Building a zero-carbon economy – Call for Evidence

Submitted by Kate Scott[1], Catherine Cherry[2] and Chris Smith[3]

[1] Presidential Research Fellow in Environment, Geography Department, University of Manchester.

[2] Research Fellow, School of Psychology, University of Cardiff.

[3] Research Fellow, School of Earth and Environment, University of Leeds.

Part 1: Climate Science

Question 1 (Climate Science): The IPCC's Fifth Assessment Report and the Special Report on 1.5°C will form an important part of the Committee's assessment of climate risks and global emissions pathways consistent with climate objectives. What further evidence should the Committee consider in this area?

ANSWER:

The role of final demand and how to govern the 1.5C transition is given less attention in the IPCC Special Report. There is a need to further explore the links between economic growth, final (energy) demand and sequestered carbon. From a preliminary analysis of the IAMC 1.5°C Scenario Explorer hosted by IIASA we find very weak correlations between these three variables. This is contrary to previous analysis showing a strong energy-economy dependence, with limited evidence of decoupling economic growth from consumption. Further analysis is needed to understand how to break the energy-economy dependence; how to decouple economic growth from energy demand; and how to meet people's needs without rising emissions. This is likely to involve some scenarios that are not dependant on a growth-based economy. Ultimately this requires analysis beyond what Integrated Assessment Models (IAMs) can provide to understand not what needs to be done but how it can be done. A Special Report on governing the transition would be a welcome next step.

We are undertaking analysis on reframing the new emissions pathways from a demand perspective to understand the role of final demand in the projections using the FAIR climate model which formed a central part of the IPCC Special Report (Smith et al., 2018). Instead of categorising remaining carbon budgets by temperature targets and overshoot levels we are looking at how alternative levels of final demand impact the remaining carbon budget for example. We are happy to share this ongoing analysis.

References:

Smith CJ, et al. (2018). "FAIR v1.3: A simple emissions-based impulse response and carbon cycle model". Geoscientific Model Development. 11(6), pp. 2273-2297.

Question 2 (CO_2 and GHGs): Carbon dioxide and other greenhouse gas gases have different effects and lifetimes in the atmosphere, which may become more important as emissions approach net-zero. In setting a net-zero target, how should the different gases be treated?

ANSWER:

Part 2: International Action

Question 3 (Effort share): What evidence should be considered in assessing the UK's appropriate contribution to global temperature goals? Within this, how should this contribution reflect the UK's broader carbon footprint (i.e. 'consumption' emissions accounting, including emissions embodied in imports to the UK) alongside 'territorial' emissions arising in the UK?

ANSWER:
Climate targets focus on GHGs produced within the UK, not those required to support the consumption of its residents. While emissions produced within the UK's territory are declining, emissions from consumption are not. A reduction of 40% production emissions while the economy grew by two thirds does not account for outsourcing and rising consumption. The UK 'consumes' about 40% more emissions than it produces through its imports (Defra, 2018).

Previous analysis showed that net imported UK emissions in 2050 could be as high as 2.5 times the UKs 2050 production-based target under policies pledged in the Cancun Agreement, or much lower but remaining nearly 50% higher than the 2050 target if country efforts were aligned with 2 degree future (Scott and Barrett, 2015, CCC, 2013). It was estimated that by 2050 the UK would drive an additional 68 to 251 CO2 outside its territory depending on global mitigation efforts. Subtracting these figures from the existing 2050 target of 160 MtCO2e would result in a target of at least 91 Mt CO2e (equating to an 89% reduction on 1990 territorial emissions), to having negative emissions of 92 Mt CO2e by 2050. The share of emissions by 2050 will have shifted from the power sector today to manufacturing and transport services, where there are more barriers to technology deployment. This highlights the need to focus on hard-to-decarbonise sectors.

The outcomes will however strongly depend on the level of commitments of all countries. We are currently undertaking new analysis downscaling global climate pathways in the IPCC Special Report to the UK and potentially even higher spatial resolutions (e.g. cities, sectors, regions). Previously this has been done as equal per capita by 2050, however this does not reflect historic contribution to the accumulation of emissions in the atmosphere today, or that consumption is the main driver of rising global emissions. Our evidence for setting UK carbon budgets aligned with 1.5C will consider alternative definitions of equity to calculate the UK's fair share and uncertainty analysis relating to both physical and political systems.

References:
Defra (2018) "UK's Carbon Footprint 1997 – 2015", Defra, London.
Scott, K. and J. Barrett (2015). "An integration of net imported emissions into climate change targets." Environmental Science & Policy 52(0): 150-157.
CCC (2013). Reducing the UK's carbon footprint and managing competitiveness risks. London, UK.

