C R E D S

Appendix 2: Effective policy processes for meeting future UK climate change targets?

Exploring the UK Clean Growth Strategy

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1. Introduction

In October 2017, the UK Government presented its Clean Growth Strategy (CGS) (Department for Business Energy & Industrial Strategy 2017) to the UK Parliament, defining its approach to meeting carbon reduction commitments up to 2032 as "accelerating the pace of 'clean growth'" (Department for Business Energy & Industrial Strategy 2017). This working paper, written as part of the work of the UK Centre for Research on Energy Demand, explores the processes used by the UK Government to identify and develop the policies and proposals contained in the CGS. It considers the effectiveness of these policy processes for meeting the fifth carbon budget (2027-2032) and the implications for longer term 2050 greenhouse gas reduction targets set by the UK Climate Change Act (2008). We focus on demand reduction policies and ask how the policy processes that led to the CGS have influenced its effectiveness for demand reduction to support improvements in building-fabric energy efficiency or development of efficient low carbon energy supply solutions? Taking into account the findings from this analysis, we conclude by considering what the current UK climate policy processes mean for future climate policies; in particular, can they set the UK on a pathway to meet more stringent targets compatible with limiting global temperature rise to 1.5oC, as agreed in the 2016 Paris Climate Agreement (UNFCCC 2016)?

1.1 The context of the UK Clean Growth Strategy

The CGS is a response to the policy requirement within the UK Climate Change Act (2008), which legislated for major reduction of greenhouse gas emissions in five year 'carbon budget' periods up to 2050. To date, UK emissions were reduced in line with the first carbon budget (2008-2012), outperforming the target by 1%. This trend is continuing for the second (2013 – 2017) and third (2018 – 2022) carbon budgets, outperforming them by five per cent and four per cent respectively (Department for Business Energy & Industrial Strategy 2017). The CGS hails the success to date, pointing out that the UK has "reduced emissions faster than any other G7 nation, while leading the G7 group of countries in growth in national income over this period" (Department for Business Energy & Industrial Strategy 2017).

However, a significant proportion of these emission reductions are attributable to the impact of the 2007-08 global financial crisis on UK economic growth, rather than the influence of government policies to support a low carbon transition (Committee on Climate Change 2010; Committee on Climate Change 2008). Stronger and more radical policies will be crucial if the CGS is to deliver continued emissions reductions in line with the 5th carbon budget, particularly if the UK adopts a more ambitious 2050 target in line with commitments made in the Paris Agreement (UNFCCC 2016).

It is therefore important to assess whether the CGS can deliver on current commitments and extend to support the greater challenges of the Paris Agreement. The Strategy states that it uses two guiding objectives to inform its approach to designing policies and proposals:

- To meet our domestic commitments at the lowest possible net cost to UK taxpayers, consumers and businesses; and,
- To maximise the social and economic benefits for the UK from this transition. (Department for Business Energy & Industrial Strategy 2017)

It also indicates a focus on "win-win" actions that cut consumer bills and drive economic growth, asserting that the reduced cost of many low carbon technologies overcomes "the trade-offs between investing in low carbon technologies that help secure our future but that might incur costs today" (p.7).

The resulting policies and proposals are characterised as focusing on areas where the greatest progress is thought to be needed. These areas include:

- Improving business and industry efficiency – 25% of UK emissions
- Improving our homes – 13% of UK emissions
  - Improving the energy efficiency of our homes
  - Rolling out of low carbon heating
- Accelerating the shift to low carbon transport – 24% of UK emissions
  - End the sale of new conventional petrol and diesel cars and vans by 2040
- Enhancing the benefits and value of our natural resources – 15% of UK emissions
  - Including zero avoidable waste by 2050; new and innovative ways to manage emissions from landfill; designing a new system of agricultural support to deliver better environmental outcomes. (Department for Business Energy & Industrial Strategy 2017)

1.2 Focus and structure of this paper

Throughout this working paper, we refer to 'policy processes' to mean the framework of existing policies and legislation, political contexts, formal engagement processes, and metrics that influence how new policies and proposals are identified and developed. We ask, how does the policy framework set by existing policies and legislation shape the focus of forthcoming ones? What metrics are selected from those available to measure progress and how do these shape decisions?

How do the existing political priorities and philosophies of political parties shape the policy process, and are these conducive to creating 'windows of opportunity' for the introduction of more radical policies to accelerate decarbonisation?

To address these questions, in section 2 we consider the methods of policy prioritisation used to develop the CGS and its implications for the effectiveness of the resulting policies. In section 3, we go on to discuss the lack of sector specificity in the CGS, and its consequences for driving change and ensuring accountability. We argue that the policy prioritisation process encourages this lack of specificity and we highlight areas where changes could result in greater specificity and progress in emissions reductions. In section 4, we broaden the focus of our analysis beyond the policy prioritisation methodologies used to shape the CGS and consider the influence of politics within the policy process. The discussion in section 5 considers the relative importance of the politics and technical methodologies within the policy process. It uses a comparison with a similar policy development process that took place in Scotland to create its Climate Change Plan (CCP) (Scottish Government 2018b), using similar methodologies to the CGS, but resulting in a different type of policy content. Finally, we consider what the CGS policy processes mean specifically for demand reduction policies.

2. Framing the policy process: methods of policy prioritisation in the CGS

We begin by considering the policy prioritisation methods embedded in the UK Government's climate change policy process. At the heart of UK GHG policy is the concept of **economic optimisation** of costs of carbon abatement. The approach focuses on minimising the aggregate cost of measures needed to reduce emissions from a counterfactual scenario (without any climate policies) to a level compatible with the UK Climate Change Act (2008). This is called the marginal abatement approach (Figure 1).

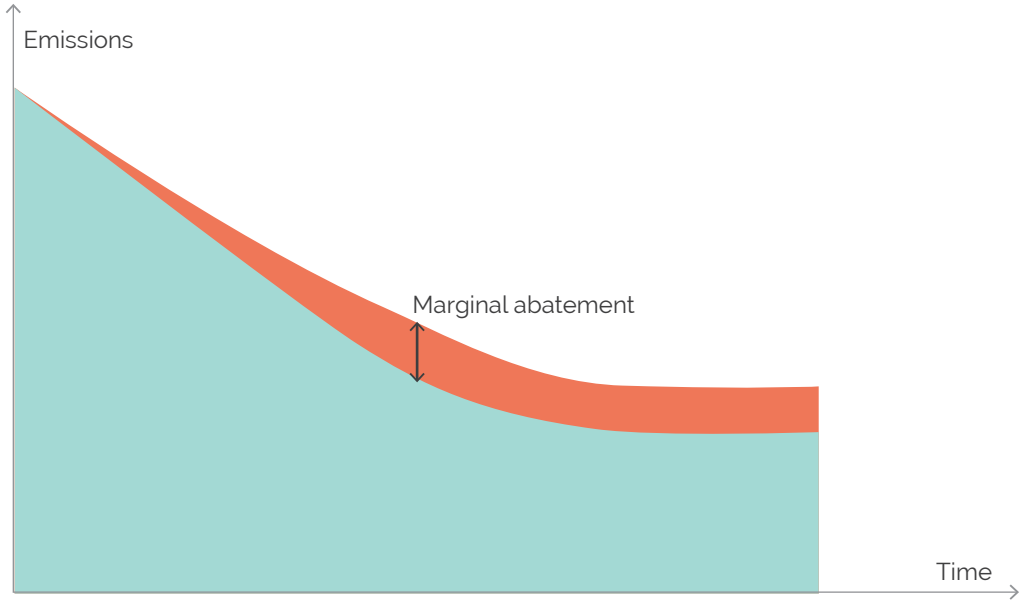

Figure 1: "Marginal abatement" approach to GHG policy. Blue represents a target-consistent emissions trajectory, pink the estimated counterfactual emissions trajectory.

