UNIVERSITY of STRATHCLYDE
CENTRE FOR ENERGY POLICY

Understanding the wider economy impacts and informing policy around Net Zero industry development

Scotland's Net Zero Infrastructure Programme (SNZI) – Year 1 Progress Report

https://doi.org/10.17868/strath.00081951

August 2022

UNIVERSITY of STRATHCLYDE
CENTRE FOR ENERGY POLICY

About the SNZI programme

SNZI is a £30m UK Government funded initiative, with industry match funding and linked to the Acorn carbon capture and storage (CCS) project. It brings together academic and industrial partners to develop a major package of work designed to progress a national low carbon infrastructure.

This important programme will provide a significant boost to the region's fast-growing low carbon credentials, paving the way for onshore and offshore developments totalling in excess of £3 billion.

As the sole academic partner, the Centre for Energy Policy (CEP) leads work around generating applied insight of the role of a CO_2 management sector/industry built around the Acorn project in Scotland, and how it would interact with the UK wider economy, including supply chain requirements, cost/resource use implications for users and new industry/market scenarios in servicing internal UK and overseas markets. Through developing understanding of the transitory and longer-term economic impacts and job preservation and creation opportunities arising. The aim is to enable development of political economy narratives around which consensus can build in wider policy stakeholder communities, and provide the basis for analytical tools developed to more directly serve user needs in the future.

About the Centre for Energy Policy (CEP)

The University of Strathclyde's Centre for Energy Policy (CEP) works with research, government and industry partners to understand and address the pressing public policy challenge of ensuring transitions to mid-century net zero targets deliver sustainable and more equitable prosperity. Since its formal launch in 2015, CEP has established a solid track record of independent, rigorous and multidisciplinary research and timely and responsive knowledge exchange and policy engagement on energy and climate issues set in a wider public policy context. Focused on achieving real-world impacts, the Centre has helped shape UK and Scottish Government policy in areas including industrial decarbonisation, energy efficiency and low carbon transport.

Authors:

Professor Karen Turner (Director, Centre for Energy Policy, CEP and Strathclyde Principal Investigator) and Dr Julia Race (Vice Dean, Naval Architecture, Ocean and Marine Engineering and Co-Investigator), prepared with the support of Dr Oluwafisayo Alabi and Dr Antonios Katris (Research Associates, CEP)

Contents

Summary of key findings

- A Scottish CO_2 transport and storage (T&S) sector operating within a wider UK carbon capture and storage (CCS) system has the potential to deliver net gains in a number of areas including GDP and employment. However, a fundamental factor affecting the nature and extent of wider economy gains will be labour market responses – particularly in wage determination – where the wider UK labour market continues to be characterised by overall and sector- and/or skills-specific supply constraints.
- The costs and timely delivery of CCS deployment projects may negatively be affected by competition for appropriately skilled labour and the consequent mobility of workers across CCS and other infrastructure projects (at home and abroad). Furthermore, displacement of employment and activity across a range of sectors can be expected as a result of rising average labour costs.
- In terms of how UK Government funds any intervention in enabling and/or operating new T&S activity (e.g., in guaranteeing demand for a potential oversizing of industry capacity), any approach that involves displacing demand away from existing activity (e.g., where household budgets are affected by a taxpayer funded approach, or export demand may be lost – in the case of an industry pays' approach this leads to competitiveness loss in international markets) could trigger a wider economy contraction and net employment losses.
- In particular, where the UK is an early mover in the deployment of CCS, requiring regional cluster industries to cover costs related to guaranteeing demand for T&S services would add to costs associated with capturing CO_2 and risk displacement of industry and supply chain activity, employment and emissions outside of the UK (commonly referred to as offshoring or leakage). This would bring challenges for, and tensions with, 'levelling up' and 'just transition' policy agendas. Here, any transitory public support of CCS activity to avoid international competitiveness loss must involve focus on building efficiency and potential 'first mover advantage' in use of CCS as a decarbonisation solutions.
- Exploring and exploiting opportunities to export T&S services to overseas industries (i.e., 'importing' CO_2 captured elsewhere) abroad could ease the domestic cost burden, thereby helping mitigate or even completely offset any negative (and, crucially, offshoring/leakage) pressures on UK GDP, employment, investment and emissions.

