



Strathprints Institutional Repository

Turner, Karen and Race, Julia (2016) Making the macroeconomic case for CCS. Carbon Capture Journal, 54. pp. 14-15. ISSN 1757-1995 ,

This version is available at <http://strathprints.strath.ac.uk/58909/>

Strathprints is designed to allow users to access the research output of the University of Strathclyde. Unless otherwise explicitly stated on the manuscript, Copyright © and Moral Rights for the papers on this site are retained by the individual authors and/or other copyright owners. Please check the manuscript for details of any other licences that may have been applied. You may not engage in further distribution of the material for any profitmaking activities or any commercial gain. You may freely distribute both the url (<http://strathprints.strath.ac.uk/>) and the content of this paper for research or private study, educational, or not-for-profit purposes without prior permission or charge.

Any correspondence concerning this service should be sent to Strathprints administrator: strathprints@strath.ac.uk

Making the macroeconomic case for CCS

The Centre for Energy Policy at the University of Strathclyde argues that the UK's decision to scrap its CCS commercialisation competition brings into sharp focus an urgent need to consider the economic service role of capture, transport and storage activities.

By Karen Turner and Julia Race

In July 2016 a spending review briefing by the National Audit Office noted that, while agreeing with the Department for Energy and Climate Change (DECC) that CCS is required to meet UK carbon targets, "HM Treasury raised concerns about the merits of the carbon capture and storage competition given fiscal constraints".¹

At a recent UKCCSRC conference on 'Making the Case for CCS', the Centre for Energy Policy (CEP) has argued that some key omissions in the information provided to HM Treasury (HMT) by DECC may have contributed to the decision to cancel the competition:

The wider economic and fiscal case was not made to provide a context for how investment and operational costs may impact industry, consumers and public budgets.

The near-term benefits were not argued (e.g. direct and supply chain employment in developing infrastructure).

The longer term benefits of establishing carbon capture, transport and storage as economic service activities (i.e. in addition to estimates of additional costs of running a decarbonised UK economy by 2050 in the absence of CCS³) were not considered.

There is a need to consider the case for CCS via the type of full social cost benefit analysis recommended by HMT for appraisal and evaluation in 'the Green Book'.⁴ However, in order to inform this type of analysis there is a

need to think more broadly about 'the economics of CCS'.

Analysis of the contribution of CCS in moving towards a decarbonised economy is most commonly made through the use of energy system models such as TIMES. However, this does not offer much insight in terms of what is involved in making this contribution happen.

Given high start-up costs and uncertainty over up-take and operational costs, it is natural to be concerned about cost effectiveness, particularly where costs to end consumers and the wider competitiveness of UK industry are in question.

On the other hand, economic system models, such as the computable general equilibrium (CGE) model used by HMT to assess the wider economic and fiscal impacts of a range of policy actions and/or changes in economic conditions⁵, either do not include CCS or simply treat it as an 'end of pipe' technology that can be turned on or off at a cost.

The crucial point is that we need to think of CCS in broader terms. How would it actually be introduced, operated and regulated? CCS involves a chain of activities. First, capture must be carried out within the industrial or power generation plant generating CO₂. Second, CO₂ must be transported to the storage location (perhaps via some utilisation activity such as enhanced oil recovery, EOR). Third, CO₂ must be stored (most likely off-shore in the UK case).

The latter two stages are likely to be external to the CO₂ emitter and involve use of a common resource in the form of a transport and storage infrastructure. Thus, the question arises as to how different parts of the CCS chain may be initiated and operated. Emitters may be responsible for capture.

However, the high investment costs required for the transport stage, combined with the issue of management of storage capacity, imply that these elements are characterised by some element of 'natural monopoly', as is the case with, for example, electricity transmission or the rail network.

If we consider the essential nature of what CCS must do, this is a problem of disposing of a (largely) unwanted (unless there are CO₂ utilisation opportunities) waste by-product of economic activity. An, albeit imperfect, analogy may be drawn with the waste collection, treatment and disposal industry, which is included in the Standard Industrial Classification of Economic Activities.⁶

As generators of waste, households and businesses 'capture' the waste they generate. However, they are not expected to transport and deal with the waste. Instead, they (directly or indirectly) make some form of payment to publicly or privately owned waste transport and management operations to do this (in a regulated environment).

As well as providing a valuable economic service activity context (where people are employed, GDP and tax revenues are created)

1. See page 7 of 'Sustainability in the Spending Review' published by the National Audit Office in July 2016 at <https://www.nao.org.uk/wp-content/uploads/2016/07/Sustainability-in-the-Spending-Review.pdf>.

2. See programme and downloads of presentations and posters at <https://ukccsrc.ac.uk/news-events/events/making-case-ccs-edinburgh-biannual>.

3. For example the CCSA report in reaching decarbonisation goals in the absence of CCS may cost the UK economy an additional £32bn per year or 1% of GDP by 2050. See <http://www.ccsassociation.org/press-centre/reports-and-publications/delivering-ccs/>.

4. See <https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>.

5. For example, see HMT/HMRC analysis of the impacts of fuel duty reductions at <https://www.gov.uk/government/publications/analysis-of-the-dynamic-effects-of-fuel-duty-reductions>.