Question 4 (International collaboration): Beyond setting and meeting its own targets, how can the UK best support efforts to cut emissions elsewhere in the world through international collaboration (e.g. emissions trading schemes and other initiatives with partner countries, technology transfer, capacity building, climate finance)? What efforts are effective currently?

ANSWER:

Cars, buildings and appliances sold in the UK are subject to energy efficiency standards (EU policy). Looking likely that the UK will maintain the energy efficiency standards, it could lead the way to expanding their scope. Energy efficiency standards have made progress in reducing the energy consumed when using these products, yet this does not address all the energy needed to produce the UK's homes, cars, phones, roads, food etc. Research has demonstrated the additional emissions reduction scope of extending energy efficiency standards to include material use (Scott et al., 2017).

Scott et al. looked across the EU's supply chain (including overseas territory) to see where GHGs are expended in the materials, transportation, construction, use, disposal and replacement of manufactured products from buildings and cars to furniture and packaging, and to identify how much of these emissions were excluded from existing climate/ energy policies. 2061 MtCO2e, equivalent to 40% of EU production emissions, were estimated to be related to material-intensive manufactured products' supply chains. 263 Mt are estimated to be embodied in UK manufacturing supply chains, closer to 50% UK production emissions. Only 38% of the EU's supply chain these are emitted within EU ETS sectors. This highlights to potential additional reach of resource efficiency policies. A similar analysis can be done specifically for the UK.

Cutting carbon along product supply chains can reduce production costs. Cost savings have been realised across a number of infrastructure case studies in the UK (GCB, 2014). In addition, energy efficiency standards have shown to have positive effects on innovation and human health. The implementation of regulatory standards for engine efficiencies in European and American cars had a 'trading up effect' where suppliers use improved standards in their home country, driving similar standards to be implemented due to the benefits from greater economies of scale (Crippa et al., 2016). This also reduced localized air pollution and related health issues.

There is work to be done on designing the right policies to exploit these opportunities and this needs to be underpinned by a mainstreaming of knowledge of embodied emissions flows.

References:

Scott, K., et al. (2018). "Extending European energy efficiency standards to include material use: an analysis." Climate Policy 18(5): 627-641.
GCB (2014). Infrastructure Carbon Review One Year On.
Crippa, M., et al. (2016). "EU effect: Exporting emission standards for vehicles through the global market economy." Journal of Environmental Management 183, Part 3: 959-971.

Question 5 (Carbon credits): Is an effective global market in carbon credits likely to develop that can support action in developing countries? Subject to these developments, should credit purchase be required/expected/allowed in the UK's long-term targets?

ANSWER:

Part 3: Reducing emissions

Question 6 (Hard-to-reduce sectors): Previous CCC analysis has identified aviation, agriculture and industry as sectors where it will be particularly hard to reduce emissions to close to zero, potentially alongside some hard-to-treat buildings. Through both low-carbon technologies and behaviour change, how can emissions be reduced to close to zero in these sectors? What risks are there that broader technological developments or social trends act to increase emissions that are hard to eliminate?

ANSWER:

Evidence has demonstrated a strong link between carbon emissions and resource use (Scott et al. 2018). Resource use is concentrated within key economic sectors' supply chains. 28 sectors account for 80% of the UK's carbon footprint and 68-82% of the material footprint (Giesekam et al., 2018). Therefore, targeted support for management of supply chain emissions and resource use in key sectors could drive reductions in industrial emissions.

Mitigation policies have largely focussed on delivering reductions in operational carbon emissions from products in use, ignoring supply chain interventions. As operational emissions reduce due to existing policy levers, many of the most cost effective opportunities for continued reductions will sit elsewhere in the product life cycle. While UK infrastructure case studies have demonstrated substantial capital cost and carbon savings by measuring and managing embodied carbon in the design of new assets (GBC, 2014), they represent the minority of industry practice.

How products are made and consumed has a major effect on their embodied emissions (Scott et al., 2018; Cherry et al., 2018; Green Alliance 2018). Emissions from resource use can be cut by designing products to use less material and making supply chains more efficient (putting less in), and/or by lowering demand for new products by making them longer lasting and increasing reuse and sharing (getting more out). Used together, these strategies would significantly reduce industry's carbon emissions.

Scott et al. (2018) shows that improving material use could reduce emissions by nearly 200 MtCO2e by 2032. The modelled savings all fall in the scope of domestic targets, and would mainly come during the fourth and fifth carbon budgets from five key sectors: construction, vehicles, food and drink, electronics and appliances, and clothing and textiles (figure 1). While this study measured savings within UK industry only, manufactured products often have international supply chains and at least half of the emissions across the five sectors are generated outside the UK. Therefore, greater resource efficiency in the UK will result in additional emissions reductions in international product supply chains.

