

Institution: University of Strathclyde		
Unit of Assessment: C19 Politics and International Studies		
Title of case study: Shaping energy, climate and industry policy to realise wider economy and societal benefits in transitioning to net zero		
Period when the underpinning research was undertaken: 2012 - 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Karen Turner	Professor	07/07/1997 – present
Antonios Katris	Research Associate	01/11/2015 – present
Oluwafisayo Alabi	Research Associate	01/04/2016 – present
Christian Calvillo	Research Associate	01/10/2016 – present
Julia Race	Reader	01/09/2014 – present
Period when the claimed impact occurred: 2018 – December 2020		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact		
<p>Through direct engagement with public policy stakeholders at Scottish, UK and international levels, Strathclyde's Centre for Energy Policy (CEP) research on understanding, quantifying and building consensus around the wider economic impacts of different industry, household and policy actions has shaped policy development to support low carbon transition to mid-century net zero carbon targets. This includes use of CEP's research by the UK Government Department for Business, Energy and Industrial Strategy (BEIS) to support a 2018 policy strategy on carbon capture, usage and storage for industrial decarbonisation, and to inform the UK Chancellor's July 2020 decision to allocate public spending to support residential energy efficiency.</p>		
2. Underpinning research		
<p>One of the UK's most pressing public policy challenges is to reduce climate change impacts while ensuring sustained prosperity as households, industry and the wider economy transition to net zero carbon ambitions. Since 2014, the University of Strathclyde's Centre for Energy Policy (CEP) has sought to address this, undertaking research to examine: the wider economy consequences of energy and climate policy actions in different sectors; how understanding and communication of these consequences (and the potential effects of alternative courses of action) can help policy stakeholders frame and build consensus for different strategies and interventions.</p> <p>Led by Professor Karen Turner, an applied political economist working in the interdisciplinary field of energy-related policy, CEP has developed a range of analytical and modelling tools (with technical input from engineers at Strathclyde, St Andrews and UCL) to investigate the economy-wide impacts of specific energy and climate policy actions. These have been applied to priority issues including UK and Scottish residential energy efficiency programmes, electricity network investments to support the projected UK Electric Vehicle (EV) rollout, and support of carbon capture activity in emissions-intensive regional industry clusters. Collaboration with policymakers to ensure policy relevance has been a key feature of this work, enabling CEP to provide analyses of real decarbonisation projects, in order to address specific policy challenges in a useful and grounded way. Key examples drawn from CEP's research portfolio are outlined below, showing the interconnectedness and cumulative development across projects.</p>		
Economy-wide impacts of energy saving innovations		
<p>An early CEP EPSRC project (2015-2017) refined Computable General Equilibrium (CGE) methods to investigate how actions to increase residential energy efficiency may trigger a wider and sustained stimulus across the economy by reducing energy bills and freeing up real income to spend on other goods and services. This research found that the trajectory of UK GDP could be raised by up to 0.1% per annum by supporting residential efficiency actions that enable households to use on average 10% less energy in heating and lighting their homes [R1].</p>		

In a subsequent EPSRC Impact Acceleration project (2019/20), conducted in partnership with the BEIS Home and Local Energy Analysis Team, CEP further refined and developed the application of the CGE methodology to investigate the timing and magnitude of different household and wider economy impacts (focussing particularly, but not exclusively on jobs and GDP) under alternative energy efficiency funding instruments. As reported in **R2**, the key findings were:

- all funding instruments considered enable residential energy efficiency gains that trigger a process of wider economic expansion with net jobs and GDP generation;
- while the current system that involves centralised project delivery with recovery of cost through consumer bills generates a smoother path of economic expansion, greater returns can be secured through low interest loan or tax-funded grants for household-specific projects;
- there is a trade-off between the extent of sustained economic expansion and favouring low income households in the distribution of funding, simply because of the smaller actual energy bill savings and spending power of these households.

Value of supply chains supporting low emission vehicles and other low carbon solutions

In collaboration with engineers at St Andrews and UCL via the EPSRC Supergen Hydrogen and Fuel Cell Hub (2016/17), CEP developed an input-output 'multiplier' method to decompose supply chain value. This research found that petrol and diesel supply chains are highly import-intensive of petrol, while UK electricity and gas supply chain have strong links to labour intensive, high wage and/or other value-added sectors such like UK construction, finance and manufacturing **[R3]**.

Extending the application of the input-output 'multiplier' method through an EPSRC Impact Acceleration Account project (2017/18), in partnership with BEIS, CEP investigated the composition and extent of the current contribution of emissions intensive manufacturing sectors to UK employment, wage income and GDP. This led to the recommendation that justification for government support to develop competitive decarbonisation through carbon capture at the UK's regional industry clusters should take account of the fact that sectors such as petrochemicals support up to four indirect jobs across the UK economy for every direct industry job **[R4]**.

