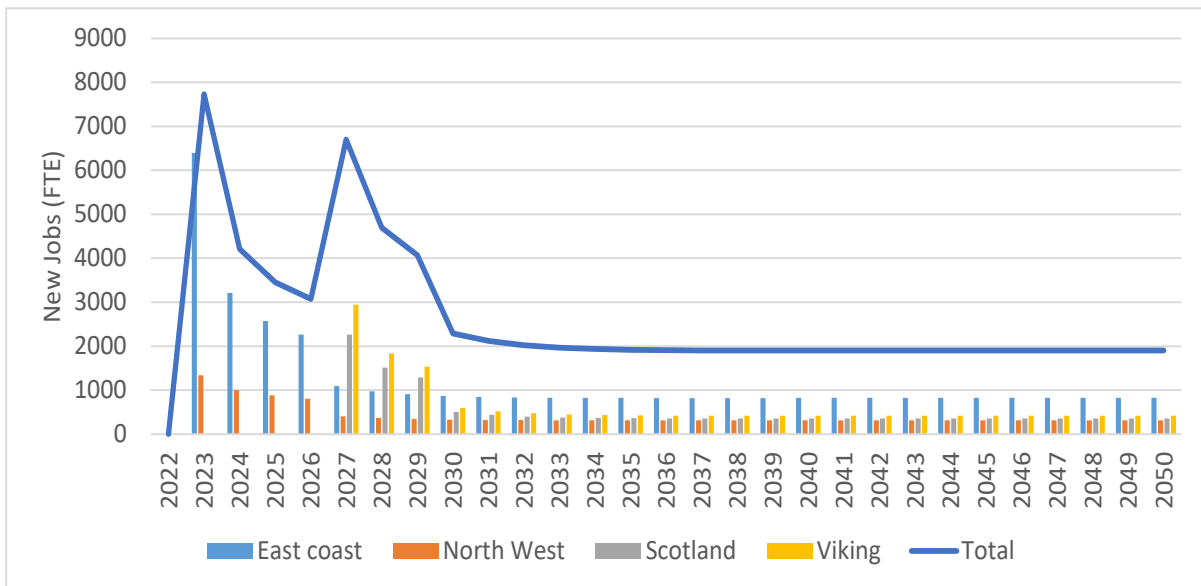


Figure 3. Construction sector employment changes (FTE) for Track 1 and Track 2 T&S activity relative to baseline.

2. Regional implications of employment changes

Figure 4 shows the regional mapping of employment changes linked to the deployment of the T&S sector servicing the Track 1 and Track 2 clusters on peak activity years (2023, 2027) and in the long run (2050). It groups impacts into those sectors where most employment changes take place – the T&S sector itself and the construction sector – and all others. This regional mapping has been developed based on current existing jobs shares per sector and region, from ONS data¹². In Figure 4, the first frame identifies the regions considered, whilst the second and third frames show the distributed outcomes across sector groupings and regions in the two peak years of 2023 and 2027. The fourth frame shows sustained employment changes in the long run.

In 2023, Track 1 T&S systems (Figure 4.a) drive high employment needs for construction of over 3,000 FTEs for each of the Yorkshire & the Humber and North East, regions and over 1300 FTEs for the North West region. At this time, the Track 2 T&S systems (Scottish and Hynet) have not started activity, so that, for example, there is some displacement of employment in the Scottish region (a net loss of around 260 jobs) that is linked to wage-driven cost and price pressures triggered by the rise in labour demand associated with the investment activity around the Track 1 T&S activity.

Generally, in all regions not directly benefitting, the high demand for construction jobs in northern regions hosting the Track 1 and 2 T&S systems creates wage pressures that affect all sectors of the economy. This includes the construction industry but there the demand boost dominates. However, the wage-driven cost and price pressures drive job and activity displacement in other sectors, especially in more wage- and/or labour-intensive ones, such as services, hospitality, etc. Crucially, this leads to regional net employment losses being greater in the regions where these types of sectors are more prevalent, e.g., London and southern regions.

¹² ONS, 2022. JOBS05: Workforce jobs by region and industry - Office for National Statistics <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/workforcejobsbyregionandindustryjobs05> (accessed 4.11.22).

