Resource consumption, industrial strategy and UK carbon budgets

We quantify UK cumulative emissions between 2013 and 2032 to analyse whether resource consumption strategies, in addition to existing and planned UK climate, can meet the UK's 4th and 5th carbon budgets. Our research shows that business, industry and government efforts to resource consumption can meet anticipated shortfalls in climate policies and provide opportunities for resource productivity and innovation.

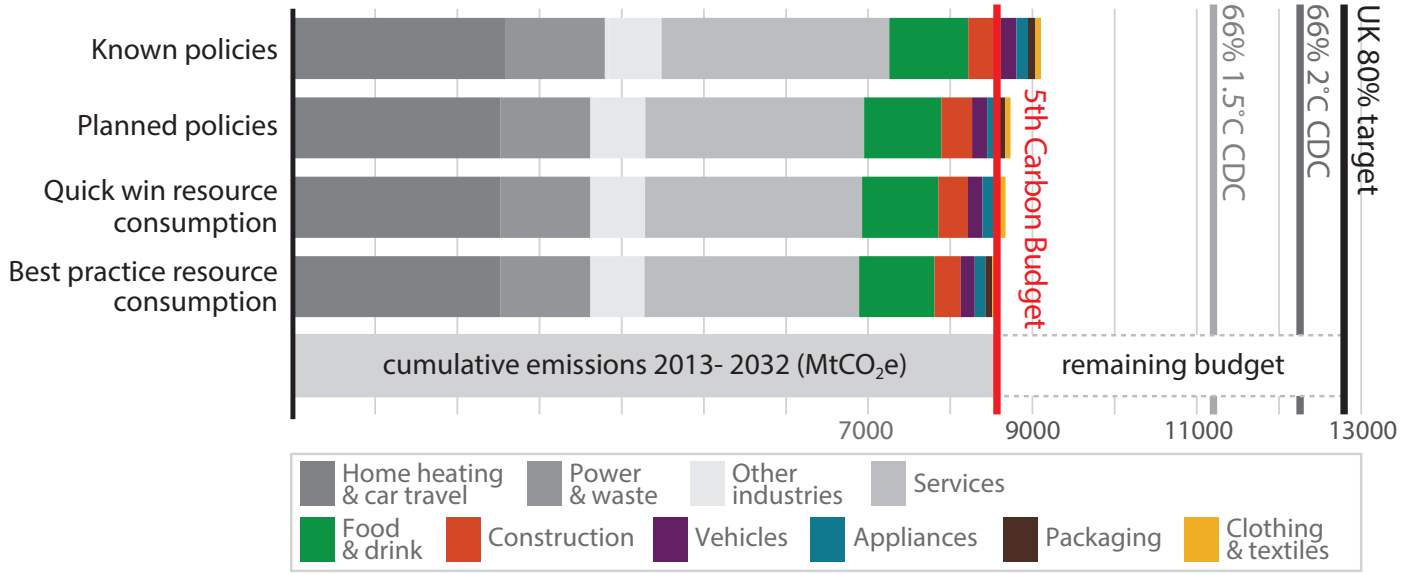
Main findings

- Reducing resource consumption could meet the UK's 4th and 5th carbon budgets
- Based on the implementation of our resource consumption strategies, UK emissions in 2032 would be 361 $MtCO_2e$, 55% below 1990 levels, compared to 429 and 378 Mt from known and planned climate policies
- Cumulatively, by 2032 BEIS' climate package will exhaust 68% of the UK's legally-binding target
- If the UK adopts the aspirations of the Paris Agreement to limit global temperature rise to 1.5°C, the climate package will have exhausted 78% of the 2050 budget by 2032

Half way to 2050 – where will we be?

Between 2013 and 2032 BEIS' planned climate policies will save 371 Mt cumulatively, in addition to known policies. Quick Wins in resource consumption save a further 62 Mt, with Best Practice saving an additional 100 Mt within the UK. We have modelled a broad collection of material use and product longevity strategies focusing on 6 product groups (individual results overleaf), however this is not an exhaustive list. In addition, potentially positive feedbacks could drive further efficiency gains, which the UK has experienced recently with a greater than expected uptake of solar PV. UK emissions are compared with different temperature-related climate targets as the end-point target may change due to international climate negotiations and The Paris Agreement (Figure 1).

