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Dear Roseanna,

I am writing in response to your letter of 12 October in which you requested further advice on the new Scottish Climate Change Bill, to update the Committee's March 2017 advice on the appropriate levels of future Scottish emission reduction targets and the best design of a statutory climate target framework.

In our March report, *Advice on the new Scottish Climate Change Bill*, we presented two options for a new Scottish target for emissions reduction by 2050. 'Option 2' entailed a 90% reduction on 1990 emission levels by 2050. At the time of the advice, this reduction was at the limit of known options to reduce Scottish emissions.

Our assessment of feasible emissions reductions can change when scientific methods change or when the evidence base improves. We have updated our analysis with the latest available information and taken into account expected future changes, to the extent possible now.

In June 2017, new estimates for emissions were released. These, together with further information about planned developments in greenhouse gas (GHG) measurement, could impact Scotland's ability to reach its stretching target. The Committee has therefore re-examined whether a 90% reduction by 2050 is still consistent with our High Ambition scenario (Annex A).

Our updated analysis concludes that a 90% reduction on 1990 levels by 2050 is still feasible for Scotland on the basis of the current estimation methods and evidence published to date. The recommended level of the interim targets (56% in 2020, 66% in 2030, and 78% in 2040) also remain feasible.

We have also considered forthcoming revisions to the methods for estimating Scottish emissions. The UK has an international obligation to make methodological changes regarding the measurement of greenhouse gases (GHGs). As a consequence, the official GHG inventory is likely to be more variable in the near term. This makes it highly challenging for the targets to drive consistent action to reduce emissions.

We recommend that the best design of a statutory climate target framework is to assess compliance with targets against a 'GHG Account' in the short term, with regular reviews – at least every five years – to ensure that the framework remains based on the scientific evidence.

The following describes our reasoning for these recommendations and the methodology of the GHG Account in more detail.

The challenge

Improvements to greenhouse gas inventories, reflecting the most recent scientific knowledge, are required under the UN Framework Convention on Climate Change (UNFCCC) and are based on international peer review. Updates are made on an annual basis. The UK is internationally obliged to include new sources of emissions into the greenhouse gas inventory by 2020.

Scotland will be disproportionately impacted by these changes (Annex B). These scientific improvements are to be welcomed, as they improve the accuracy of the inventory and enable emission reduction efforts to be targeted better. But, in the near term, these new methods can lead to large annual revisions which can make it difficult to monitor Scotland's progress against climate change targets.

The Committee has therefore considered how best to make the statutory climate target framework as resilient as possible to short-term changes and revisions in the GHG inventory. We have reviewed a variety of possible approaches and considered a range of issues, including practical challenges, the degree of transparency and how well the target framework holds up under these large prospective changes.

Our recommendation: a GHG Account to assess target compliance

Progress in decarbonisation is measured as emission reductions compared to a base year, usually 1990. Measuring progress as percentage reductions compared to a base year can protect the target from some impacts of those annual changes – this is what we recommended for the targets in March. However, some changes (e.g. large revisions that affect the base year and current years differently or addition of emission sources to the inventory) can cause disruptions and require adjustments to be made.

When significant changes occur such that the existing targets become significantly easier or more difficult to achieve through the set of actions that was expected to be needed to meet them, there are essentially three options of how to proceed:

- Adjust the amount of effort needed to meet the targets
- Adjust the targets
- Use an emissions estimate based on the methodology in place at the time that targets were set

It is this latter option that we recommend.

Adjusting the effort

The emissions targets that were recommended by the Committee are based on a level of decarbonisation effort that has been assessed as stretching but feasible. If the scientific basis on which emissions are estimated is changed, it is possible that the same level of effort will achieve a different relative emission reduction. In this case, a target can be missed not because of lack of policy effort but because of changing methodologies.

Alternatively, the change in methodology could lead to the targets being too easy to meet and potentially result in lesser action to reduce emissions.

It is important that near-term targets drive the necessary actions to reduce emissions, and that the targets can be met through taking these ambitious but feasible actions. The value of the targets is that they should be challenging but achievable with sustained policy effort, ensuring planning certainty for businesses, consumers and the public sector.