Through work partly funded by the ESRC CESI centre (2018-2019), in partnership with Scottish Power Energy Networks, CEP developed a more flexible and theory-consistent computable general equilibrium (CGE) scenario simulation modelling approach to consider whether multiplier results from **R1** for a shift to electric vehicles (EVs) still hold under two practical public policy considerations. First, where extensive industry infrastructure investment is required to enable the projected UK roll out of EVs. Second, where the wider economic expansion enabled by this and the shift towards electric fuelling trigger a range of price and income effects. This research found that the need to recover electricity industry investment costs through consumer bills and the presence of lasting labour supply constraints in the UK economy do act to depress employment and GDP growth. However, the strength of UK economy linkages in the electricity supply chain is sufficient to power sustained net expansion in jobs and incomes **[R5]**.

Building consensus on the role of Carbon Capture and Storage (CCS) in industry clusters

Drawing on the IAA evidence **[R4]** and learnings from political science on the use of economic narratives to build consensus around broad positive ideas to underpin public policy strategies, CEP examined how CCS in industry clusters can deliver value to the political economy. Focused on sustaining the economic contribution of emissions-intensive industries, this EPSRC UKCCSRC project (2019-20) concluded that both policy decision makers and stakeholders require a grounded illustrative evidence base such as that provided by our multiplier metrics **[R6]**.

3. References to the research (Strathclyde-affiliated researchers in **bold**)

- R1 G. Figus, K. Turner, P. McGregor, A. Katris** (2017) Making the case for supporting broad energy efficiency programmes: impacts on household incomes and other economic benefits, *Energy Policy*, 111: 157-165 <http://dx.doi.org/10.1016/j.enpol.2017.09.028>
- R2 A. Katris, K. Turner, K. Vishwakarma** (2020) Funding UK Residential Energy Efficiency: The economy-wide impacts of ECO and its alternatives, CEP Policy Brief (18 pages) <https://doi.org/10.17868/71454>

- R3** K. Turner, O. Alabi, M. Smith, J. Irvine, P.E Dodds (2018) Framing policy on low emissions vehicles in terms of economic gains: might the most straightforward gain be delivered by supply chain activity to support refuelling?, *Energy Policy*, 119: 528-534
<https://doi.org/10.1016/j.enpol.2018.05.011>
- R4** K. Turner, J. Race, O. Alabi, R. Low (2018) Making the macroeconomic case for near term action on CCS in the UK? The current state of economy wide modelling evidence, CEP Policy Brief <https://strathprints.strath.ac.uk/63554/>
- R5** O. Alabi, K. Turner, G. Figus, A. Katris, C. Calvillo (2020) Can spending to upgrade electricity networks to support electric vehicles (EVs) roll-outs unlock value in the wider economy?, *Energy Policy*, 138: 111-117 <https://doi.org/10.1016/j.enpol.2019.111117>
- R6** K. Turner, O. Alabi, J. Race (2020) Nudging policymakers: a case study of the role and influence of academic policy analysis, *Journal of European Public Policy*, 27(8): 1270-1286
<https://doi.org/10.1080/13501763.2020.1742774>

Notes on the quality of research: All journal articles were peer reviewed. This research has been supported with competitively-awarded funding totalling approximately GBP2,000,000. The main funder was EPSRC (e.g. Turner PI, 'Energy Saving Innovations and Economy-Wide Rebound Effects', 01/03/15-28/02/17, GBP302,477), with additional funding from UK government bodies and their public corporations (e.g. Low, Turner, Reframing value of CCS in Scotland, Crown Estates Scotland, 01/10/2018-30/11/2018, GBP12,000) and other industry and third sector sponsors.

4. Details of the impact

Since 2018, Strathclyde's research and expertise in political economy impact analyses has:

1. Directly informed the UK Government's Carbon Capture, Usage and Storage (CCUS) Action Plan (BEIS, 2018), justifying the deployment of CCUS in industrial clusters by evidencing jobs and GDP supported by high value manufacturing.
2. Enabled UK Government decision-making on residential energy efficiency, supporting public financing for a significant new energy efficiency programme in response to the Covid-19 economic crisis by evidencing wider economy returns.
3. Framed the Scottish Government's approach to energy efficiency decision-making, embodied in the 2018 Energy Efficient Scotland Route Map (EESR) through similar evidence of economic gains emerging.
4. Informed industry responses to the decarbonisation and net zero transition challenge.