The marginal abatement approach was derived from economic methods previously used for management of environmental pollution, recognising both the damage caused by pollution and the costs (or benefits foregone) of reducing pollution. Individual climate protection measures are prioritised on the basis of a calculation of their marginal abatement cost (MAC, £ per ton CO2 abated).

The optimum level of their deployment is identified in order to minimise both the theoretical "**social cost of carbon**" and the cost of carbon abatement (c.f. Figure 2). This marginal cost (i.e. net social cost per tonne of carbon abated) can be analogised to a price signal, with the least cost package of measures needed to close the gap being all measures whose cost per tonne fall below this limit. This has been termed the 'shadow price of carbon' (SPC) and aims to establish a market-mimicking strategy for deploying measures; any measure below the limit is treated as a cost-effective contribution to meeting the overarching target while any measure above is treated as an excessively costly way of meeting the carbon constraint

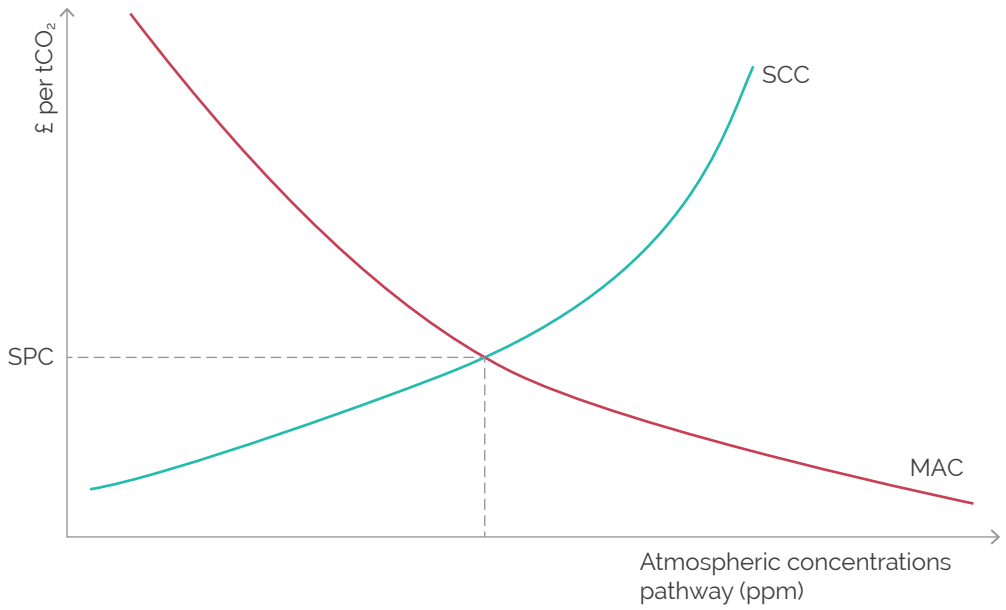

Figure 2. Theoretical approach to economically optimal climate change policy, from the UK Government Department of Energy and Climate Change (DECC) (2009, fig.2.1). SCC = Social Cost of Carbon, MAC = Marginal Abatement Cost, SPC = Shadow Price of Carbon. As atmospheric concentrations increase (to the right), so the damage caused by climate change increases (SCC) while the costs of climate mitigation decrease (MAC).

In practice, rather than calculating a notional economic optimum at the intersection between the cost of abatement and the benefit of avoiding (the costs of) climate change (which would be a highly uncertain calculation), the UK Government instead takes climate protection targets as fixed, and asks what it would cost to meet them for the years 2020, 2030 and 2050 (DECC 2009). A carbon price for each intervening year is then set based on a linear interpolation between the carbon price at these three key points in time. Figure 3 illustrates the calculation, with the 'x-axis' representing the required percentage of carbon abatement and the 'y-axis' indicating the resulting optimum 'shadow price of carbon' (SPC) to meet that level. Climate policy is then focused on measures that are calculated to have a marginal abatement cost below this attributed optimal price of carbon.

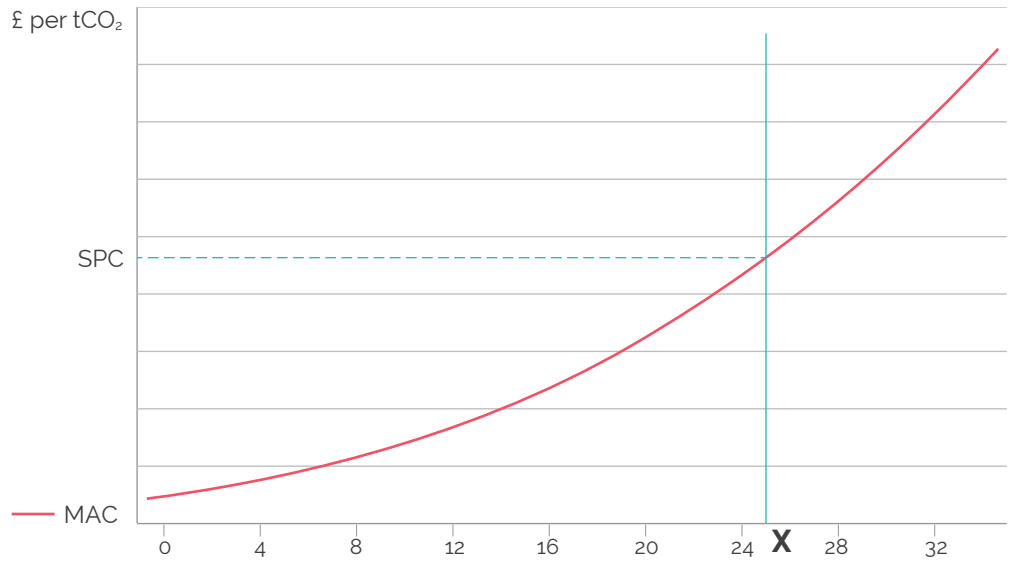

Figure 3. Illustration of the 'target consistent' approach to setting the carbon price, from (DECC 2009). MAC = Marginal Abatement Cost, SPC = Shadow Price of Carbon. (Note the x-axis represents increasing abatement effort – decreasing emissions – by contrast with Figure 1 in which the x-axis represents increasing atmospheric GHG concentrations.)

Other important and consequential adjustments to the carbon price are made to take into account the European Union Emissions Trading Scheme (EU ETS) for the power sector and energy- intensive industries. These industries, captured by the EU ETS, are considered separately using different carbon price forecasts by the EUA up to 2020 based on global price approximations (after this point, the traded sector carbon price is gradually brought into line with the non-traded carbon price, becoming unified from 2030 onwards). This has resulted in two "essentially different [carbon] commodities" up to 2030 (DECC 2015, p.11), one in in the traded, and one in the non-traded, sector (Figure 4). We discuss the impact of these two different carbon prices in section 2.1.2.