For the near term, we therefore recommend that the level of effort required is maintained when the scientific methodology used to estimate emissions changes. However, it is advisable to reassess the ambition of the targets periodically, and if necessary adapt the level of effort that is deemed appropriate, in order to ensure that legislated long-term targets reflect the best available science and can feasibly be achieved.

Adjusting the targets

In principle it would be possible to adjust the levels of targets every time there is a change in the methodology for estimating emissions, in order to maintain the required level of policy effort whilst using the latest methodology. In practice this could lead to the targets being changed every year. This would be confusing for stakeholders and investors, and would undermine the signalling function of the targets.

Use an emissions estimate based on the methodology in place at the time that targets were set

Instead of adjusting the target or the effort level, it is possible to assess compliance with targets in the short-term against an emissions estimate based on the methodology in place at the time that targets were set.

This option distinguishes between the emissions inventory based on the best scientific evidence currently available and a 'GHG Account' used, in the shorter-term, to assess target compliance.

The GHG Account would be based on the latest emissions inventory, adjusted to take account of methodology changes so that it reflects the emissions inventory methodology in place at the time that targets were set. It would allow for a periodic review to ensure longer-term consistency with the latest science and international circumstances:

- A 'GHG Account', distinguished from the most up-to-date emissions inventory, is used to assess progress against annual targets in the short term.
- The GHG Account is aligned with the emissions inventory in place when the targets were set. Using such a GHG Account means that targets will be met if the level of policy effort matches that intended when the targets were set.
- The GHG Account is derived from the latest emission inventory using the transparent methodology described in Annex B.
- The GHG Account is reset periodically to align with the most up-to-date emissions inventory. To prevent the inventory and the GHG Account from diverging too significantly over time, we recommend that this is done at least every five years.
- At the same time that the GHG Account is reset, the level of annual emissions targets would be reviewed and, if necessary, recommendations made to change them. This should include consideration of key criteria in the Climate Change (Scotland) Act,

including the latest scientific evidence, international circumstances and what is required to reach the long-term target.

The GHG Account should follow an accounting framework that sets out how the latest GHG inventory is adjusted so that it is made consistent with the inventory of the year the target was set ('base inventory').¹

We recommend following this approach for legislation of Scotland's new emissions targets.

This recommended option has several benefits:

- It provides clarity and certainty over the required effort in the short-term and maintains this level of effort, whilst at the same time smoothing the impact of changing scientific circumstances.
- The five-year revisions ensure that the GHG Account does not diverge too significantly from the latest science and the long-term target.
- The process of deriving the GHG Account, as outline in Annex B, is transparent and replicable, ensuring accountability.

While there is no ideal solution to this challenge, we believe the proposed approach will provide a robust and workable framework for the targets over the coming years, while providing as transparent a process as possible.

Yours sincerely,



Lord Deben
Chairman, Committee on Climate Change

¹ We recommend the initial base inventory to be the inventory that will be published in 2018. If the inventory published in 2018 differs significantly from the one published in 2016 inventory (i.e. the inventory that was used to set the targets), the Committee would have to update its analysis on the target level. Alternatively, the inventory published in 2016 could be used as the base inventory. The inventory published in 2017 should not be used as the base inventory, as it underestimates the forestry sink.

Annex A – revisions to the inventory and the impact on the Scottish Climate targets

In June 2017, BEIS published the updated greenhouse gas (GHG) inventory for Scotland, Wales and Northern Ireland, which covers emission estimates for 1990, 1995 and the years 1998 to 2015

The new inventory included substantive changes for the Scottish GHG estimates: base year (i.e. 1990)² emissions were estimated to be 0.2% lower than previously and emissions in 2014 were estimated to be 5.9% larger. These changes were mainly caused by methodological changes in the forestry and waste management sectors:

- **Forestry:** The use of new datasets (i.e. the new National Forest Inventory and the new small woodlands dataset) led to revisions of +3.2 Mt for 1990 and +3.1 Mt for 2015. The main driver for the increase in land use, land-use change and forestry (LULUCF) emissions was the change in the soils component of the forestry model, which led to an increased estimate for emissions from afforestation.
- **Waste management:** the use of a new Scotland-specific landfill model led to significant changes in estimates for 1990 (-4.2 Mt) and 2014 (-0.8 Mt).

The Committee analysed whether these revisions would change the recommendations we gave in our March 2017 advice, especially considering whether it would impact Scotland's ability to achieve a 90% reduction on 1990 levels by 2050. We outline below the individual steps of this analysis.