Figure 1: Contribution of resource consumption strategies to meeting UK carbon budgets



The scenarios

Known climate policies - existing and adopted UK climate policies
Planned climate policies - existing, adopted and planned UK climate policies
Quick win resource consumption (QW) - resource strategies already operating based on available evidence
Best practice resource consumption (BP) - increased coverage or best practice

The temperature related targets

5th carbon budget – 5 UK carbon budgets have been agreed up to 2032
66% chance of 1.5°C – Global emissions converge to an average global per capita emissions point in 2050 which does not exceed the total cumulative budget to keep average global temperature rise to less than 1.5°C
66% chance of 2°C – Same as above but for 2°C
UK 80% target – the existing UK 2050 climate target is equivalent to a 50% chance of exceeding 2°C average global temperature rise, but is not reconciled with a 2°C global cumulative budget

What are the sector level strategies?

A range of resource consumption strategies have been modelled across 6 product groups to demonstrate individual sector action (Table 1). In 2013, these embodied almost 20% of UK production emissions. Strategies are implemented incrementally from 2013 to 2032. Quick Win (QW) measures are defined as not requiring significant shifts in infrastructure, business practices and behaviours. Whilst open to debate, we have used evidence or expert opinion where possible to quantify the quick win potential. In the Best Practice (BP) scenario strategy coverage is extended or the resource reduction is made more ambitious. These imply a more concerted effort towards changing business operations and behavioural norms.

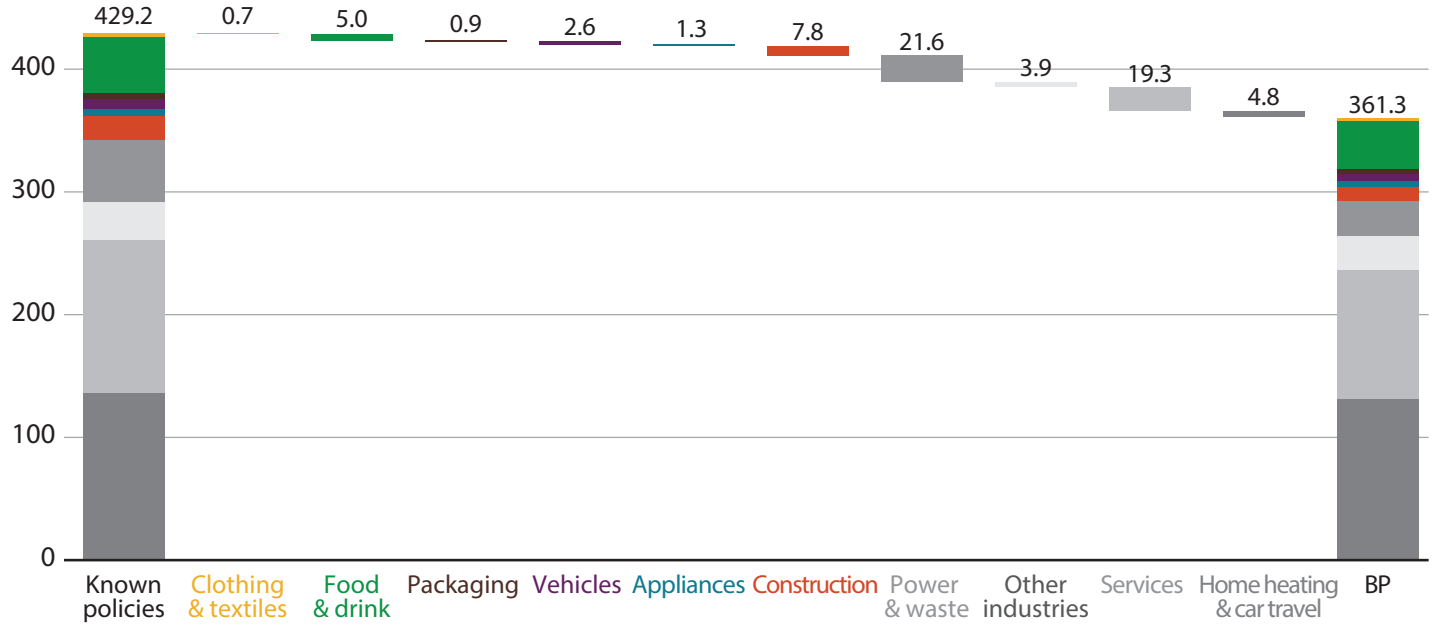
Table 1: Sector strategies modelled from 2013-32

