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An integration of net imported emissions into climate change targets

Kate Scott *, *John Barrett*

Sustainability Research Institute, School of Earth and Environment, University of Leeds, Leeds LS2 9JT, UK

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ABSTRACT

There is an international divide between net emissions importers and net emissions exporters, with industrialised nations mainly falling into the former and emerging economies the latter. Integrating emissions transfers into climate policy, so as not to disadvantage export-intensive countries, has been suggested to increase participation in international emissions reduction commitments. Consumption-based scenarios are presented for the UK identifying the geographic and sectorial source of emissions to meet future consumer demands given the current international climate policy landscape. The analysis is applied to the UK yet the discussion is applicable to international climate policy; assigning national responsibility for global emissions reductions; and extending the mitigation potential for net importing countries. Two trajectories for UK consumption emissions are calculated in which (1) international reduction targets are consistent with those pledged today equating to four degrees of temperature rise and (2) international reduction targets achieve a two degree future. By 2050 it is estimated that UK consumption emissions are 40–260% greater than UK territorial emissions depending on the strength of global reduction measures, and assuming the UK meets its 80% reduction in 1990 emissions by 2050 target. Cumulative emissions are presented alongside emissions trajectories, recognising that temperature rise is directly related to every tonne of carbon emitted. Whilst this paper argues that the current UK emissions targets underestimate the UK's contribution to global mitigation for two degrees, it shows how expanding the focus of policy towards consumption introduces new opportunities for reduction strategies at scale. The paper advocates the implementation of consumption-based emissions accounting which reveals underexploited policy interventions and increases the potential to break down barriers that exist between industrialised and emerging economies in international climate policy.

1. Introduction

Drastic cuts in emissions are needed to achieve the global climate objective of limiting temperature rise to two degrees. The IPCC 5th assessment report presents the latest scientific evidence on the relationship between emissions and temperature rise (Stocker et al., 2013). The report shows that global temperature rises are approximately proportional to an increase in cumulative carbon emissions, and not simply end-point targets for 2050, given that emission pathways can differ (Gillett et al., 2013). This has major implications for the way climate change targets are implemented. Contributions to climate policy literature have illustrated the need to replace end-point targets with cumulative carbon budgets (Anderson et al., 2008; Anderson and Bows, 2011, 2012; Meinshausen et al., 2009; Peters et al., 2013; Gillett et al., 2013; Chicco and Stephenson, 2012). Cumulative emissions will depend on the interplay of technology and policy development, and how effective policy can enable the deployment of low carbon technologies (Chicco and Stephenson, 2012).

* Corresponding author. Tel.: +44 113 3435576.
E-mail address: k.a.scott@leeds.ac.uk (K. Scott).
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Reaching global agreement on how much responsibility should be assigned across regions is being contested in international climate negotiations, creating somewhat of a climate 'impasse' (Grasso and Roberts, 2014). Currently greenhouse gas emissions reductions are by-and-large governed by a pledged-based system of end-point targets benchmarked against territorial emissions in a handful of regions implemented under the Kyoto Protocol and Cancun Agreements; however these commitments alone equate to in the region of four degrees of warming (IEA, 2012). Industrialised countries, termed Annex I parties,[1] have the strongest quantitative commitments and reporting obligations compared to emerging and developing economies, non-Annex I parties,[2] which have qualitative obligations, more lenient reporting requirements and eligibility for financial and technological assistance (Depledge, 2009). Countries are often referred to as Annex B and these are the Annex I countries that have ratified an emissions reduction target under Annex B of the Kyoto Protocol, which in its second phase accounts for less than 15% of global emissions (Grubb, 2013).

In contrast to territorial emissions accounting, research papers in the last five-to-ten years have calculated countries' consumption-based emissions accounts: the emissions embodied in a country's final consumption regardless of where they are produced (for example Davis and Caldeira, 2010; Hertwich and Peters, 2009). Studies show that industrialised countries tend to be net importers of emissions whereas emerging and less developed countries tend to be net emissions exporters. In the first round of Kyoto targets the emissions saved were completely offset by net emissions transfers from non-Annex B to Annex B countries (Peters et al., 2011; Kanemoto et al., 2014), referred to as carbon leakage. However, there has been little debate on the use of different system boundaries for international emissions reporting (Peters and Hertwich, 2008), and efforts to incorporate consumption impacts into international negotiations have been marginalised (Isenhour and Feng, 2014). Some now advocate that net emissions importers should take on responsibility for the 'additional' imported emissions generated outside their territories (Singer et al., 2014).