Introduction

This report details the programme of activity, outputs, outcomes and lessons emerging through the research undertaken as part of the UKRI-Innovate UK funded programme "I**nvestigating Wider Economy Impacts of Net Zero Industry Development – Scotland's Net Zero Infrastructure Programme"** by the University of Strathclyde's Centre for Energy Policy (CEP) between March 2021 – March 2022**.** As the lead academic partner on the SNZI Programme, CEP is developing understanding around the near-, medium- and longer-term economic impacts and job preservation and creation opportunities (for Scotland and UK) as Scotland transitions away from oil and gas to low carbon fuels like hydrogen and carbon dioxide (CO_2) removal technologies such as Carbon Capture and Storage (CCS). Our specific objectives are:

- To conceptualise a CO_2 management sector and the role and impact for the SNZI project in developing this industry in Scotland through the build out of the Acorn CCS project and Acorn Hydrogen.
- To understand, using the Acorn project(s) as an applied example, how such a CO_2 management industry would interact with wider economy, including supply chain requirements, cost/resource use implications for users and new industry/market scenarios in servicing internal UK and overseas markets.
- To develop a political economy narrative and build consensus across stakeholders including UK Government, Scottish Government, local government, industry, workers and consumers of the wider social and economic net benefits of a CO_2 management industry.
- To work with programme partners and policy users to investigate and enable the potential uptake of the economic modelling produced through the refined UK/Scottish CGE models (and underlying refined national input-output accounts) that incorporate specification of an evolving/potential CO_2 management sector.

In this first year of the programme, CEP's research focused primarily on CCS, and particularly on the T&S component, but with lessons drawn from the CEP team's previous work (funded by the Bellona Foundation and UKCCSRC) on the economy-wide implications of deploying T&S at the UK level, and of industrial adoption of carbon capture at Scottish and UK levels for the example of the Chemicals industry. The first year of work concentrated on exploring how the operation of a T&S sector built around the Acorn project primarily, but not exclusively, servicing the Scottish industrial cluster could impact on the wider UK economy.

The evolving policy landscape and research challenges

Through the CCS Infrastructure Fund the UK Government has committed £1billion to the deployment of CCS technologies in the UK and is aiming to capture and store at least 10Mtpa by 2030. This commitment forms part of a wider set of ambitions articulated in the UK Government's Net Zero Strategy published in October 2021, and more recently the Energy Security Strategy (April 2022). The UK's Carbon Capture, Usage and Storage (CCUS) cluster sequencing process was published in the first quarter of the programme (May 2021) and in October 2021 Hynet and the East Coast were announced as Phase 1 industrial clusters with Scotland identified as a reserve (and potential Phase 2) cluster.

These processes and decisions influenced our approach to the research. Specifically, we explored the impact in the UK economy of a CO_2 T&S sector that services the Scottish east coast cluster (including but not limited to Grangemouth). This enabled an initial exploration of how the use of shipping, instead of onshore pipelines, may affect investment requirements and the industry cost structure, which in turn impacts the wider economy. This is a crucial element, not least because it will have implications on the supply chain structure of the T&S industry. Building on the benchmark of a baseline where this looks very much like that of the current Oil and Gas (O&G) industry, we engaged with a range of experts, including existing SNZI programme partners, to identify what the structure of a T&S sector might look like in practice, and how it may evolve. This process was facilitated by our previous work as part of the UKCCSRC funded project '*The role of CCS in industry clusters in delivering value to the political economy'* through which we had previously developed the 'as if' O&G benchmark and tested for the Scottish case in the first peer-reviewed journal publication of the project.

Our research challenges were as follows:

- **Research Challenge 1:** Understand how a new CO_2 T&S industry servicing a Scottish regional cluster links into the Scottish and UK economies.
- **Research Challenge 2:** Could a strong export demand for the services of the T&S sector influence the potential economy-wide impacts.

Key findings and outcomes

Research Challenge 1: Understand how a new CO_2 T&S industry servicing a Scottish regional cluster links into the Scottish and UK economies.

In responding to this challenge, the first question was what does the T&S supply chain look like? As a benchmark, we considered how the introduction of a new T&S industry, initially servicing industrial capture in the Scottish Grangemouth cluster, might impact the wider UK economy if it shared the same supply chain structure as the existing O&G industry.

This was a useful starting point (and one that we consulted with industry and policy experts on), given the role many hope that CCS can play in utilising the existing O&G industry and supply chain capacity in Scotland in a way that helps transition the industry away from fossil fuel extraction and distribution. We set our initial scenarios in terms of how the key impacts of introducing a new T&S industry on the economy will differ depending on how Government decides to fund the need to guarantee demand for the output of what is likely to be initially oversized T&S capacity. The key findings emerging we are as follows:

- **Finding 1.1:** Introduction of the T&S industry does indeed have the potential to enable an economy wide expansion and to create new jobs, locally and across the UK, in a range of sectors, including many higher wage and/or labour-intensive service activities.
- **Finding 1.2:** Any gains will depend on the labour market conditions and, particularly in the presence of persisting labour supply constraints in the UK, what this may mean for wage rates, price levels, and potential displacement of other activity and employment across the economy. This combines with other cost pressures associated with the likely need for government to recover the costs of guaranteeing demand for T&S output at least in the medium to longer term in generating a challenging and complex mix of gross losses and gains in different parts of the economy across different timeframes.