1. Informed UK Carbon Capture, Usage and Storage (CCUS) Action Plan

In 2018, the UK Government published a Carbon Capture, Usage and Storage (CCUS) Action Plan as part of the UK Industrial Strategy. This sets out how government and industry will work together to enable the deployment of CCUS at scale during the 2030s and provides the framework for decision-making. Through direct engagement with the Department for Business, Energy and Industrial Strategy (BEIS), key aspects of this Action Plan were informed by Strathclyde's Centre for Energy Policy (CEP) research on developing metrics to communicate the value to the UK economy of activity supported by industries that need to decarbonise [R3, R4], and building consensus around emerging policy narratives [R6]. Confirming this, the Head of the CCUS Policy Team at BEIS notes: 'we drew directly on your research insights in developing the action plan. In particular, we used the research set out in Turner et al. 2018 [R4] to shape the argument made on page 29 of the Action Plan around the sustained contribution that CCUS can enable in supporting direct high value jobs in capital intensive industries and, crucially, in supporting indirect employment' [S1]. This influence is made explicit in the Action Plan which draws language from and cites CEP research [R4] to justify support for competitive CO2 emissions reductions systems that will ensure the continued growth and evolution of energy-intensive industries such as petrochemicals [S2, pp.29, 70]. Strathclyde is also identified as a key UK asset, with CEP's 'World-leading research into economic impacts of CCUS' recognised as one of only 7 'ideas foundations' of the Industrial Strategy [S2, pp.16-17, reiterated in S1].

The Head of Energy and Innovation Policy at the INEOS Group (a leading multinational chemical company and largest petrochemical manufacturer, with sites at 3 of the 6 UK regional industrial

clusters) confirms the importance of this change in UK government strategy to industry actors who need to respond to the decarbonisation challenge. He outlines the importance of CEP's role from an industry perspective: *'The changes CEP research has effected in government policy strategy on CCUS and industrial emissions reduction has brought industry focus on commercial decisions and policy in this area. By enhancing our understanding of the likely impact of these changes across the wider economy, your expertise and research is enabling more effective industry engagement with government to drive forward action required for the net zero carbon transition'* [S3].

Following the publication of the CCUS Action Plan, substantial progress has been made through the wider UK Industrial Strategy to advance development of CCUS in the UK. This is reflected both through high level policy signalling (e.g. 'The ten point plan for a green industrial revolution' announced by the Prime Minister in November 2020), and GBP140,000,000 for the Industrial Strategy Challenge Fund (ISCF), where CEP's research continues through two industry-led ISCF projects to 'roadmap' and enable deployment of industrial decarbonisation solutions.

CEP's insights on the impacts and opportunities of industrial decarbonisation have also informed ongoing UK policy debates. For example, in April 2020 written and oral evidence submitted by Professor Turner to the House of Lords EU Internal Market Sub Committee was used to support recommendations on state support for net zero initiatives to the UK Minister for Small Business, Consumers and Labour Markets [S4]. Reporting on an inquiry into *EU-UK Brexit negotiations on the level playing field and state aid*, the Committee's letter quotes Turner in several places with regard to *'the economic impacts of subsidies to support decarbonisation and energy efficiency'*, *'major infrastructure projects to support the net-zero transition'* and *'the synergy between the UK's net-zero ambitions and its levelling up agenda'* [S4 pp.17-19].

2. Enabled UK Government decision-making on residential energy efficiency

In July 2020, the UK Chancellor announced a new programme of government support for residential energy efficiency through the 'Green Homes Grant' in the Covid-19 recovery package. Through the scheme, homeowners and landlords in England can apply for up to GBP10,000 to make properties more energy efficient. CEP helped to inform this decision to provide public support for residential energy efficiency actions through a partnership with BEIS officials funded through the Strathclyde's EPSRC Impact Acceleration Account. CEP's research demonstrated how different forms of support for energy efficiency actions through mechanisms and policies such as the Energy Company Obligation (ECO) and the Green Homes Grant can be justified by sustained delivery of GDP and employment gains, but that the distribution and extent of gains vary depending on how costs are recovered. Recognising CEP's influence, the Economic Advisor on the BEIS Clean Growth team responsible for home energy states: *'The research has provided particularly useful information on the macroeconomic impacts of ECO and helped the Government draw conclusions about the most socially cost-effective funding mechanisms. The work highlighted second-order impacts of particular elements of the scheme, helping to identify ways in which policies can be improved to promote growth and equitable transition to Net Zero'* [S5].