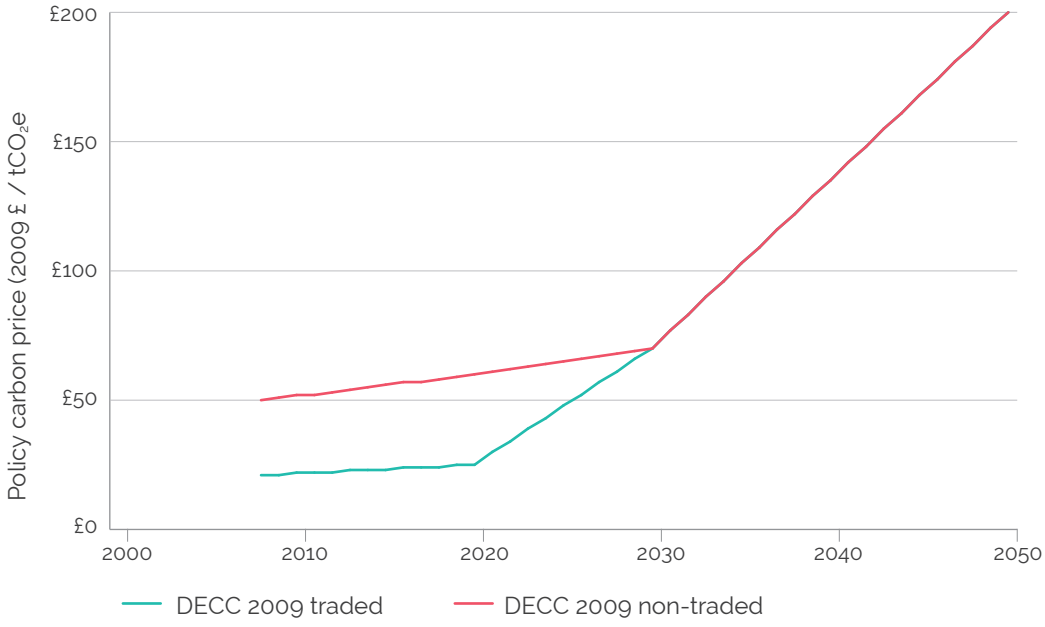

Figure 4. Traded and non-traded sector policy carbon prices estimated by DECC (DECC 2009). These have since been updated to reflect inflation but not changes to assumptions about targets or abatement costs.

2.1 The influence of the marginal abatement approach on the effectiveness of the CGS

Given these specific choices in policy prioritisation methodologies, what is the influence of the marginal abatement approach on the policy choices made within UK CGS? In the following sections, we argue that this method produces a range of challenges for the effectiveness of the resulting carbon abatement policy.

2.1.1 Uncertainties about the overall level of carbon reduction for the 5th Carbon Budget

The focus on cost optimisation within the marginal abatement approach used by UK Government has led to conflicting policy details within the 5th carbon budget and the CGS, introducing a degree of uncertainty about the Government's political will to meet the legislated target level of carbon reduction for the UK up to 2032.

The Committee on Climate Change recommended a reduction of 57% in GHG emissions on 1990 levels by 2032, based not only on marginal cost models, but also an analysis of the 'critical paths' for deployment of measures that are needed to keep options open for meeting the longer term 2050 80% target. The need for 'critical path' analysis arises in part from the fact that UK energy policy countenances a relatively wide range of primary energy sources (nuclear, renewables and CCS) that have different implications across sectors in terms of need for certain technologies and supply chain skills. For example, the Committee recommends a high level of heat pump deployment up to 2032, partly to keep open the possibility of heat electrification, which may be needed if CCS (on which high-volume hydrogen production relies) fails to be deployed. In addition to 1.1 million cost effective heat pumps (in retrofit), it also recommends 1.2 million heat pumps in new build; partly to contribute to building up the skills base and supply chains that would be needed in a high-heat pump scenario after CB5. In another example, the Committee recommends 2 million installations of solid wall insulation. 1 million are 'cost effective' against the central carbon values, while the benefits of insulating the additional 1m homes are contributing to fuel poverty alleviation and future-proofing for heat pumps.

The UK government's calculation of the optimised carbon abatement level for CB5, however, resulted in 53% reduction target by 2032 (DECC 2016, para.236) and did not take into account wider social or supply chain considerations. This approach to assessing cost-effective emissions reduction over the CB5 period appears to have carried through to the CGS, which also uses the 53% target (Department for Business Energy & Industrial Strategy 2017). Thus, the shortfall in projected CB5 abatement can be interpreted as the difference between what appears optimal against a carbon price set by the marginal cost model and what is considered necessary to keep open the possibility of the 2050 80% target. This strict adherence by UK Government to the cost optimised carbon abatement level therefore fails to recognise that there may be reasons for supporting carbon abatement beyond the short term lowest cost options.

2.1.2 Impact of the dual-carbon price calculations up to 2030

Reliance on the marginal abatement approach and its complex methods for carbon price calculations has created further uncertainty about the overall carbon reductions planned by the UK Government.

For example, applying the EU ETS carbon price for the traded sectors has resulted in less carbon reductions in practice due to adjustments in the EU ETS cap. These adjustments in recent years[1] reduced UK responsibilities making it easier for the energy intensive traded sectors to meet their designated budgets, correspondingly weakening the pressure exerted by the overall UK carbon budget on non-traded emissions. The Committee on Climate Change also highlighted this problem and suggested to UK Government that it should protect non-traded targets from EU ETS fluctuations, but this suggestion was rejected for the CGS.

2.1.3 The challenge of calculating an accurate 'business as usual' scenario

The method for calculating marginal abatement costs and carbon budgets requires projection of a 'business as usual' (BAU) emissions trajectory, from which the impact of abatement measures is deducted. To date, the BAU trajectory has been overestimated because, for example, it failed to take into account the impact of the financial crisis. This resulted in less abatement effort being required to meet the carbon budgets for the affected periods, because slowdown in the economy reduced carbon emissions instead.

BAU estimates rely on projected parameters such as population and economic growth, and the CCC uses the Government's own projections. Economic growth projections may be performative; that is, they may play a role in shaping the activities that result in reality conforming more closely to the projection, for example by supporting business and investor confidence in the UK economy. If so (or if projections are perceived to be performative by the Government), there would be little incentive to factor in potential recessions, which could be criticised as 'planning for failure'. This would mean long-run BAU projections tend to overstate the effort needed to meet future budgets.

Whether or not overstating BAU emissions is a systematic problem, it has also been noted as a concern by the Committee on Climate Change (Committee on Climate Change 2010). Not only did BAU emissions estimated for CB2 and CB3 ignore the impact of recession, the Committee registered its concern that the DECC Energy Model, on which CB4 estimates were based, "may underestimate the future extent of decoupling of energy demand from GDP growth … in which case a tighter budget would be appropriate," (Committee on Climate Change 2010).

1 The 'Market Stability Reserve' was introduced to handle a surplus of credits with the ETS. This resulted in credits (EUAs) being withheld in 2014-16, with the intention of releasing these in future (to keep the total number of EUAs in the long run fixed). However, this lowered traded emissions in the UK's 'net account' during the second carbon budget, weakening the budget's pressure on non-traded emissions.

Both of the issues cited in section 2.1.2 and 2.1.3 exacerbate the challenge of translating the carbon budgets into consequences for deployment of measures, as the amount of 'carbon saved' by deliberate action is uncertain. It is made contingent on international negotiation, and it is relative to a counterfactual that is likely to be systematically inaccurate.

2.2 The impact of marginal abatement cost calculations – static cost effectiveness

The marginal abatement approach foregrounds the costs of individual measures and therefore relies heavily on an accurate approximation of the marginal abatement costs and impacts of each measure.

This posed a calculative challenge to the UK Government when modelling the cost effectiveness of measures for the 5th Carbon Budget. The Budget period covers 2028-2032, but some measures have lifetimes that exceed this window. It was decided that the value of carbon saved after 2032 should not be counted towards the cost effectiveness of measures in the CB5 period (DECC 2016). Instead, the UK Government constructed a CB5 scenario in which every measure deployed had a net (discounted lifetime) cost below the Government's 2030 carbon price (£78/tCO2e in 2015 prices). This calculation was dubbed 'static cost effectiveness'. However, there are two challenges with the calculation methods used in the CGS analysis, which particularly impact on demand reduction and low carbon heat measures. These are outlined in following sections (section 2.2.1 and section 2.2.2).