- **Finding 1.3:** The magnitude and distribution of costs and benefits emerging across the economy depends on how the government covers its T&S expenditure, and there are some crucial trade-offs. For example, a public deficit funding option may deliver the best economy-wide outcomes at the expense of an increased budget deficit (where servicing consequent future borrowing requirements would further impact the macroeconomic outlook), while a pure 'industry pays' approach risks competitiveness loss and offshoring/leakage of investment and jobs (and displacement of carbon emissions), which would trigger a wider economic contraction and net employment losses.
- **Finding 1.4:** Where cluster industries are required to cover the costs of guaranteeing demand for T&S industry outputs, this will add to the challenges associated with adopting carbon capture (which may trigger losses in capital productivity and returns where additional equipment is required to produce a given level of output) in introducing real tensions for the Scottish 'just transition' and UK regional 'levelling up' agendas. This is because the contractionary and offshoring processes triggered by international competitiveness loss would likely have impacts concentrated in the regional host industries (including indirect supply chain and worker/consumer spending impacts).

Research Challenge 2: Could a strong export demand for the services of the T&S sector influence the potential economy-wide impacts.

We focused again on a T&S sector servicing primarily the Scottish industry cluster, using the same investment and demand assumptions around the structure of the sector as with Research Challenge 1. Crucially, the second round of analyses was informed by a discussion and material provided by SNZI programme partners, ensuring our scenarios aligned with the proposed timeline of the Scottish cluster.

- **Key Finding 2.1**: Securing export demand for Scottish T&S services could partly or wholly mitigate the negative economy-wide impacts emerging particularly in the case of basic 'industry pays' scenario analysed as part of the first Research Challenge. However, this does not mean that there are no negative impacts. There are still sectors losing out due to the additional costs passed to some of the UK industries, primarily due to the increased output prices that this drives which have a negative impact on the export demand of some sectors. This could lead to the persistence of net UK employment losses and public budget deficit outcomes, but with these being of much smaller magnitude compared to what emerges from scenarios not involving any export opportunities.
- **Key Finding 2.2:** Increased export demand does have the potential to drive a wider economic expansion. However, export demand is likely to be sensitive to price changes that may be absorbed in a purely domestic demand case, where government's priority is on utilising the T&S capacity. For this reason, when export demand replaces domestic demand, some gross economy-wide gains may be slightly eroded.
- **Key Finding 2.3:** The key benefit of increased export demand is that it reduces the level of T&S demand that could potentially have to be covered by government and/or require costs to be transferred in a way that negatively affects domestic activity levels. An immediate impact is that, with government not needing to guarantee demand for all the capacity created, there are smaller required budget deficits as the export demand is increased. Following on from this, the level of costs that need to be recovered from taxpayers (UK households) or UK industry, or add to the public deficit will be reduced, with knock on implications in terms of reducing the budgetary and or competitiveness implications.

Emerging impacts

Generating relevant and useful research in collaboration with policymakers

In this first year of the SNZI programme, our work has focused on developing a foundation of research and analysis that highlight key points of policy interest to ultimately support effective decision making around industrial decarbonisation. Firstly, as described above, our initial work has concentrated on developing research to inform understanding on the impact that decarbonising Scottish industrial sites (through CCS) could have on the wider UK economy. Given the quickly moving policy environment and the proposition for projects to be supported, at least initially, by significant government subsidies (as outlined in the CCUS Business Models proposals) this work is of significant interest to policymakers.

Our first briefing has been shared with officials at the Department for Business Energy and Industrial Strategy (BEIS) and the CEP team subsequently presented to CCS officials in a wider meeting to discuss the implications of our research findings and how they can inform policy development. Here officials recognised the value of the work in aiding thought around how CCS deployment may impact the wider economy and some of the inherent trade-offs involved.

Further analysis, informed by discussions with policymakers, focused on the potential for exports to alleviate economic pressures. This is something of significant policy interest given Government's aim of creating a commercially independent industrial sector in the UK that is ultimately less reliant on Government subsidy/support. Here our research shows that exports, particularly for CO_2 T&S services, could play an important role in alleviating wider economy pressures associated with deploying CCS.

Our engagement with the BEIS CCUS Directorate also highlighted the issue of labour market constraints and job displacement as a key area of policy interest which was also reflected in discussions with industry as highlighted below.

