

Topic for discussion: The Fifth Carbon Budget

Guest Speaker: Matthew Bell, Chief Executive of the Committee on Climate Change (CCC)

Chair: Keith MacLean, ERP Co-chair

Meeting note prepared by: Helen K Thomas, Research Analyst, ERP

This post-plenary session was attended by ERP members and colleagues from the wider energy field. This note provides a summary of the presentation provided and of the Q&A session that followed.

ERP would like to thank Matthew Bell as guest speaker and all attendees at this event for an informative and interactive session.

Notes from Guest Presentation:

Background/role of the CCC:

- The CCC is a public, independent body, set up under Climate Change Act to provide independent advice to the UK Government and Parliament. Its aim is to assist the UK in achieving the 2050 targets of an 80% reduction in emissions, relative to 1990 levels.
- The committee provides two main functions:
 1. Advice to government on setting the UK's five-yearly carbon budgets
 2. Annual reporting to parliament on progress against the carbon budgets
- The CCC also advise government on adaptation to climate change

The Fifth Carbon Budget in context (e.g. of the Paris Agreement) and implications for the future:

- The Climate Change Act requires an 80% emissions reduction by 2050 commensurate with limiting global temperature rise to around 2°C.
- The Paris Agreement however, was a little bit more ambitious, agreeing to limit global warming to between 1.5-2°C.
- Importantly the Paris Agreement included a regular five-yearly revision with more definite language such as 'will' and 'shall' rather than more vague language such as 'may' and 'best effort'.
- The implication is that each country will need to show what it is doing to reach the levels of reductions that have been committed, and to increasing that effort if total global effort falls short.
- Matthew warned the conference not to take CCC's budgets and scenarios as detailed forecasts. The CCC's role is more about stating what is possible and achievable within the current constraints of technology and affordability in order to meet the carbon budgets and the 2050 target cost-effectively.

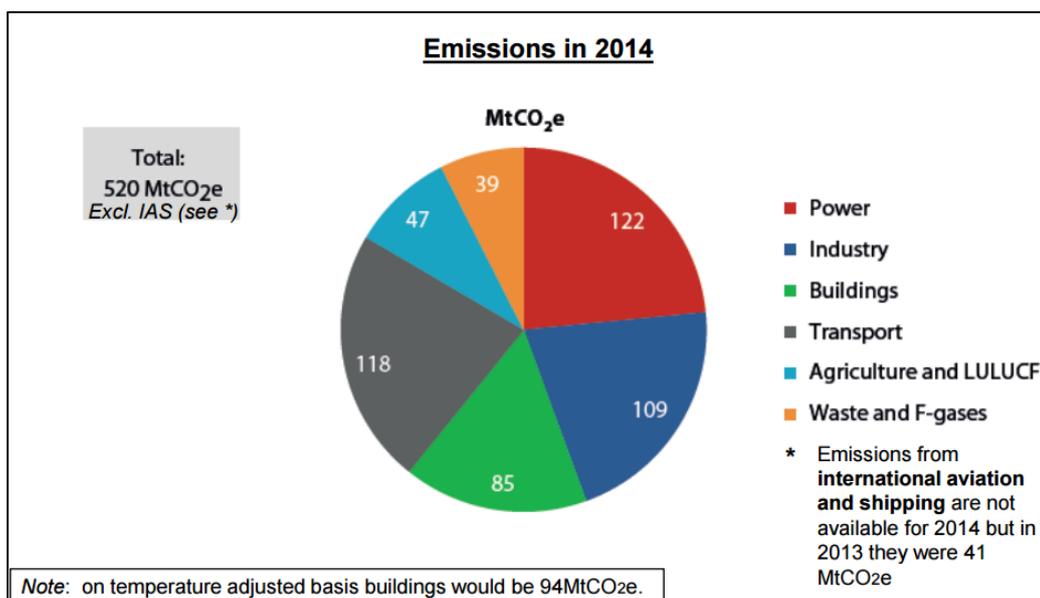
So where are we heading...?

- Steadily towards a more carbon neutral world helped by increased business logic, increased political will and stronger scientific evidence around climate change.
- There is still uncertainty regarding the speed, costs and right approach for achieving this...
- The CCC is trying to take account of that uncertainty – e.g. by recommending that the UK keeps as many options open for as long as possible.
- The Fifth Carbon Budget for the period 2028 -32 is the incremental next step from the 4th budget for 2023-27 and a signpost for government and business. The Committee has recommended that it be set 57% below 1990 levels.