BEIS also note the contribution that CEP's research [R1, R2] and insight played in supporting the Green Homes Grant announcement made by the Chancellor in July 2018: *'For a recent Government announcement on a GBP2,000,000,000 insulation scheme a wide range of sources on the number of jobs that insulation can support were compiled, of which the research the Centre for Energy Policy formed part of the consideration. We are pleased that the research undertaken could provide supporting evidence for large scale policies that will have a huge impact in reducing carbon emissions and supporting jobs'* [S5]. This example demonstrates the systematic pathway to impact that CEP has established. Not only is CEP's work being referenced by policymakers, but CEP is also working closely with government officials to conceptualise and co-create timely and relevant research that can be drawn on, as part of a necessary wider body of evidence, to directly support the decision making process. Beyond that, the Computable General Equilibrium (CGE) methods and approaches developed by CEP are being utilised by Government teams delivering lasting and ongoing impact, for example in the BEIS adoption of our UK CGE economic model.

3. Framed Scottish Government approach to energy efficiency decision-making

In 2018, the Scottish Government published the Energy Efficient Scotland Route Map (EESR), which sets out the journey our homes, businesses and public buildings will take to become more energy efficient. Through direct engagement with the Scottish Government's Better Homes Division, enabled by an EPSRC Impact Acceleration partnership, CEP's research on the impact of residential energy efficiency gains across the wider economy led to a change in the framing of decisions on energy efficiency policy to emphasise the importance of enabling wider economy gains. These include sustained net gains to Scottish GDP and new jobs created. This is reflected in the EESR, which cites CEP's research [R1] and displays a headline result in an infographic [S6, p.23].

The (then) Head of Area Based Schemes within the Better Homes Division affirms: *'We gained some key insights from your work regarding the nature of economic expansion processes triggered by both investment in and realisation of energy efficiency gains. In particular, the work highlighted (a) the potential for short term negative impacts on household incomes due to repayments of loans before real income gains triggered by efficiency gains take full effect; (b) the importance of Government's role in putting in place a funding framework that gives certainty to households and the confidence to the sector to invest in their business over the duration of the energy efficiency programme'* [S7].

Since the EESR was published, a range of specific actions have emerged, including the introduction of regulations to improve the energy efficiency of rented homes (due April 2020, but postponed due to Covid-19), and a process of consultation on legally binding standards for owner-occupied homes.

4. Informed industry responses to the decarbonisation and net zero transition challenge

CEP's research and expertise has directly informed industry responses to the decarbonisation challenge. To give an illustrative example, insights on the wider economy impacts of facilitating the rollout of electric vehicles [R5] have enabled industry actors, such as the electricity network operator SP Energy Networks (supplier to 3.5 million homes and businesses in Scotland, England and Wales), to align their regulated business plans with policy commitments to achieve net zero. Acknowledging the value of CEP's research and its influence on the company and energy sector more broadly, the Policy and Economics Manager at SPEN notes: *'The robust analysis undertaken at the Centre has given SPEN a crucial understanding of how investing in the electricity networks to facilitate the roll-out of electric vehicles could bring benefits to the transitioning UK economy, including supporting the required recovery from the current COVID crisis. The research has also been useful in helping SPEN recognise and understand the wider public policy consequences of such an investment, and to understand how impacts on different sectors and households depend not only on a range of policy and economic factors, but also on the timing of industry investment decisions and recovery of costs through energy bills'* [S8]. Furthermore, SPEN has used evidence of the wider benefits of network investment to *'demonstrate to policy makers the need to take a whole energy system and economy-wide approach when designing an appropriate regulatory framework for the sector'*, and applied it within strategic planning processes to *'ensure that our business plans for the RIIO-2 Price Controls are aligned with public policy objectives'* [S8].

5. Sources to corroborate the impact

S1 Factual statement from Head of CCUS Policy Team, BEIS, dated 17 December 2018.

S2 UK Government (2018) [Clean Growth: The UK Carbon Capture Usage and Storage deployment pathway – an action plan](#) (pp.16-17,29,70).

S3 Factual statement from Head of Energy and Innovation Policy, INEOS dated 2 September 2020.

S4 Letter from House of Lords EU Internal Market Sub Committee to Paul Scully MP, Minister for Small Business, Consumers and Labour Markets, BEIS, dated 2 April 2020 (pp.17-19).

S5 Factual statement from Economic Advisor, Clean Growth, BEIS, dated 26 August 2020.

S6 Scottish Government (2018) [Energy Efficient Scotland Route Map](#) (p.23).

S7 Factual statement from Head of Area Based Schemes, Housing, Regeneration and Welfare Directorate, Scottish Government, dated 26 June 2018.

S8 Factual statement from Policy and Economics Manager, SP Energy Networks, dated 16 October 2020.