2.2.1 The static cost effectiveness calculation favours technologies with shorter lifespans

The first issue is that the static cost effectiveness calculation used in the CGS analysis results in an undervaluing of measures with long lifespans. This is because of the assumed sharp increase in the shadow price of carbon from 2030 onwards in the non-traded sector (see Figure 4 in section 2). From 2030 onwards the projected carbon price increases at a faster rate than the selected discount rate of 3.5%, so that the discounted value of lifetime carbon saved (per lifetime tonne) is higher than the 2030 value (see Figure 5). Prior to 2030, carbon price growth is slower than the discount rate. This means that 'static cost effectiveness' overvalues lifetime carbon for measures whose life ends before 2030 and undervalues them for measures installed in 2030 but continue into the future.

Figure 6 illustrates this effect by calculating the lifetime value of carbon saved for measures of different lifespans assumed to be installed in 2030, according to the Government's prices (published in 2017). A measure with a lifetime of 20 years, for example, would be cost effective over its lifetime if its net (discounted lifetime) cost were below £101 per tonne of CO2 abatement delivered, but the UK Government approach would only include it in its CB5 scenario if this cost fell below £77 per tonne (the Government's 2030 carbon price). As a result, measures with relatively long lifespans such as building insulation can be argued to be undervalued, and hence underrepresented, in the UK Government's CB5 optimisation calculations.

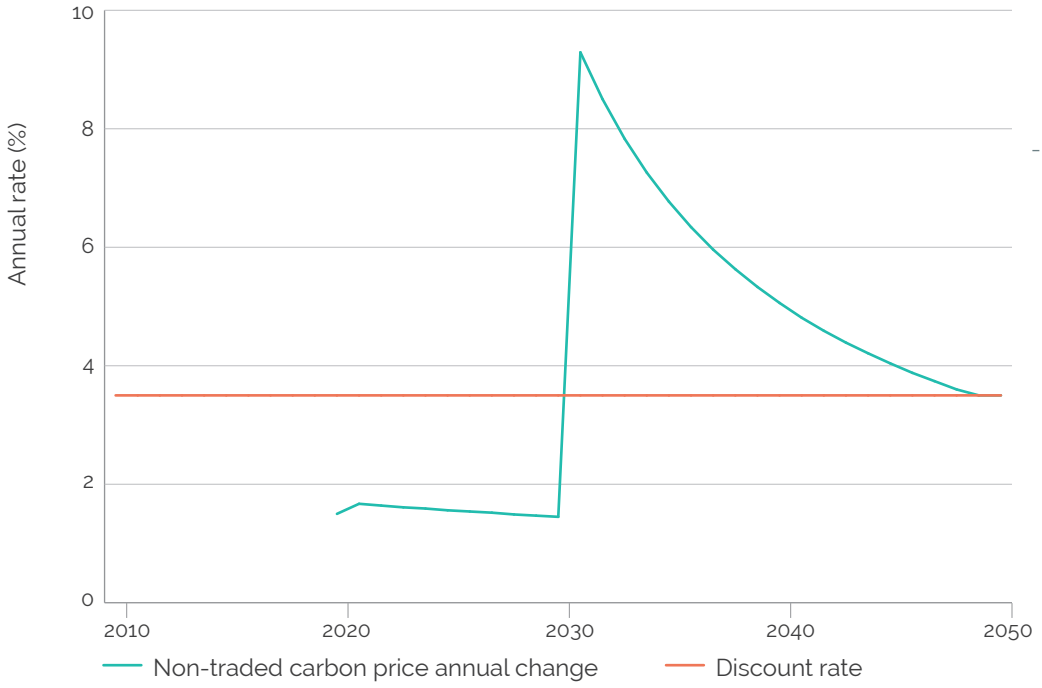

Figure 5: Comparison of growth in non-traded carbon price and Government discount rate. Carbon price from BEIS 2017 guidance www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal#history (NB: constant discount rate is not quite accurate as for long periods the UK discount rate declines.)

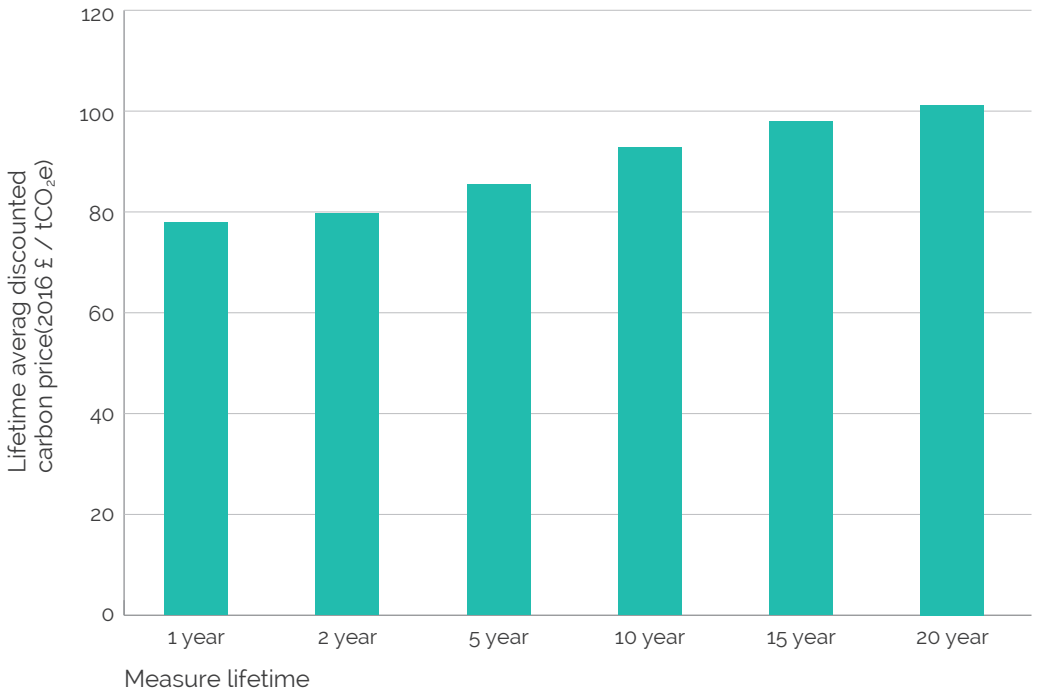

Figure 6. Illustrative example of discounted value of lifetime carbon savings for measures of different lifetimes deployed in 2030. Carbon price from BEIS 2017 guidance www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal#history

This is not the only approach that could be taken within the marginal abatement framework. An alternative would be a scenario in which every year all measures were adopted whose lifetime costs are lower than the value of their lifetime carbon emissions (both discounted).

2.2.2 The static cost effectiveness calculation does not recognise the variability of costs under different energy system scenarios

The second issue with the static cost effectiveness calculation is that it does not allow for variable costs of measures due to the influence of interactions between decarbonising energy supply and reducing energy demand (e.g. Kesicki & Ekins 2012). Yet again, this particularly impacts the calculations for demand reduction measures such as fabric efficiency since the value of these measures are sensitive to the assumed supply (MacLean et al. 2016). For example, the value of demand measures is likely to be underestimated if energy savings are assumed against the incumbent gas supply (for heating), because all low carbon heat options in the UK tend to increase costs (The Energy Research Partnership 2017).

The CGS keeps options open on energy supply. Its technical annex presents three scenarios with different emphases: electrification, hydrogen and emissions removal. Despite the absence of decisions between these pathways, the UK Government has chosen to approximate single values for the costs and emissions impacts of each measure.