References:

Scott, K., et al. (2018). "Bridging the climate mitigation gap with economy-wide material productivity." Journal of Industrial Ecology.
Giesekam, Owen & Barrett (2018) Developing a carbon based metric of resource efficiency
GCB (2014). Infrastructure Carbon Review One Year On.
Cherry, C., et al. (2018). "Public acceptance of resource-efficiency strategies to mitigate climate change." Nature Climate Change.
Green Alliance (2018) "Less in More out", London.

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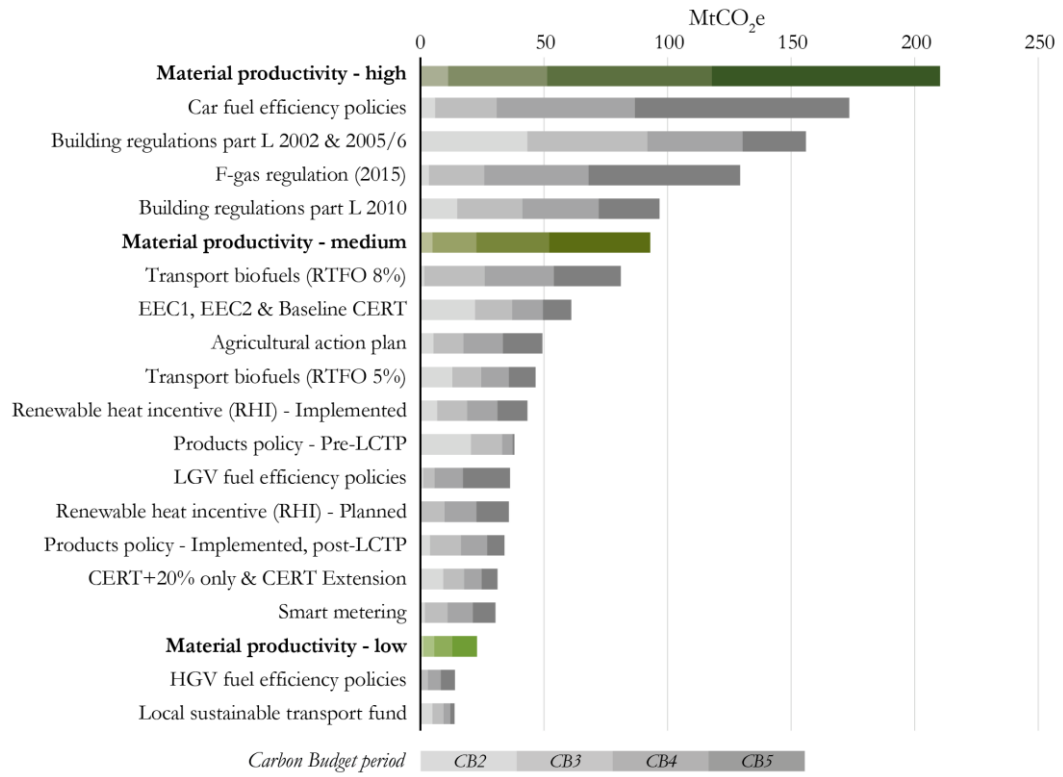

Figure 1: Emissions savings from material productivity scenarios compared to UK climate policy savings

Question 7 (Greenhouse gas removals): Not all sources of emissions can be reduced to zero. How far can greenhouse gas removal from the atmosphere, in the UK or internationally, be used to offset any remaining emissions, both prior to 2050 and beyond?

ANSWER:

Question 8 (Technology and Innovation): How will global deployment of low-carbon technologies drive innovation and cost reduction? Could a tighter long-term emissions target for the UK, supported by targeted innovation policies, drive significantly increased innovation in technologies to reduce or remove emissions?

ANSWER:

Question 9 (Behaviour change): How far can people's behaviours and decisions change over time in a way that will reduce emissions, within a supportive policy environment and sustained global effort to tackle climate change?

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ANSWER:

A net zero transition will require a radical shift in systems of production and consumption. While resource efficiency strategies, such as:

- redesigning more efficient, reusable, and recyclable products and packaging;
- encouraging more efficient product utilisation through sharing, swapping and gifting;
- and extending product lifetimes through extended producer responsibility schemes, remanufacturing and product service systems,

have the potential to reduce UK carbon emissions (Scott et al., 2018; Cherry et al., 2018), these new products, policies and business models are also likely to reshape everyday life in unexpected ways. Gaining public acceptance is therefore critical.

Innovative research from the Centre for Industrial Energy, Materials and Products (CIE-MAP) has explored the conditional acceptability of different resource efficiency strategies amongst the UK public (Cherry et al., 2018; Peake et al., 2018). Making use of in-depth workshops and a representative national survey (n=1,093), we found that there is a clear public mandate for a shift towards a resource efficient economy (87% support).