Informing wider stakeholder debate on industrial decarbonisation

In this first year of the programme we have undertaken a range of engagement activities aimed at both disseminating research findings and informing further research and analysis. For example, around the UN Climate Change Conference COP26 the CEP's Director Professor Turner contributed to a number of panel events focused on industrial decarbonisation, where learnings from research undertaken in the SNZI programme were shared.

In early 2022 a workshop was held with industry stakeholders from the Track 1 Industrial clusters in the North West and North East England. An overview of our research findings was presented which enabled wider discussion around how economic opportunities and impacts associated with deploying CCUS in the UK might emerge. Again, a key issue around labour supply constraints was raised by a number of industry participants. Here, it was recognised that labour shortages could impact both short term project/ programme deployment and medium to long term economic outcomes - something that our wider industrial decarbonisation research evidences.

Next steps

Understanding what a T&S industry supply chain looks like: A key point underlying our work so far is the assumption that the T&S industry will have an identical supply chain structure to the existing O&G industry. As part of the research programme, we have engaged with industry experts and other key stakeholders to interrogate this fundamental assumption and there is consensus that it is a useful/initial starting point. However, to improve the accuracy and validity of our scenario simulation model findings and insights, it is necessary to move towards understanding what a supply chain will look like for this new sector. In this respect, we have conducted a series of interviews with industry experts in the field of T&S, CCS more broadly and the existing O&G industry to better understand, and represent, how a new T&S sector could differ from the O&G industry in our economy-wide model.

Further development and analysis around the role of shipping: The outcomes from stakeholder interviews will also inform further analyses on the potential role of shipping as the means of transporting the captured CO_2. Currently, we have only conducted some exploratory analyses on the role of shipping, but more information will be necessary if we are to expand and report our analyses. However, we expect that shipping will play a significant role moving forward, as it will undoubtedly be the main transportation method for UK clusters without a neighbouring storage site or for CO_2 brought from abroad.

Consider the impacts of a T&S industry for a Scottish context: Beyond this development, it is our intention to also consider the impacts of a T&S industry in a Scottish context. To date, we have focused on a T&S sector that services primarily the Scottish cluster but considered the impacts at the UK level. As we move forward, and depending on policy/stakeholder interest, we may look to resetting existing and future analyses using a regional model for Scotland. This will allow us to better capture the regional impacts as well as investigate whether the outcomes will be affected by different considerations of which operations on the UK continental shelf can and cannot be allocated as part of the Scottish economy.

The impacts of a carbon tax: Our engagement with the wider policy community including BEIS and HM Treasury (HMT) highlighted the importance of exploring the impacts of introducing a carbon tax to the UK industries, which was identified as one of the key climate policy instruments in the UK Net Zero Review (October 2021). With the SNZI programme we have the potential opportunity to explore how the introduction of CCS and a new carbon tax mechanism interact and how far a carbon tax could incentivise and accelerate the deployment and demand for CCS.

A renewed focus on the carbon capture elements of CCS: We also plan to revisit the carbon capture element of CCS as more policy information becomes available. Our work so far had to rely on mostly illustrative cases that can highlight the main trade-offs emerging from the introduction of carbon capture in industries. This included our consideration of how this introduction could be supported by the government. In this evolving policy landscape, it is crucial that we continue our analysis so that we can explore how specific proposed policy actions can mitigate or aggravate the findings of our existing peer-reviewed work on carbon capture.

SNZI dedicated research outputs

- **Project Brief:**
  Investigating Wider Economy Impacts of Net Zero Industry Development
- **Policy Brief:**
  Could the introduction of a new CO_2 Transport and Storage industry in Scotland service decarbonisation, 'green growth' and 'just transition' agendas?
- **Policy Brief:**
  The importance of building export capacity in a new Scottish CO_2 Transport and Storage industry: alleviating domestic funding pressures and securing green growth and jobs transition

Linked research outputs

- **Journal Article:**
  Could CCUS in the UK constitute a new source of sustained 'green growth'?
- **Peer-Reviewed Journal Article:** Could a new Scottish CO_2 transport and storage industry deliver employment multiplier and other wider economy benefits to the UK economy?
- **Peer-Reviewed Journal Article:** Characterisation of UK Industrial Clusters and Techno-Economic Cost Assessment for Carbon Dioxide Transport and Storage Implementation

UNIVERSITY of STRATHCLYDE
CENTRE FOR
ENERGY POLICY

Understanding the wider economy impacts and informing policy around Net Zero industry development
Scotland's Net Zero Infrastructure Programme (SNZI) – Year 1 Progress Report