Product Group	Description	QW	BP
Clothing & textiles	Increase the lifetime of commercial and household clothing and shoes by 3 and 9 months (WRAP, 2013).	10%	33%
	Divert additional clothes, shoes, carpets and rugs from landfill for re-use: the weight of clothes discarded annually are almost equivalent to the weight of new clothes bought. 31% of these are landfilled (WRAP, 2011). Only 4% of rugs and carpets are re-used, with the majority going to landfill (WRAP, 2012).	5%	15%
	Reduce supply chain waste through an efficiency improvement in fibre and yarn production, dyeing and finishing (WRAP, 2013).	5%	15%
Food & drink	Reduce avoidable household, hospitality and food service food waste: on average 19% of household and 18% of the hospitality and food service sector food purchases are thrown away, of which 60% and 75% respectively are avoidable. WRAP suggest a 30% reduction is challenging, but case studies have achieved 80% (WRAP, 2013a).	30%	66%
Packaging	Reduce the weight of packaging through lightweight design (plastic, glass, paper and metals): case studies have shown between 10-46% material savings for glass bottles, cardboard boxes etc., which in addition reduces transport and storage needs.	10%	20%
	Increase packaging recycling rates by industry and households towards achieving recycling targets set for 2030 in the EU Packaging Directive: on average, 67% of total UK packaging is recycled or recovered (WRAP, 2015). This should be 75% by weight by 2030. 24% of plastic is currently recycled, 64% of glass, 85% of card and paper and around 55% of metal products. Recycling of card and paper has reached its recycling rate.	10%	20%
	Waste prevention measures in industry and households e.g. reducing supply chain waste and using less packaging.	5%	10%
Vehicles	Lightweight and design optimisation in steel, aluminium, other metals, plastics, and systems and assemblages: case study evidence shows material reductions through using high strength steel, replacing steel with aluminium and vehicle downsizing (Modaresi et al, 2014).	3-5%	5-8%
	Reduce car ownership through leasing or car club schemes: car clubs can reduce car ownership 25%, increase in those using public transport 40%, and can achieve a 15% improvement in engine efficiency (Next greencar, 2016). The share of registered UK car club participants is ~0.002%.	1%	5%
Electronics & appliances	Increasing the lifetime of commercial and household electronics and appliances still functioning when discarded: the UK wastes the same weight of electronics as is bought each year. A third (38%) is landfilled, half (55%) is recycled and only 7% is reused as a whole product. A quarter of these are suitable for re-use.	27.5%	55%
Construction	Design optimisation to reduce material inputs.	1-2%	2-9%
	Substitution of carbon intensive materials with lower impact materials e.g. timber displacing steel, concrete and brick respectively. The best practice scenario sees timber frame increasing to the current Scottish housing market share; hybrid timber-steel becoming the dominant form for new low rise structures; cross-laminated timber making up 50% of mid-rise construction; and greater use of supplementary cementitious materials.	5, 15 & 15%	15, 70 & 70%
	On site process improvements and waste prevention	10%	20%
	Increased reuse of steel, timber, bricks and other materials in construction: e.g. structural steel reuse is currently 5%	1-10%	5-35%

Which sectors can do what?

The emissions savings of planned climate policies and resource consumption strategies in 2032 are compared in Figure 2. The supply chain emissions of other sectors using the 6 products will also reduce, e.g. the service sector will embody fewer emissions by using products for longer or procuring less intensive ones. Common assumptions are applied within product groups e.g. electronics, yet use and replacement practices will be different across different products, such as fridges and mobile phones. However, empirical evidence on behaviour change is limited, particularly at the economy-wide scale. Therefore, unless specified in Table 1, we have applied assumptions from individual product or business-level case studies to the wider sector. The resource consumption strategies are modelled in addition to planned climate policies. However, inevitably there is uncertainty over low carbon technology deployment rates and the scale of behaviour change. The scenarios allow us to compare potential efforts across sectors to identify those that seem easier to implement.