Year 2027 reflects the picture when investment activity starts around the Track 2 T&S systems (Figure 4.b), where the Scottish T&S activity requires over 2,300 construction jobs in Scotland, and about 3,200 jobs linked to Viking CCS, located between Yorkshire and the Humber and the East Midlands regions. As observed in the first year of investment in the Track 1 T&S systems, we also see job displacement in other regions and sectors, again particularly where more wage- and/or labour-intensive consumer facing activity is concentrated.

Year 2050 shows the long-term regional employment changes. The CO₂ T&S sector is operating across all clusters, supporting around 400 direct jobs across the clusters' regions. Construction jobs are also sustained over time in these regions, servicing infrastructure capital linked to the construction activity previously developed. However, the sector shows activity across all regions due to the general increase in economic activity across multiple sectors, albeit at a lower scale in southern areas due to the impact of wage cost driven displacement. Crucially, and as labour market constraints relax, the job displacement previously seen is reversed and other supply chain and induced jobs across the wider economy are supported in the long-term, reaching an increase of around 4,120 sustained jobs relative to the baseline.

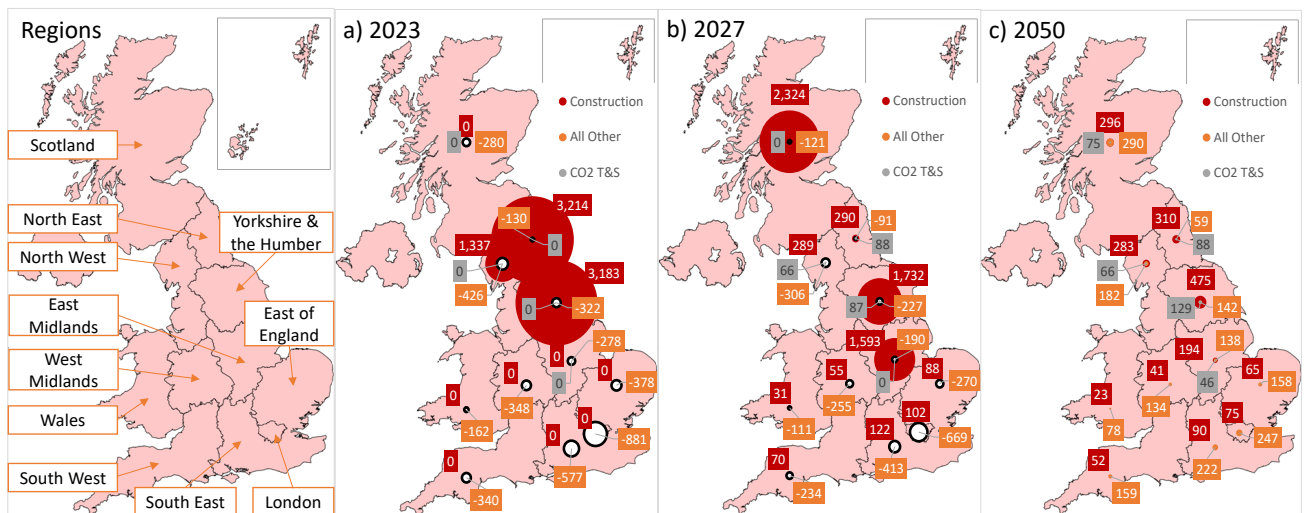


Figure 4. Regional employment changes (FTE) for Track 1 and Track 2 T&S activity relative to baseline – focus on key activity years: 2023 and 2027, and sectors: construction and CO₂ Transport & Storage.

3. Comparison of cluster plans employment estimates

From the UKRI: Enabling net zero: a plan for UK industrial decarbonisation report³, we summarise in Table 1 the job creation potential reported across the six Industrial Cluster Challenge (IDC) cluster plans. From this table we can see that:

- There is no consistency on the type of jobs reported. (E.g., across direct jobs, total jobs, retained jobs, etc.), or in timelines (e.g. jobs per annum vs cumulative until 2040, 2045, etc.).
- There seems to be no consistent methodology used to assess economic and employment impacts across the plans. In some cases, there is also lack of detail on the methodology and assumptions reported (see not available 'N/A', in Table 1).
- There is a lack of detail on location and/or types of jobs.

Table 1. Comparison of job creation reporting across the IDC clusters plans.