- A 36% reduction in emissions (relative to 1990 levels) was achieved by 2014 (an average annual reduction of about 2%) and the 4th carbon budget (2023-2027) requires a 52% decrease by 2027.
- Emissions between now and 2020 are effectively ‘locked in’ although there are still some decisions to be made. It is hoped there will have been a total decrease of 43% by 2020.
- In that light, the Fifth Carbon Budget is the next incremental step. It requires an increase from the 2% annual emission reductions to a reduction of about 3% emissions reduction annually between 2015 and 2030.
- 2030-2050 will then require on average approximately a 4% emissions reduction per year to achieve the final targets. This is a steady, least cost, secure, affordable, and consistent with technological developments.

Developing advice and the current situation:

- The CCC is an evidence-based organisation. When developing advice, the committee gathers evidence from all possible sources and a wide range of stakeholders.
- To provide some details on setting the Fifth Carbon Budget, the breakdown of emissions in 2014 was presented (see Figure 1) showing a relatively even distribution across the sectors.
- Good news: the UK has made incremental progress everywhere; Bad news: a broad front is required to tackle these emissions - policies are needed right across the economy.



Source: UK climate action and the Fifth Carbon Budget (presentation for ERP) January 2016, Matthew Bell, Chief Executive, CCC

So what does this mean for each of the broad sectors of the UK’s economy in the lead up to 2030?

- The most challenging sectors are the buildings and low carbon heat.
- The UK is currently off-track to achieving the 4th carbon budget due to slow progress in these sectors.
- To achieve what is set out on the Fifth Carbon Budget, 1 in 7 homes and 1/2 of all commercial buildings should utilise low carbon heating by 2030.
- Other sectors are on target. In 2013-14 emissions rose slightly in the transport sector, but only by 1% (well within margins of error), and this sector has shown emissions reduction over time.

- More fuel efficient cars need to be balanced against falling fuel prices. In 2013-14 the growth in kms driven outweighed the improvements to fleet average efficiency. Levels of newer, more efficient cars therefore need to increase and continue to penetrate the existing stock.
- EVs also need to continue to penetrate. The CCC advice requires that the majority of new car sales in 2030 are low emission vehicles. This is not a forecast, this is the action required to help reach the target emissions set.
- Technological development with transport is pushing in the right direction which makes this achievable, whereas low carbon heat is harder to tackle.
- The Fifth Carbon Budget envisions the power sector reducing emissions to 100g of CO²/kWh by the early 2030s, with the closure of coal and other measures taken, this should be achievable.
 - Grid decarbonisation is important, to ensure that electric heating and EVs genuinely are low carbon
 - About 1/3 of the reduction in emissions from heating and transport depend on low carbon electricity being available.
- The industrial sector need to achieve approximately a 1% emissions reduction per year (on average) to 2030. The Fifth Carbon Budget requires a continual steady improvement but post Fifth Carbon Budget, if the UK is to continue to have heavy industry as part of its mix, then a real solution (e.g. CCS) will become very important. There is therefore a need to prepare and have these technologies in place and ready, rather than assuming an automatic ‘switch-on’ in 2033’.
- There is a similar story for agriculture, with an average of a 1% per year decrease required through the 2020s and from improvements to efficiency, fertilisers, the diets of animals, breeding, fuel efficiency, machinery etc. After 2030, the requirements for agriculture grow ever more onerous and again, the UK needs to be in a position to act fast – preparation is key!
- Waste emissions is a success story: diversion from landfill, recycling etc. has reduced emissions by 65% from 1990s, but there is still lots to be done. Ever decreasing proportions of emissions within this sector however, adds weight to actions from other sectors.
- CCC has to deal with uncertainties so poses a range of scenarios, for example demand-side choices will not be exactly as envisaged. The CCC does not provide a recipe but it does provide the options.
- The CCC believes that the 57% emissions reduction relating to the Fifth Carbon Budget is consistent with the requirements under The Climate Change Act and ensures a cost effective path to 2050, whilst ensuring a consideration of the aspects previously mentioned.