The UK public highlighted strong concerns surrounding current product longevity, inbuilt product obsolescence, plastic and packaging waste, and the common lack of product reparability. We identified a range of policies for which there is already substantial public support:

- Requiring recyclable packaging (89%)
- Ensuring businesses take responsibility for product repair and recycling (81%)
- Provision of remanufactured/refurbished products (78%)
- Support for community product sharing facilities (60%)

Considering more radical policies, we also identified a growing support (48%) for a carbon/material based tax system that replaces VAT.

Acceptance of all polices/strategies (particularly those that have greater implications for everyday life, e.g. sharing schemes) was found to be dependent on a series of conditions that underlie public preferences, including: fairness and the distribution of responsibility; trust and accountability; convenience and affordability; safety and hygiene; community cohesion; and personal autonomy.

These conditions, or public values, closely echo findings from similar research on energy transitions (Demski et al., 2015), demonstrating that even across different sectors, public preferences surrounding a low carbon transition are relatively stable. We show that people have complex motivations (not driven solely by cost) and favour those strategies that align with their values. If the transition towards a net zero economy is to be successful, strategies will need careful testing that engages early with relevant publics and addresses their concerns and motivations.

References:

Scott, K., et al. (2018). "Bridging the climate mitigation gap with economy-wide material productivity." Journal of Industrial Ecology.
Cherry, C., et al. (2018). "Public acceptance of resource-efficiency strategies to mitigate climate change." Nature Climate Change.

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Peake et al. (2018) 2By popular demand: what people want from a resource efficient economy2, Green Alliance, London.
Demski et al. (2015) "Public values for energy system change". Global Environmental Change, 34, 59-69.

Question 10 (Policy): Including the role for government policy, how can the required changes be delivered to meet a net-zero target (or tightened 2050 targets) in the UK?

ANSWER:

There is a lack of information on the policies which can support the scaling up of material efficiency strategies to achieve emissions reductions at scale. Current drivers for industry to pursue material productivity strategies are weak. Materials and carbon are relatively cheap, and companies lack information and expertise. We have proposed, together with Green Alliance, a resource efficiency task force across DEFRA and BEIS, which recognises the interdependencies between resource efficiency and climate change. This needs to break down the barrier of policy silos. We proposed a 3 stage governance process whereby government works in partnership with industry to support material productivity gains in key sectors (Barrett et al., 2017; Green Alliance, 2018). Stage 1 supports measures to establish metrics, monitoring and management structures for whole life carbon emissions of key products. Stage 2 supports demonstration and dissemination of innovative products, processes and business models. Stage 3 focusses on sharing sector learning and regulating sectors where insufficient performance improvements are achieved. This should be linked with the Resources and Waste Strategy and the 25 year Environment Plan's aim to double resource productivity and eliminate avoidable waste by 2042.

In stage one sector specific bodies would be assigned responsibility for implementation and dissemination of best practice, supporting the roll out of whole life cycle carbon management e.g. common data reporting and establishing benchmarks. In stage 2 funds (channelled through the Industrial Strategy) would support the development of resource efficient products, processes and business models. Best practice and innovation would also be incentivised through government procurement standards reflecting best practice in the industry. By stage 3, if insufficient progress had been made, targets would be introduced to deliver absolute reductions in whole lifecycle carbon. This could happen through different mechanisms such as extending existing energy policies to include embodied emissions or introducing new front runner programs.

References:

Barrett, Scott and Giesekam (2017) "Supporting material productivity gains through sector deals", CIEMAP, Leeds.
Green Alliance (2018) "Less in More out", London.

Part 4: Costs, risks and opportunities

Question 11 (Costs, risks and opportunities): How would the costs, risks and economic opportunities associated with cutting emissions change should tighter UK targets be set, especially where these are set at the limits of known technological achievability?

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ANSWER:

Question 12 (Avoided climate costs): What evidence is there of differences in climate impacts in the UK from holding the increase in global average temperature to well below 2°C or to 1.5°C?
ANSWER:

Part 5: Devolved Administrations

Question 13 (Devolved Administrations): What differences in circumstances between England, Wales, Scotland and Northern Ireland should be reflected in the Committee's advice on long-term targets for the Devolved Administrations?
ANSWER:

Part 6: CCC Work Plan

Question 14 (Work plan): The areas of evidence the Committee intend to cover are included in the 'Background' section. Are there any other important aspects that should be covered in the Committee's work plan?
ANSWER: • A Special Report on the role of demand reduction, behaviour changes and governance frameworks that matches in magnitude and importance the available evidence on modelling exercises • Revised UK targets based on the latest climate science, equity and distributional issues, and consumption • A resource efficiency programme across Defra and BEIS that bridges climate policies and the Resources and Waste Action plan, which requires the monitoring and reporting of companies supply chain emissions and early engagement with relevant publics