IDC Cluster plan	Job creation reported	Methodology	Reference
Humber Industrial Cluster Plan (HICP)	the creation of over 22,000 direct jobs	System model developed by Element Energy and Cambridge Econometrics	HICP, Humber Industrial Cluster Plan: Together it is Possible, 2023, pg. 52.
Net Zero North West (NZNW) Cluster Plan	34,500 jobs	Economic multipliers Developed by MACE group	NZNW, North West Cluster Plan, 2023, pg. 5.
Repowering the Black Country (RtBC)	50-500+ jobs per hub (with 60 hubs expected to be required)	N/A	Repowering the Black Country (RtBC), Exploitation Plan, 2023, pg. 4
Scottish Net Zero Roadmap (SNZR)	average of 5,000 jobs per year between 2023-2045	Input-output approach (Element Energy?)	NECCUS, SNZR - A Net Zero Roadmap for Scottish Industry, 2023, pg. 5.
South Wales Industrial Cluster (SWIC) Cluster Plan	Help retain 113,000 industrial and manufacturing jobs in the region	N/A	SWIC, South Wales Industrial Cluster Plan: A Plan for Clean Growth, 2023, pg. 24
Tees Valley Net Zero (TVNZ) Cluster Plan	by 2040, up to 30,000 new jobs	N/A	TVNZ, TVNZ Key Findings Report, 2023, pg. 4.

This lack of consistency has been recognised as a policy and project delivery challenge. In the Enabling net zero: a plan for UK industrial decarbonisation report³, the UKRI makes the following recommendations:

- **‘Recommendation 4: Develop actionable measures and timings of jobs and skills requirements needed for industrial clusters to decarbonise’** (...) ‘This involves establishing a consistent method of modelling workforce and skills needs based on planned projects and mapping the regional requirements to understand the availability and allocation gaps.’
- **‘Recommendation 5: Define and prescribe standardised methodologies for decarbonisation impact estimating’** (...) ‘To facilitate this, common methodologies for decarbonisation estimating need to be identified and adopted to allow decisions to be made based on consistent information, and in doing so, increase the effectiveness of delivering the UK’s emissions targets.’

Our research responds directly to these recommendations, providing a peer-reviewed economic modelling approach that allows for a consistent individual cluster and aggregated economic analysis and employment needs for industrial decarbonisation activity for the cluster efforts.

Conclusions and future directions

The three key messages contained with this briefing around transitory peaks in UK construction sector job creation, the risk of job displacement in regions and sectors and ensuring consistency in assessing employment requirements and economic impacts across industry clusters point to four wider policy implications.

First, action on addressing worker and skills shortages is absolutely critical to delivering industry as well as other decarbonisation efforts as well as economy-wide outcomes in relation to the net zero transition. Mechanisms such as the Green Jobs Delivery Group initiated by UK Government are vital and momentum around these must be sustained.

Second, understanding demand and supply issues including transitory peaks and regional and sectoral implications needs to happen across different decarbonisation areas (industry, heating, transport, etc.) at an individual level and at aggregate level in order to understand the scale and nature of both the opportunities and challenges of ensuring the skilled workforce necessary for the net zero transition.

Third, there is an urgent need to review and make decisions on how competition and/or coordination between nascent T&S economic sectors (at home and abroad) will operate. Crucially, this is not limited to 'product' competition (i.e. T&S services) but to resource competition e.g. for labour, which is more complex, impacting all sectors of the economy. In this regard, it is important to also make decisions regarding the extent of government leadership required to ease potential congestion and ensure that the new UK T&S sector and other CCUS-related industries maximise domestic GVA, employment and revenue gains in a constrained economic landscape, while delivering competitive decarbonisation for UK industry.

Fourth, the CO₂ Transport and Storage industry is a nascent sector and understanding of the associated investment and employment requirements are continuously evolving. As well as defining more consistent ways of considering requirements and their economic impacts, these assessments need to be regularly reviewed and refreshed based on the latest data as understanding of requirements develops.

Our aim is to develop this research programme with a focus on exploring the regional implications and the types of jobs and skills requirements of a nascent CO₂ transport and storage sector in more detail. This includes how labour market responses and consequent economy-wide impacts of investing and deploying CO₂ transport and storage may be affected by the projected decline of the UK oil and gas industry, from which infrastructure and supply chain capacity are drawn.

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