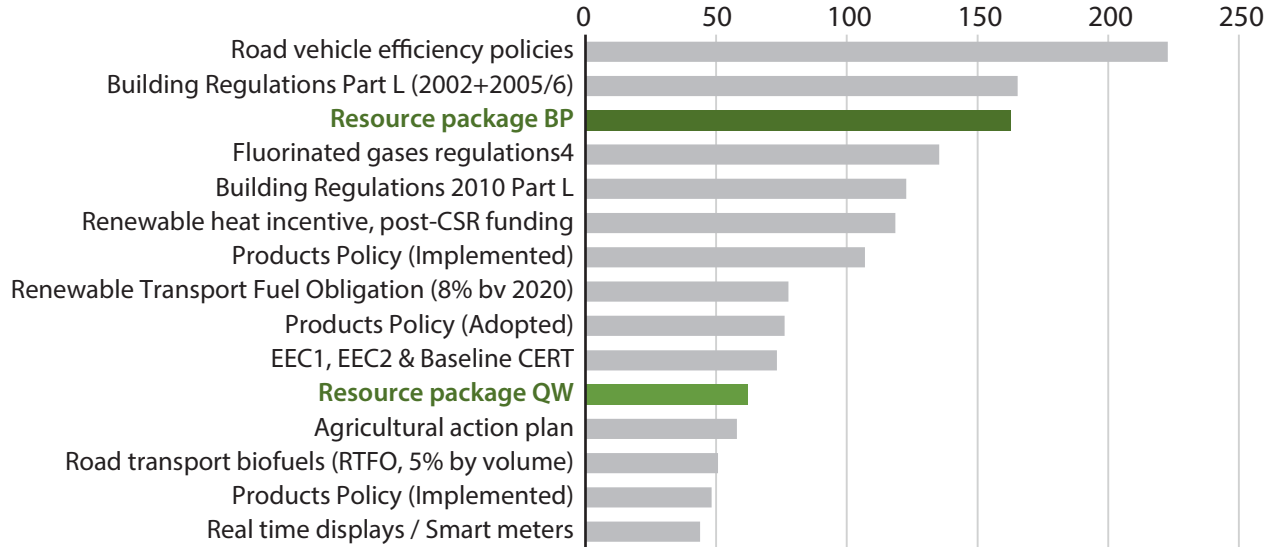
Figure 2: Mitigation in 2032, $MtCO_2e$



How do resource consumption strategies compare with existing climate strategies?

Figure 3 compares the emissions savings calculated for the top 13 government climate policies to those calculated for the resource packages. Resource consumption policies are comparable with the scale of savings anticipated in existing climate policies. However, there is not one 'magic' sector where all savings can be made – efforts are needed across all sectors. Savings from the resource package include supply chain savings from known and planned climate policies. For example, domestic transportation of products for UK consumption comply with foreseeable transport-related policies. However, there is uncertainty surrounding what these policies will achieve.

Figure 3: Top 15 cumulative policy savings 2013 to 2032, $MtCO_2e$



What can resource consumption measures achieve for UK carbon budgets?

- Reducing resource consumption could meet the UK's 4th and 5th carbon budgets
- Quick win resource consumption measures across 6 product groups can save an additional 62 $MtCO_2e$, with an extra 100 $MtCO_2e$ saved if best practice is achieved
- Savings from resource consumption strategies across industry are comparable to savings from existing climate policies
- Based on the maximum implementation of our resource consumption strategies, UK emissions in 2032 would be 361 $MtCO_2e$, 55% below 1990 levels, compared to 429 and 378 Mt from known and planned climate policies respectively
- Cumulatively, by 2032 BEIS' climate package will exhaust 68% of the UK's legally-binding target, leaving 32% left to emit between 2032 and 2050. 78% would be exhausted by 2032 if the UK adopted 1.5°C targets

What are the opportunities for the industrial strategy?

What – a unique opportunity exists to align industrial and climate policy through improved resource productivity which can drive innovation and develop new markets

Why – while resource efficiency options are limited in energy intensive sectors, the analysis shows considerable opportunities further down the supply chain that address manufacturing, develop alternative business models and improve asset utilisation

How – a broad collection of strategies are needed across sectors, and researchers, businesses, trade organisations and government need a collaborative programme to inform and exploit these opportunities

Who – an industrial strategy programme would benefit from government regulation to underpin efforts by businesses and create a level playing field

References

Modaresi, R., Pauliuk, S., Løvik, A. N. & Müller, D. B. (2014) Global Carbon Benefits of Material Substitution in Passenger Cars until 2050 and the Impact on the Steel and Aluminum Industries. Environmental Science & Technology, 48, 10776-10784.

Next greencar (2016) http://www.nextgreencar.com/car-clubs/#environment

WRAP (2011) Valuing our clothes, the true cost of how we design, use and dispose of clothing in the UK

WRAP (2012) Textiles flow and market development opportunities in the UK

WRAP (2013) Design for Longevity, guidance on increasing the active life of clothing

WRAP (2013a) Household Food and Drink Waste in the United Kingdom 2012

WRAP (2015) Estimates of Food and Packaging Waste in the UK Grocery Retail and Hospitality Supply Chains

CIE-MAP

Working closely with government and industry, CIE-MAP conducts research to identify all the opportunities along the product supply chain that ultimately deliver a reduction in industrial energy use.

CIE-MAP brings together the four leading UK universities of Bath, Cardiff, Leeds and Nottingham Trent with a range of expertise in engineering, economics, psychology, design, political science and governance. Funded by the Research Council's Energy Programme, CIE-MAP forms one of six centres focuses on reducing energy demand in the UK.

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Brief prepared in November 2016

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