6. See file:///C:/Users/kkb12179/Downloads/sic2007explanatorynote_tcm77-223502%20(3).pdf, Section E, classifications 38 and 39 (page 38).

the waste analogy also provides a basis for considering the motivation for engaging in CCS from a human and/or environmental cost/risk perspective.

However, this also gives rise to a crucial problem: infrastructure has long been in place to dispose of waste because of very localised and immediate health concerns. In contrast, the problem of climate change is a global one that impacts over a longer time frame and potentially in a location remote from the source.

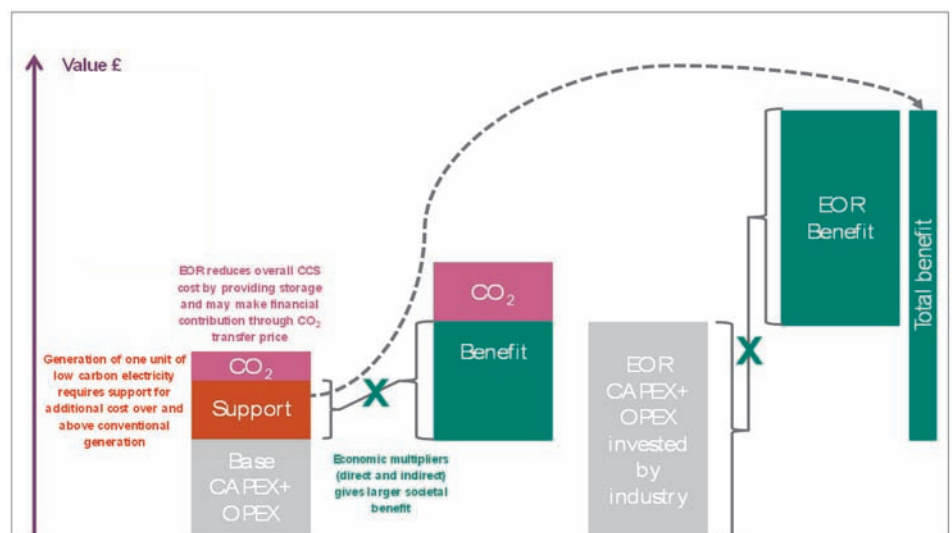
Thus, the economic case for collection and management of CO₂ via CCS may need to be stronger. One potential source of near term economic benefits would be development of transport infrastructure. While the value of 'economic activity for its own sake' may be contested, it is true that particularly creation of jobs in direct and supply chain activity to facilitate major infrastructure developments (e.g. Hinkley Point) is valued by public and politicians alike.

Moreover, where infrastructure development is ultimately to enable a fuller stream of economic and social benefits (and where average costs of the enabled activity will decline over time) we generally accept the initial financial and other resource costs, and welcome even short-term job and other value creation associated with the development.

It then becomes crucial to assess how both average and marginal costs of the different elements of the CCS chain are likely to decline over time – through advances and evolution in technologies, learning by doing and economies of scale with fuller deployment (including CCS cluster opportunities) – and to identify a full set of potential benefits. Wider economic benefits are also likely to evolve over time as UK supply chains respond to the presence of CCS.

Capturing the impact of CCS linked to EOR through multipliers

For example, CEP has conducted preliminary research of potential multiplier impacts through UK supply chains of CCS linked to EOR. As shown in the Figure, multiplier analysis focuses on how direct spending (privately or via government support) in any one activity creates further benefits through out-



Capturing the impact of CCS linked to EOR through multipliers⁷

put, employment and value-added generated in up-stream supply chains and through creation of any additional activity, for example where CO₂ can be used as an input to other processes (particularly if this involves a transfer price). There are a number of factors governing how multiplier benefits are likely to evolve, including:

Capacity and capability of domestic supply chains to support investment and operational stages of capture, transport and/or storage activities (noting that, via the oil and gas industry, and linked service sectors, the UK already has skills/expertise and, to some extent, a physical infrastructure foundation for transport and storage).

Whether technologies are developed at home or abroad (with the former providing technology/service export opportunities).

Whether the development of (elements of) CCS capability and infrastructure enables retention of existing energy-intensive industries and potentially attracts new firms to UK locations.

The July 2016 spending review by the National Audit Office notes that the UK Government retains the belief that CCS is likely to be necessary and play a crucial role in the future energy system and low carbon economy. It is necessary, then, to quantify solidly grounded scenarios for the role that the cap-

ture, transport and storage elements can play in an economic service context.

Moreover, and to effectively consider the case for required policy support in the shorter term (to facilitate the long term contribution of CCS), it is necessary that this be done in the type of economy-wide CGE modelling and social cost-benefit framework that is familiar to and trusted by key policymakers in HMT and elsewhere.

This will involve inter-disciplinary research activity (involving collaboration between academia, industry, government and society) to ensure that both the wider economic and technological characteristics of capture, transport and storage elements are effectively represented, and that the results usefully inform the wider public debate on the future of CCS in the UK.



More information

Karen Tuner is Director of the Centre for Energy Policy and Julia Race is Senior Lecturer in the Department of Naval Architecture, Ocean and Marine Engineering, both at the University of Strathclyde. www.strath.ac.uk

7. Figure taken from report (pp31-35) at <http://www.sccs.org.uk/images/expertise/reports/co2-eor-jip/SCCS-CO2-EOR-JIP-Report-SUMMARY.pdf>