 <ul style="list-style-type: none"> Heat networks, heat pumps, etc Insulation, efficiency & behaviour change By 2030s: 1 in 7 homes, half of public and commercial use, low-carbon heat 	 <ul style="list-style-type: none"> Further conventional fuel efficiency improvement By 2030 around 60% new cars & vans electric (hybrid or full) Travel behaviour change: mobility choices, driving styles
 <ul style="list-style-type: none"> Options: wind, nuclear, CCS, interconnection, gas, storage Demand-side behaviour By 2030s: <100 g/kWh, smart demand 	 <ul style="list-style-type: none"> Adjusting industrial processes, energy efficiency, heat recovery Development of CCS Through 2020s: apprx. 1%/yr fall emissions from measures
 <ul style="list-style-type: none"> efficient fertiliser use, animal diets, breeding, fuel efficiency Through 2020s: apprx. 1%/yr decrease emissions 	 <ul style="list-style-type: none"> All main biodegradable waste diverted from landfill, alternatives to F-gases By 2030s: apprx. 50% decrease emissions from today

Need for action across all sectors [Source: UK climate action and the Fifth Carbon Budget (presentation for ERP) January 2016, Matthew Bell, Chief Executive, CCC]

Notes from Q&A session:

Q1: The Fifth Carbon Budget advice seems challenging from a South Wales Steel Industry perspective, as it seems that Wales needs to move at the same pace as the EU.

Q2: Regarding nuclear within the Fifth Carbon Budget report, the committee seems pretty ‘pro’ renewables but agnostic on nuclear – is this true?

Q3: A lot of what the CCC advises is associated with behaviour change. Work by Nick Pigeon et al in Cardiff studies public attitudes to climate change and shows that members of the public welcome change as long as it is change for the better. Recommended / more use of public transport instead of cars for example, can quite a difficult sell. Do you have thoughts on how we can change attitudes to aspects such as these?

A1: In relation to the comment regarding the Welsh Steel Industry, it is true that if the pie-chart were redone to solely represent Wales, then there would be a higher proportion of emissions from the steel sector. The CCC has collected evidence from Wales/Welsh organisations and hears the challenges, however there are lots of good ideas submitted to the committee by these organisations which will help with the incremental 1% emissions reduction challenge. But there are open questions relating to the 2030s/40s for the UK to retain heavy industry – ensuring this is possible whilst continuing to reduce emissions. The CCC spends a lot of time interacting with industry and trying to understand this.

A2: Regarding renewables and nuclear – in general committee is agnostic across all technologies. It provides clear objectives wherever it can to ensure that the UK is on track to meet the carbon budgets. That is possible under a range of different technology mixes. Where the CCC has to go a little further is in regards to the costs of decarbonising and measuring all technologies against the same benchmarks / standards. If we are demanding ever increasing reductions in costs from offshore wind and solar, converging down to the cost of gas (plus the price of carbon); then nuclear has to be on same trajectory. Does historical evidence suggest that costs can be brought down in same way? As long as nuclear can reduce in cost and compete in the electricity market (whilst heading towards the 100g CO₂/kWh mark), then the CCC will support it.

A3: Behavioural change is a big issue and the CCC has always incorporated this into its advice and scenarios. Heat pumps, EVs, eating habits etc are all things the committee tries to incorporate. But there is lots still to be studied and learnt, so the CCC will be looking at this increasingly in the future and identifying for example, where policy and other measures can help. Lots of efforts to reduce emissions so far have had a supply-side focus, so a demand-side focus is needed too. As a side note, the CCC will be appointing a new member to the Committee who is a behavioural scientist/expert.

Q4: One of the biggest challenges highlighted in the presentation relates to the heat sector. Which technologies can deliver this low carbon heat (e.g. to achieve low carbon heat in 1 in 7 homes and for ½ of the commercial sector)?

A4: The main options here are a combination of heat pumps, heat networks, biofuels into the grid, and an alternative scenario of hydrogen. The easier part of the committee’s job is that we can provide a *range* of plausible scenarios that are consistent with meeting the targets at a reasonable cost and within other constraints, rather than the final decisions. National Grid colleagues for example help to ensure that we make ranges realistic and achievable. However, even those that may have to make specific decisions don’t yet know what the solution is yet, so we need to push forward on all fronts (a range of technologies) to try to understand which are most cost effective for future.

There are other options around market mechanisms, letting competition figure out which is best, regulation is another option, and there are different choices of instruments for achieving low carbon heat (and other) objectives. But the UK is not at a stage where we know the answer yet, so keeping a range of options open is sensible as long as a) we understand the need to progress all of those options and b) that at some point a choice will have to be made, including regarding National Grid infrastructure etc.