3. The importance of specificity for policy effectiveness

Specificity within policy can drive action and provide transparency and accountability. However, a significant feature of the CGS is that it does not set out any additional constraints or specific trajectories beyond the overarching UK carbon budgets. Notably the overarching carbon budget is not broken down into expectations for specific sectors in terms of carbon emissions reductions or specific actions[2]. The latest progress review by the Committee on Climate Change (2018) was also explicit that inadequate policy effort has been given to specific measures:

> Low-cost, low-risk options to reduce emissions are not being supported by Government. This penalises the consumer. There is no route to market for cheap onshore wind; withdrawal of incentives has cut home insulation installations to 5% of their 2012 level; woodland creation falls short of stated Government ambition in every part of the UK. (Committee on Climate Change 2018)

What are the advantages to a government of not specifying sectoral or measures-based targets? Retaining flexibility allows policy to respond to changing circumstances as, for example, technology or energy costs develop. But it also allows governments to avoid committing support to certain approaches to decarbonisation.

In this section, we argue that the CGS policy process, in particular the marginal abatement approach used for policy prioritisation, is a key driver of the lack of specificity in the CGS. We explore the implications of this lack of specificity for the policy effectiveness of the CGS to achieve the level of change required to meet near- and long-term targets.

2 This is a stark contrast with the Scottish Climate Change Plan (CCP) which proposes sectoral envelopes and trajectories for the deployment of particular measures. Section 5.1 explores this contrast and reasons for it in more depth.

3.1 Resistance to sectoral budgets from marginal abatement policy prioritisation

Sectoral targets are not technically compatible with the marginal abatement approach, which foregrounds cost optimisation for deployment of individual measures across the whole economy, rather than on a sectoral basis (see section 2.2). The marginal abatement approach sends a price signal to policy makers, in principle allowing the (cost-) optimal set of decarbonisation policies to be found from the bottom up.

The undermining of this overall cost-optimisation has been used as an argument by the UK Government for resisting use of sectoral targets, in favour of keeping open flexibility to "pursue decarbonisation where it is cheapest, to avoid unnecessarily expensive consumer bills or unnecessarily distorted markets" (UK Government 2016, p.5). For example, in the lead up to setting CB5, the adoption of an emissions intensity cap for electricity generation was debated (Energy and Climate Change Committee 2016), but the Government spelled out its commitment to retaining sector flexibility:

> Setting sector-specific targets, like a power sector decarbonisation target, takes this flexibility away from us—distorting markets and pushing up bills. (UK Government 2016)

Arguably, flexibility here is a political advantage to a government unwilling to bind itself to any particular pathway, but potentially a disadvantage to actors directly involved in the delivery of energy saving and low carbon measures. In the following sections we discuss the benefits of specificity in climate policy and the possible implications of this rejection of specificity within the CGS.

3.2 Benefits of sector specificity

3.2.1 Coordinating distributed decision making

The lack of specific CGS carbon budgets for each sector limits its influence over actors' decision making. Multiple actors across all sectors of the economy, working at different scales (from community groups to multi-national companies), and with different objectives need to take action to meet the fifth carbon budget. Ultimate responsibility for carbon reductions is therefore highly distributed and the overall carbon budgets are too remote to be the basis for decision making.

This challenge was highlighted within a recent consultation conducted by the Committee on Climate Change (2015) to inform its advice on the fifth carbon budget[3]. One question asked consultees: "As a business, as a Local Authority, or as a consumer, how do carbon budgets affect your planning and decision-making?". Over half of the 28 respondents to this question said that the existence of carbon budgets had little or no impact on their planning and decision making; but that policy stability was more important (16 out of 28).

3 Notably this appears to have been the only open consultation process preceding the Clean Growth Strategy.

These respondents included some large scale actors (e.g. Statkraft), but it is notable that the majority were smaller organisations who are operating within a specific sector context. Example quotes from the consultation are included below:

> Carbon budgets are not often considered. Where they are at all, they are seen as too opaque and distant to have a direct impact on investment decisions. However, the policy and legislation that may emanate from them undoubtedly has an impact." (EEF and UK Steel)

> Carbon budgets give options and recommendations to government who then decide on policy – the downside to this is that policy can change … Confidence would be much improved and measures could be provided more cost effectively … if there were clearer long term commitments to policies and targets." (Kingspan)

These responses indicate the importance of clear and specific indications from government about the level of investment and policy drivers that are expected within the carbon budget periods, to enable organisations to make investment decisions. Organisations that are operating within specific sectors cannot make informed planning decisions without an idea of the direction of policy and its implications for their work.

3.2.2 A route to protecting internationally exposed sectors

Economy-wide carbon reduction targets are seen as particularly challenging for energy intensive industries operating in global markets. A single economy-wide carbon budget results in such industries lobbying to protect themselves against ambitious carbon targets. A sector-specific approach would give the UK Government the option to set higher targets for domestic economy sectors, particularly buildings and transport, and lower targets for energy intensive industries where climate policy is perceived as threatening international competitiveness.

3.2.3 Specificity as a more effective international negotiating position

Splitting the UK's carbon budgets into specific sector targets could also be useful in international climate change negotiations. The current UK contribution to global emissions, at least when considered on a territorial basis, is relatively small, meaning the impact of climate change on other countries is unlikely to be affected by the UK's offer of more stretching targets[4]. An alternative approach to international negotiation would be to unilaterally demonstrate a high degree of ambition to reduce emissions from sectors not exposed to international competition (a 'good faith' position). Targets for energy intensive industries would be separated out and tightened only as part of a global agreement. This would allow the UK to fulfil its promise of global climate leadership while restricting comparative disadvantages arising from a unilateral position.

4 Similarly, the risk to the UK that other countries 'free-ride' on UK emissions reduction is not significant as the small scale of UK emissions means even their complete elimination would free up very little space for the rest of the world to relax its effort to keep atmospheric concentrations down.

3.2.4 Monitoring, evaluation and accountability of policy

Monitoring progress against policy goals and targets is an important part of the policy process, both for holding keys actors and policy makers to account and also for understanding where and how progress has been made. Although emission reductions against successive carbon budgets have been sufficient to date, the lack of sector specific targets means that lack of progress in certain sectors has been difficult to challenge or hold to account.

The Committee on Climate Change (Committee on Climate Change 2018) has become increasingly critical of lack of progress in particular sectors, notably buildings and transport. However, without Government commitment to specific targets for progress in these sectors, this criticism is arguably toothless. For example, the recession after the 2007-08 financial crisis had the effect of reducing GHG emissions; creating space for the UK Government to 'cut the green crap' (Mason 2013) while simultaneously claiming 'significant progress' (Department for Business Energy & Industrial Strategy 2017). Sector-specific carbon targets, therefore, play a further important role in the policy process by requiring transparency and accountability at a more detailed level, unobscured by wider dynamics of the economy or by greater progress in one particular sector.

The CGS sets out indicators which it plans to report on annually. However, there are a number of challenges to their effectiveness as signals of where the UK Government hopes to see progress:

- Indicators are not described in sectoral chapters or linked to specific policies, but are instead introduced separately in an infographic entitled "Changes that illustrate how our pathway could be delivered". The infographic heading flags "It is possible that equivalent emissions savings could be achieved in different ways" (Department for Business Energy & Industrial Strategy 2017). This caveated style means their contribution to the document's 'ambition' sections is opaque, and the CGS listing of policies is not linked to outcome milestones or trajectories.
- Indicators are presented for 1990, 2015 and 2032, with no stated expectation of their development through the 2020s.

As such, the CGS indicator is ineffective both in signalling where change is needed and in enabling the success of policies to be judged. Instead these functions fall to the overarching carbon budget.