Studies have shown on the grounds of equity that industrialised countries should take on more responsibility than is currently assigned to mitigate global carbon emissions (Steininger et al., 2014; Grasso and Roberts, 2014; Raupach et al., 2014; Athanasiou et al., 2014; Pan et al., 2014). Athanasiou et al. (2014) even suggest that emissions reductions in Annex I countries should be greater than the emissions generated within these countries, meaning they need to take responsibility for reducing emissions in non-Annex I countries. What has not been explicitly analysed in the literature is distributional trends in consumption emissions and whether trends in net traded emissions are likely to continue within existing climate change frameworks.

The UK, for example has an 80% emissions reduction target on 1990 territorial emissions by 2050, to be achieved through implementation of its Carbon Plan (HM Government, 2011), and has interim 5 year carbon budgets (set 4 terms in advance) to try to ensure a reduction in cumulative emissions towards meeting the end-point target. It is unclear however how much of the UK's cumulative consumption-based emissions would continue to sit outside the UK in the country of origin, complicating their inclusion in reduction targets. A few studies have shown for highly aggregated global regions what consumption-based emissions trajectories are needed to meet carbon budgets for two degrees, without considering what they are likely to be given existing climate polices (Bows and Barrett, 2010; Springmann, 2014). Both references provide high-level regional analysis without disaggregated trade and sectorial details. To help inform the evidence gap this paper analyses the corresponding cumulative emissions of implementation of international climate policies from a national consumption perspective. The paper poses four research questions:

(1) Within the existing international climate policy framework, will the UK continue to be a net importer of emissions to 2050?
(2) In which regions and sectors will UK consumption-driven emissions be emitted in 2050?
(3) What is the cumulative impact of UK consumption emissions to 2050?
(4) How can climate policy respond to achieve a reduction in the cumulative global emissions caused by UK consumption?

The paper is the most comprehensive analysis to date of consumption-based pathways at the country and sector level. It extends well established territorial decarbonisation scenarios from the IPCC's representative concentration pathways (Stocker et al., 2013) and the IEA's Energy Technology Perspectives (IEA, 2012) to include trade. While the IPCC provided a detailed analysis of the embodied emissions of trade as part of the assessment of past drivers, the literature was not available to consider future projections within the scenario analysis. This paper is one of the first to provide a detailed analysis of the future emissions embodied in trade within the context of the IPCC's detailed analysis of territorial emissions. Whilst providing this detailed consumption-based emissions pathways for the UK, the results are also discussed in the context of domestic and international climate policy and the feasibility of achieving a two degree future.

2. Method for determining consumption-based emissions trajectories for the UK (2010–2050)

Territorial emissions are published annually in the UK by DECC (Department for Energy and Climate Change), and the UK is one of a handful of countries to publish consumption-based emissions from 1990 to 2013 (DEFRA, 2015; Barrett et al., 2013). National consumption-based emissions are equal to territorial emissions minus emissions generated to produce exports (consumed elsewhere) plus emissions generated elsewhere to produce imports, and are calculated using multi-region input–output models. UK consumer demand will not just induce production in the UK economy but will induce global production activities, resulting in emissions being released outside of its territory. Consumption-based accounts lag a few years behind the release of territorial emissions therefore at the time of this research 2010 was the latest year available.

In this paper consumption-based emissions are projected at 5 year intervals from 2010 to 2050. The modelling framework is built on collaboration between the authors and the UK Committee on Climate Change (CCC) who were investigating emissions associated with future UK consumption patterns, documented in the CCC's report *Reducing the UK's carbon footprint and managing competitiveness risks* (CCC, 2013). In addition this paper presents territorial emissions alongside consumption-based emissions for comparison and the cumulative impacts of the scenarios are calculated based on the direct relationship between temperature rise and carbon emissions (Gillett et al., 2013).

[1] Industrialised OECD member countries and countries deemed to be economies in transition in 1992.

[2] Those deemed as developing in 1992 and recognised as being vulnerable to the adverse impacts of climate change.