Q5: Amber Rudd's letter to colleagues raised concern regarding a shortfall (of about half) in terms of heat and transport for reaching renewables targets. Are the CCC assuming the 15% overall renewables target is met in the appropriate carbon budget and maintained thereafter, and if so what happens if there is a shortfall in terms of heat and transport?

A5: A distinction in terms of CCCs role is needed here. Annually the committee reports to parliament – but we don't make any assumptions - the CCC focusses on what has been achieved and what current policies will achieve.

When setting the Carbon Budgets, Government has said it is committed to meeting the 3rd and 4th carbon budgets, so we have to assume that we *will* meet 4th carbon budget. That doesn't mean we take it all as given e.g. additional work on heat has been carried precisely because of the challenges in this sector, but we do assume that government will meet 4th budget in one way or another.

The 2020 EU agreement is not something that the CCC monitors. UK government could for example miss the EU Carbon Budgets but still be on target to UK Carbon Budgets. It depends on what is deemed to be more important, or we achieve both? CCC's role relates to the UK Carbon Budgets, not the EU targets.

Q6: The Climate Change Act assumes international action and in the context of Paris, hopefully we can now achieve this.

Re the six key sectors noted in the presentation, one could assume that for several of those sectors, the UK will be part of a wider international process e.g. in the power sector, collapsing costs haven't been driven by the UK.

What about the identification of challenges particular to the UK, where we can't rely on being part of an International process but where the UK has to solve issues itself e.g. solid wall insulation. The UK building stock is individual and I guess this is related to the heat challenge also. The CCC previously carried out some work regarding here is what we (the UK) can deploy/develop. So there are areas where the UK has a unique challenge and therefore we have to find ways to deliver on these, which other countries won't.

A6: The CCC tries to draw a line or distinction where recommendations for UK action/affordability balances with international action that will take us along that path to decarbonisation anyway. Where this is the case, there is less of a case for early UK action. The committee is always trying to judge where early UK action is most sensible in terms of cost. Car batteries for example are never mentioned in recommendations because the evidence says this will take off for other reasons internationally; heat pumps etc. however, the UK does need specific action/rollout.

There are 2 types of measures/actions within the CCC's scenarios:

- Some measures look at current cost/technological approach and add a sensible carbon cost to it. If the total cost of this means we should still be doing it – then this is a win-win situation.

- Then there are a series of measures that *should* be put into place even though they may cost more (including the carbon price). If the UK doesn't build up supply chains in certain areas or ensure public behaviour is used to a particular technology or change - then despite action in the rest of world, the UK can't just suddenly switch on and ramp up what is needed. Scenarios for low carbon heat requires relatively costly kit but this means low cost by the time we reach the 2050 time horizon. If we are only concentrating on the shorter term (e.g. to 2016), then this doesn't make economic sense - but optimisation to 2050 is key.
- CCS is an example here again in addition to Transport and Storage. If these are not done here (in the UK) then there is limited action when needed (e.g. mid 2030s).

Q7: If carbon is bad but the UK doesn't wish to select a particular technology, then (in my opinion) the options are to:

- 1) price the bad thing
- 2) subsidise giving up bad thing or
- 3) mandate a removal of the bad thing

If for whatever reason the UK doesn't wish to do the 1st two things, then mandating (aside from occasional cheating!) does work. Why is same system not applied to the power sector or other sectors? The voluntary option is often too slow, so shouldn't we learn lessons and move forward with others?

A7: There is certainly a range of options here: regulation, tax or subsidies/using funds and use of a combination of these with lot of gradations within each one. For example, more efficient boilers in homes have resulted in lowered carbon because of building standards regulations stating that all new boilers should be replaced with more efficient ones. And vehicles is another good example. But there is also 'bad' regulation which massively distorts and imposes huge costs. Government is always deciding right balance.

Sectors such as agriculture are difficult. The approach so far has (by and large), been a voluntary one. The 1% contribution that the agriculture sector needs to make has been encouraged via best practice e.g. fertilisers, research into animal feed, common agriculture policy etc. but has mainly been a voluntary approach. It is perhaps best to start out on that route and if that doesn't work then try the 2nd/3rd/4th best measures of intervention. With cars, electricity and heating we have reached the 2nd best solutions faster; with agriculture and industry we haven't practised these yet but we will have to do so if voluntary action isn't working.