The CGS does set out one indicator in a less caveated way. It proposes to publish annually the Emissions Intensity Ratio (EIR): annual GHG emissions divided by annual GDP. In proposing this the CGS states "By 2032, we expect the EIR will need to be nearly as low as 100 tonnes/£million to meet our ambitions" (Department for Business Energy & Industrial Strategy 2017). However, no trajectory or pre-2032 milestone is set for the EIR, blunting its effectiveness as a progress indicator. Nonetheless, reporting of the EIR will clarify the contribution of economic growth (or lack thereof) to overall UK emissions.

Had this been in place since the passage of the 2008 Climate Change Act, then the relative contributions of recession and policy to GHG emissions reduction would have been clearer.

3.2.5 In summary

Despite the range of potential benefits from sectoral budgets or targets, the focus of the policy process on optimisation of the marginal abatement approach has obscured the inclusion of specificity within policy. This is not to say that it precludes its use entirely (for example, we will examine the Scottish Government's alternative approach to specificity in section 5), but that it is currently used as a logic and justification for maintaining policy flexibility. Especially since this is more politically palatable to the government in power. We go on to discuss the influence of politics within the policy process further in the next section.

4. The influence of politics within the policy process

Clearly, the policy process which led to the CGS was not just influenced by the policy prioritisation framework or regulatory requirements of the UK Climate Change Act. The political context and public discourses are also crucial influences on policy formation. An indicator of this was that earlier drafts of the CGS did include sector specific emissions reductions and indicators that would have provided a means for monitoring progress and accountability. However, these were removed in the final published version of the document, suggesting political resistance to sector-specificity. In this section we consider how political dynamics have created and closed off windows of opportunity for policy progress in the CGS policy process; and ask what these dynamics have meant for the effectiveness of climate change policy in the UK.

4.1 A 'policy window' for stronger climate policies

We use the term 'policy window' to describe a period of opportunity when it is politically palatable to introduce more ambitious policies or make use of more directive policy levers. For example, Carter and Jacobs (2014) give an insider account from within the UK Labour party of a policy window for climate change that was open between 2006 and 2012, partly as a result of a repositioning of the opposition, the Conservative party, to shed the image of being 'the nasty party'. The Conservative Party support for climate policy peaked in their 2010 party manifesto, reflecting a more general political strategy associated with David Cameron to 'detoxify' the party, which included the slogan 'vote blue, go green'. Carter and Jacobs describe the period as producing a 'competitive consensus' during which parties tried to 'out-green' their rivals. Carter and Jacobs (Carter & Jacobs 2014) argue that this policy window closed "as an increasingly critical coalition of sceptic Conservative MPs and right-wing press attacked the whole basis of climate policy."

This idea of a closing Conservative policy window is also supported in an analysis by Carter et al. (2017), who counted mentions of pro- and anti-climate positions in Conservative manifestos from 1997 to 2015, comparing them to the UK Labour party.

The term "anti-climate" is used to denote statements that promote policies which Carter et al. (Carter et al. 2017) judged to have damaging GHG consequences (such as anti-regulation, anti-tax or pro-fossil fuels statements), rather than statements denying climate change. Each party's 'net position' was determined by calculating the proportion of statements that are pro-climate minus the proportion that are anti-climate.

Figure 12 shows the results of Carter et al.'s (Carter et al. 2017) analysis. In general, a low proportion of statements in Labour manifestos are anti-climate, and the 'net position' follows the proportion that are pro-climate. By contrast the Conservative party has a relatively constant proportion of statements that are pro-climate, and the 'net position' is shaped by changes in manifesto's anti-climate positions. The Conservative party's net position is consistently lower than the Labour party's and, with the exception of 2010, the difference is predominantly due to anti-climate statements.

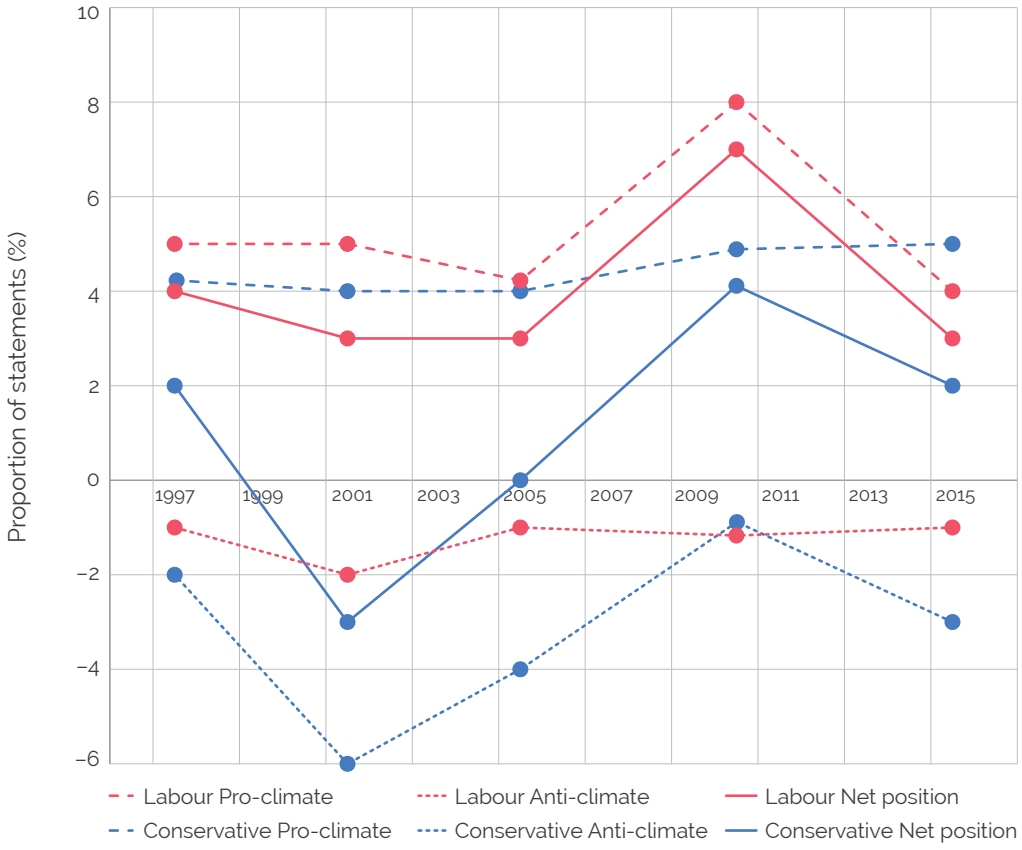

Figure 7 Proportion of statements in general election manifestos that are pro-climate and anti-climate (latter represented as negative numbers). "Net position" is proportion pro minus proportion anti.

This suggests the Conservative party's position on climate change policy is shaped less by a relative disregard for climate change, than by a set of priorities whose consequences have (in Carter et al.'s opinion) a negative impact on climate policy. This included positions that were pro-roads, pro-fossil fuels, pro-growth and pro-global free trade.

Climate change policy is therefore challenging to the Conservative party (relative to the Labour party) not because of a disregard for climate change, but because addressing climate change has negative consequences for other objectives the party wants to fulfil[5].

Perhaps the most notable influence on a climate policy window in more recent years is the impact of the change in Prime Minister in 2016 and Britain's decision to exit from the European Union (Brexit). The 5th Carbon Budget was agreed in parliament the month of the Brexit referendum, and since that date significant parliamentary time and policy discussions have been dominated by issues related to Brexit, leaving little time for other policy agendas.

4.2 Attractiveness of flexibility to the UK Conservative Party

Even within the climate policy debate, party politics has taken precedent in some cases; overriding the carbon abatement policy prioritisation approach. For example, the Conservative Party has increasingly rejected onshore wind since the closing of the policy window described above. Ironically, the lack of sector specificity has enabled the party to pursue such technology-specific policies; working at odds with its earlier argument that sector- and measure- specificity should be rejected to allow cost optimal climate mitigation. The Conservative Party 2010 manifesto did not mention onshore wind, but made generally supportive statements about a range of low carbon sources:

> "We will promote small- and large-scale low carbon energy production, including nuclear, wind, clean coal and biogas," (The Conservative Party 2010, p.91).

In their 2015 manifesto, rejection of onshore wind was explicit ("We will halt the spread of onshore windfarms," p. 57) and again in 2017 ("we do not believe that more large-scale onshore wind power is right for England," p. 22). Were the Government to adopt sector- or measure-specific targets, it would be increasingly difficult to maintain a position against supporting (in the CCC's expression) 'cheap onshore wind.'

Conflict between climate policy and Conservative priorities also affects policy on the energy performance of buildings. The trajectory for tightening standards for new buildings inherited as part of the zero carbon homes policy was substantially weakened before being entirely abandoned. Scrapping the zero carbon homes policy was framed as alleviating the regulatory burden on housebuilders ("the Government will repeat its successful target from the previous Parliament to reduce net regulation on housebuilders," UK Treasury 2015, p.46).

5 In accounting for the CGS the obvious omission in Carter et al.'s analysis is the 2017 manifesto, and more generally the impacts of the change of Prime Minister and of Brexit. However, we take this as some indication of the political context leading up the decisions made in the CGS.

The means by which "net regulation" on housebuilders was reduced during the 2010-2015 parliament was the requirement that impact assessments calculate the "cost to business" of new policies, and if this cost was found to be positive other regulations had to be reduced in compensation[6]. When reviewing building standards in 2012-2013, the Government's preferred option at consultation stage was a modest 8% improvement (in spite of its own calculations which found a 14% improvement had the highest net social benefit due to higher GHG savings (Government 2012)). This was further weakened because of calculated regulatory burdens on business:

> The post consultation work drew [on various technical principles and also] focused on Government's commitment that the costs on home builders will be at least offset by equivalent deregulatory changes [...]. In balancing these objectives it was necessary to adjust the final policy which now delivers around a 6 per cent level of improvement in CO2 emission standards. (Department for Communities and Local Government 2013, pp.9–10)

These calculations served to carry the political preference against regulation and in favour of housebuilders, against the longer term issues of climate change. The timing and political context surrounding the policy process is therefore a crucial influence on the ambition and content of climate change policy.

6 The policy was initially dubbed "One in one out" as compensation had to be of equal value to business. The required compensation was ratcheted up to "one in two out" (compensation to be double the value of new cost) and then "one in three out".

5. Discussion

5.1 Considering alternative approaches to policy prioritisation – the Scottish Climate Change Plan (CCP)

This analysis demonstrates a range of challenges with the CGS policy process that have resulted in weaker policy for meeting the 5th Carbon Budget and, indeed, the more ambitious climate targets in line with The Paris Agreement. We have considered the influence of the policy prioritisation methodologies as well as the influence of the political context and governing party political philosophies. In this section we discuss the relative importance of these influences within the policy process. How critical is the policy prioritisation methodology that was embedded in the CGS policy process to the policy content that results? Or is the political context influencing how the methodology is applied?

In order to answer these questions, we make a comparison with the Scottish Government's policy process for the creation of their Climate Change Plan (CCP); a similar report to the CGS on proposals and policies to deliver on carbon reduction in Scotland up to 2032, required under the Climate Change (Scotland) Act (2009). This plan has been created within a very similar legislative and economic context, but under the remit of the Scottish Government as a devolved area of policy.

The policy prioritisation approach used in the Scottish CCP is in many ways based on the same theoretical ideal of optimising the costs of carbon reduction measures, however, there are some important differences in how the prioritisation is embedded within the policy process. Table 1 considers the approaches used within the CCP policy process in relation to the identified limitations of the CGS policy process.

Table 1: Comparison of the CGS with the CCP, discussing where the CCP has taken an alternative approach to its policy prioritisation methodology to the CGS.

Limitation of the CGS	Alternative approach of the CCP
The policy prioritisation methodology creates uncertainty about the required level of carbon reduction within the CGS (section 2.1)	Similar to the CGS, the carbon reduction projections in the CCP (set out in sector 'envelopes') are affected by similar issues such as the impact of economic recession, i.e. less carbon abatement would be needed to meet the carbon envelopes in the event of economic recession but would not necessarily have embedded a decoupling with economic growth in the long-term. To overcome this, the CCP sets out a wide range of specific measures the Scottish Government expects to see deployed in addition to sectoral envelopes, potentially reducing the uncertainty in what emissions targets mean for policy and sectoral development. The Committee on Climate Change (Committee on Climate Change 2016) also recommended to the Scottish Government that it should prevent changes to the EU ETS cap affecting the non-traded emissions budget, in common with their advice to UK Government. Rather than specify the contribution of the non-traded sector, the Scottish Government (Scottish Government 2017a) proposes to base its carbon account on territorial emissions rather than allocating its share of the ETS cap. While this does not fix the non-traded budget, it does mean it is sensitive to what happens in the traded sector in Scotland rather than to the Europe-wide process of setting (and altering) the ETS cap. In addition, the Scottish Government sets a minimum carbon reduction level of 3% per year from 2020 to ensure consistent progress and prevent costs being pushed to the latter part of the period to 2050.
The CGS focuses on cost optimisation up to 2032, without considering a 'critical path' to meeting the longer-term 2050 80% target or other considerations such as fuel poverty reduction or supply chain development (section 2.1.1)	Rather than focusing on the costs of individual measures, the CCP compares the whole pathway cost with the cost of unmitigated climate change. The cost of climate change mitigation was estimated (Scottish Government 2018b) by re-running the TIMES model without a GHG constraint, finding the proposed pathway 'costs' approximately 1% of cumulative GDP to 2050. This is justified in the document by reference to the scale of the impact of unmitigated climate change at 5% of global GDP on conservative assumptions. This gives a broad justification for driving the chosen course of action set out in the CCP but allows space for wider considerations such as fuel poverty reduction or supply chain development without having to justify the cost of measures individually.
The 'static cost effectiveness' calculations used within the CGS analysis favour certain technologies, to the detriment of technologies with longer lifespans such as demand reduction technologies (Section 2.2)	The value of energy savings arising from fabric efficiency is sensitive to the assumed energy supply for which demand is being reduced. The Scottish Government used the TIMES model to consider the impact of these price interactions for different scenarios, linking this to their chosen sectoral carbon envelopes (Scottish Government 2018b).
The focus on economic optimisation in the CGS is used by the UK Government to resist setting sectoral budgets (Section 3.1)	Scottish Government used the TIMES model to translate carbon targets into sectoral envelopes with trajectories for specific measures compatible with this. Although the sectoral envelopes are to some extent economically optimised by use of the TIMES model, this did not prevent wider social and political objectives to also be taken into account. Sectoral envelopes were shaped by political trade-offs across governmental departments (Scottish Government 2018a). This led to policy choices to prioritise decarbonisation in certain sectors more than others. For example, energy demand reduction and heat decarbonisation in buildings was given a particularly ambitious carbon reduction level in the original draft of the CCP put out to consultation[7] (Scottish Government 2017b, p.48). These figures were eventually reduced in the final version, in part in response to criticism from the Committee on Climate Change that the target for low carbon heat was unrealistic (2017). The CCP now sets milestones (2020, 2025 and 2032) for energy and emissions intensities of domestic and non-domestic buildings. While these final indicators do not specify the contribution of fabric improvements, supply vectors or in-building technologies, other targets are retained; these are for 60% of walls to be insulated by 2020, and 35% and 70% of domestic and non-domestic heat respectively to be supplied from low carbon technology.