Side note from Chair: The impact of regulation can be seen in the example of condensing boilers. Prior to their introduction, their expected trajectory was about 200 years. Following regulation, within 2 years, this time had been cut to 20 years. Low cost legislation led to major change - and according to UCL research, was the single biggest carbon reduction activity in that sector. We can also look at the wider impacts/benefits e.g. health (emissions directive/clean air act).

Q8: In relation to least cost routes/trajectories to carbon reduction – how far does the CCC regard in its remit issues surrounding institutional / governance arrangements that might contribute towards these least cost routes?

At a city level or community level, there are lots of obstacles. 'Big kit' solutions may require a different set of institutional and governance arrangements. How far is the CCC looking at barriers to delivery?

A8: The committee assess on a case by case basis and has to be cautious of 'scope creep' / aspects that are not within its remit. It does point out the ancillary health/employ bens etc. but doesn't spend time investigating those. It's also not very large so can't get involved in all aspects.

The committee don't tend to drill down into local initiatives/how to design a sensible auction or governance framework for delivering outcome, it is there to set high-level parameters and what the requirements are. It is then largely over to Governments at local/regional/national levels, and other bodies, to figure out what the most effective way of complying is.

Having said that - in areas where progress is lacking, the CCC will carry out more detailed research and recommendations. In the progress report last year/analysis of Fifth Carbon Budget, there is lots of detail that doesn't necessarily make its way into the recommendations but sits there to inform the discussion and back up the recommendations.

Q9: In relation to mandating performance and technologies – one way look at this, is the difference between the usage case and the intrinsic performance of that technology. For example, using a boiler or a car is a way of setting up an experimental case to verify performance. However it is more difficult to do that in other cases, e.g. with behaviour change – there is a key difference between pinning down the intrinsic performance of something vs how it is used.

A second point related to the performance gap in buildings and ways to regulate buildings based on design performance. The InnovateUK building performance evaluation programme is looking at this for example. There is current a 2.5-4.5% difference between the anticipated or modelled performance of a building and of that which is required.

Does the CCC look at actual rather than predicted performance? But to measure actual performance, we need to change the metrics to measure some of this performance in practice, and to gain more detail at a granular level.

A9: I agree. Using the example of the difference between cars testing emissions and road emissions, the CCC does take account of *actual emissions* but the work is only ever as good as the measurement that is carried out, and lots of work is needed to ensure that measurements are accurate. We need to focus on how we measure what we need to and how accurate those measurements are in real-life use.

Side note from Chair: This echoes the key findings of a recent ERP report on Energy in Buildings. Do we need more standards? The answer is thought to be no – we need more implementation and control.

Q10: Although the UK has done a good job with reducing emissions since 1990, what about our net carbon footprint - do we (the UK) import large amounts of goods with a high carbon footprint and does this matter in terms of reaching the Carbon Budgets? Should we do anything about this, or will the UN / Paris Agreement take care of that?

A10: The answer depends on what is means by 'importing *large* amounts of goods'. Consumption-based emissions have gone up, production-based emissions have been decreasing (the production-based emissions are what CCC has been reporting on).

In regards to whether it matters that consumption-based emissions are not within the CCC's remit – in some senses it doesn't, because of the architecture of the Climate Change Act, which means the CCC's work is around production-based emissions. However, 3 years ago, the CCC did set out production vs consumption-based emissions because if the two diverge too much then there is clearly something wrong. The committee does track consumption-based emissions but it has no formal legal framework to deliver consumption-based targets, only production. Whether that is a good or bad thing is a debate to be had...

If every country in the world is acting on the Paris agreement levels, then production and consumption will be consistent and be solved and consistent with the 1.5/2 degree limit. If countries are not acting on

this agreement, then consumption-based emissions become more important and aspects such as border taxes will become heavier, or may be required more, but that's a whole other debate.

Production-based emissions are something that sovereign states can control within their own state and are therefore more controllable or track-able

Q11: What proportion of earlier emissions savings have been from GHG *other than* carbon? And does that mean we need to up the game in terms of carbon if earlier gains were based on other GHGs?

A11: The CCC has a way of making sure a like for like comparison is carried out across the GHGs levels. A proportion of the reduction to date (waste, landfill) big reduction is non-CO². The proportion of CO² vs non-CO² has remained roughly the same: 85% of CO₂e is CO², 15% is other gases. There is a real debate as to whether countries are better off focusing on methane emissions and less on CO² - although methane stays in the atmosphere for shorter period of time than CO². The approach in general is on a reasonable CO₂e basis.

The Chair thanked the guest presenter and attendees for a full and informative discussion.