7 "Where technically feasible by 2020, 60% of walls will be insulated and 70% of lofts will have at least 200mm of insulation. By 2032, 80% of domestic heat is supplied using low carbon technologies where technically feasible" (Scottish Government 2017b)

Limitation of the CGS	Alternative approach of the CCP
The CGS lacks detailed monitoring and evaluation. Indicators of progress are not described in sectoral chapters or linked to specific policies. (Section 3.2.4)	The CCP monitoring framework sets the context for reporting, with policies explicitly linked to specific indicators. While their precise contribution is not generally specified, this approach offers a basis on which Scottish Government progress can be judged and sectoral actors (at least, those with confidence in Scottish policy) can plan. The Scottish CCP uses an extensive set of indicators for assessing the progress of climate change policy and support learning. These must be SMART and published in an annual monitoring report. The resulting CCP monitoring framework indicators cover policy outputs[8], policy implementation[9], GHG statistics, external drivers (such as technological development and the impact of Brexit) and monitoring of reserved policies (a particular form of 'external driver' which includes UK and European policies/regulations) (Scottish Government 2018b). In principle this framework would enable connections to be made between Scottish Government policies and progress in mitigating climate change, while also making visible the drivers of change outside Scottish Government control. Such factors have been significant to Scottish climate change policy through the 2010s, as changes to the EU-wide ETS and GHG inventory improvements have significantly impacted headline GHG statistics.

Although the Scottish CCP uses similar economic optimisation principles and modelling, the resulting policy document differs from the CGS through its use of sector specificity in the form of sectoral emissions reduction targets, ambitions for specific measures, and annual commitments on progress and reporting. These crucial differences have created a more practical policy landscape which is better suited to supporting more ambitious action (although, of course, this hypothesis is still to be tested in practice).

This suggests that national political dynamics, along with the political philosophies of the governing political parties are crucial factors that influence the policy process. Other likely influences on the policy process, which we have not covered in this working paper, are public discourses and attitudes to climate change, international political dynamics, and forms of media coverage.

5.2 What does this mean for demand reduction policies?

As a research team that focuses specifically on energy demand, we ask: what are the implications of the CGS policy process for progress on demand reduction in the UK?

In section 3.2.1 we discussed the challenge of the lack of sector specificity within the CGS for coordinating distributed decision making. Delivery of demand reduction, for example through building energy efficiency, is an activity with a widely distributed set of decision makers right down to the individual household level. Delivery programmes and technology solutions need to be tailored to local circumstances, and decisions are certainly not taken with an economy-wide perspective on meeting carbon budgets.

8 Policy outputs include: carbon intensity of electricity; robustness of electricity system against interruptions; energy and emissions intensities of buildings; emissions intensity of new vehicles; 100% of new vehicles registered in Scotland to be ultra-low emission by 2032; road freight emissions intensity

9 Policy implementation indicators include: renewable electricity increase (with capacity between 12 and 17 GW); community and locally owned renewable generation; improvements in energy efficiency ratings; increase in proportions of homes with solid wall and loft insulation

Decisions to install measures at a household or building level are also much more complex than considering purely the financial benefit of a measure, particularly given the sometimes significant disruption and organisation required for installation of measures in homes and buildings. The lack of sector specificity in this key policy document is therefore particularly problematic for driving progress on small-scale and local technologies such as energy efficiency in buildings. Delivery of such measures at scale cannot only rely on a competitive market to increase uptake, but instead must be supported with targeted programmes aimed at encouraging investment in measures and overcoming barriers as they become apparent.

Interestingly, in contrast to the CGS, the policy challenge of delivering energy efficiency in buildings has been recognised explicitly by the Scottish Government through the designation of energy efficiency as a national infrastructure priority with a specific policy programme of delivery associated with it (the Energy Efficiency Scotland programme). The heavy emphasis on carbon reduction in buildings created by the CCP sectoral envelopes and associated evaluation and monitoring has resulted in this area of policy being prioritised and supported by specific practical delivery programmes.

The strong emphasis on economic optimisation and ensuring market "efficiency" within the CGS policy process is also detrimental to energy demand reduction policies. As discussed in section 2.2, the static cost calculations used within the MAC approach are problematic for demand reduction measures: The calculations are biased against technologies with longer lifetimes, particularly affecting demand reduction technologies such as building insulation and district heating networks. In addition, the calculations do not vary depending on the demand reduction and supply side pathways, meaning that the interconnected benefits of investment in demand reduction for overall energy system costs are not recognised within the policy process. This focus on the costs of individual measures is also unhelpful because, although there are a number of energy efficiency measures that will offer financial payback within a short number of years, the payback can be much longer or non-existent, particularly when calculated based upon the current energy system's energy supply prices. As The Stern Review pointed out (Stern 2006), there will be an overall cost to mitigating climate change, and government policy will be critical to ensuring this investment is made in order to minimise the overall costs and avoid the even greater cost of not tackling climate change.

6. Conclusion

Understanding the policy process is critical to understanding how to shape policy content and its resulting impact. In this paper we have considered the influence of the policy process surrounding the CGS, and how this has impacted its ability to deliver on the UK's 5th Carbon Budget (2027-2032), particularly for demand reduction policies.

The policy prioritisation process used by the UK Government (the marginal abatement approach) created a range of challenges for the effectiveness of the CGS. Its strict adherence to cost optimisation for indicating which carbon reduction measures should be prioritised for policy support; its complicated carbon price calculations using two sets of prices for traded and non-traded sectors up to 2030; and its use of optimistic 'Business as Usual' scenarios to inform calculations, have all created uncertainties over the overall carbon reductions required to meet the 5th carbon budget. In addition, its focus on individual technology costs with static cost effectiveness calculations instead of whole-system costs creates a bias against technologies with longer lifetimes, a fact which particularly affects demand reduction technologies. These technocratic methods, highly focused on financial costs, have created a basis for resisting the introduction of sector or measure specific targets, or associated evaluation and monitoring to support learning and accountability.

Of course, it is not possible to understand these policy processes without looking at the wider context. Here we examined how the institutional party policies of the governing Conservative Party, which emphasize free-markets, flexibility and short-term financial costs, led to the closing of the climate policy window that had been available in 2006-2010. The political timing and context surrounding the development of the CGS therefore led to the marginal abatement approach being applied in this rigid way and gave justification for resisting more specific and interventionist forms of climate mitigation policy (in contrast to the Scottish Climate Change Plan). This has not been helped by other significant political distractions such as Brexit diverting parliamentary focus away from scrutiny or debate of climate mitigation progress.

6.1 What does this mean for the future of climate change mitigation policy in the UK?

The policy process which led to the development of the CGS has resulted in a less specific and, arguably, weaker policy document that focuses on the individual financial costs of technologies with a bias towards shorter-lifetime, supply-side technologies, instead of the whole-system costs or wider social and environmental benefits. This will make it more challenging to deliver on the UK's current climate mitigation targets for the 5th carbon budget, or indeed take on more ambitious targets in line with the Paris Agreement.

Climate mitigation will not always be "win-win" in a financial sense, nor convenient or seen as a priority by the highly distributed households, small and large business, and industries that will need to implement measures and make behaviour changes. Strong and specific government policy intervention will therefore be crucial to driving timely uptake of decarbonisation measures. Policy formation processes would benefit from a greater openness to alternative models of costs and benefits of climate protection, with use of sector and measure specific targets to support planning and accountability of progress. This could pave the way for development of the more radical policy interventions, with a better balance between supply and demand policies, needed to deliver carbon reductions compatible with restricting warming to 1.5 degrees as set out in the Paris Climate Agreement.

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