Revisions of waste management estimates in the 2017 inventory publication

Updating our advice from March 2017 only considering the changes in the waste sector would not change our assessment of the maximum achievable reduction on 1990 by 2050 significantly.

Revisions of forestry emissions estimates in the 2017 inventory publication

Updating our advice from March 2017 only with the increase in historical emissions estimates in the LULUCF sector, we might expect that this would reduce Scotland's ability to achieve a 90% target. However, this is not the case, for two reasons:

- The increase in forestry emissions was a result of underestimating the forestry sink, therefore overestimating emissions. This will be corrected in the inventory (June 2018) and the emissions estimate is expected decrease again.
- It is not possible to calculate the impact of the increase in forestry emissions on the climate change targets as there are no projections available for future forestry emissions that are consistent with the 2017 inventory publication.
 - The Committee's advice on what target level is achievable does not depend on historical emissions but rather on forward-looking analysis: level of emissions in absence of action to reduce emissions (i.e. business-as-usual (BAU) projections) and the level of emissions savings from taking action.

² The base year is 1990 for most GHGs, but 1995 for F-Gases

- The Committee uses the official BEIS publication 'Projections of emissions and removals from the LULUCF sector to 2050' for the BAU projections in the LULUCF sector. For the advice to the Scottish Government in March 2017 we used the latest available data, published in 2013.
- Shortly after the publication of our advice, more up-to-date BAU projections have been published. However, they pre-date the inventory revision in the forestry sector and are not consistent with the inventory published in June 2017.
- A new version of BAU projections is expected to be published in the near future. However, this will not be consistent with the forestry revisions, as the model that was underestimating the forestry sink has been corrected. This correction will feed through into the inventory published in June 2018.

In conclusion, there will be no set of BAU projections that is consistent with the increase in emissions in the forestry sector in the inventory published in 2017. We are therefore not able to analyse how the increase in emissions would have affected the climate change targets. Since this revision is to be corrected in the next inventory, it would not make sense to analyse its impacts in any case.

Updated BAU projections for LULUCF in April 2017

Although the revision to estimates of historical emissions in the LULUCF sector will not directly impact the achievable level of emissions reduction, updated BAU projections will have an impact. The update to the LULUCF BAU projections was published in April 2017, too late to be taken into account for the Committee's March 2017 advice. The latest LULUCF BAU projections differ significantly from the old projections:

- The LULUCF sector is projected to remain a sink until 2050 whilst it became a source under the old projections in the early 2040s.
- LULUCF emissions are still projected to increase over time, but more slowly than previously estimated. In 2030, BAU emissions are projected to be 1.6 MtCO₂e lower than previously estimated, and in 2050 lower by 3.9 MtCO₂e.

These changes mean that a 90% emissions reduction by 2050 would be more achievable than previously assessed, before taking into account subsequent revisions to the emissions inventory and projections.

Our recommendation

Considering the revisions in the waste sector, the updated LULUCF projections and other technical updates,³ we now have greater confidence that a 90% reduction is attainable on the basis of the current inventory. However, we note that further revisions to the emissions inventory and projections will move this assessment significantly over the next few years.

Consequently we conclude that the targets recommended in March 2017 are still feasible and recommend that they should not be changed now. Instead, we recommend waiting until inventory revisions regarding LULUCF have been made and uncertainty regarding

³ The 2017 advice double-counted a small amount of emissions from gas-fired power generation. We corrected this issue for this updated advice.

the inventory has reduced before reconsidering the level of the long-term target. The five-yearly review in the recommended target design allows targets to be revised based on the latest scientific evidence and international circumstances.

Annex B – Methodology to produce the GHG Account

Scottish emissions are more uncertain than UK emissions, mainly as a result of the higher share of emissions from sectors with most uncertainty: land use, land-use change and forestry (LULUCF) and agriculture.⁴

The Committee is aware of plans to revise emission estimates in the LULUCF sector significantly over the next years. This includes the addition of a new source of emissions, from peatland and other wetlands, into the inventory. Drained peatland is emitting both carbon dioxide and methane into the atmosphere, whilst natural peatland stores carbon and can act as a net-sink of GHGs. Around 60% of UK peatland is in Scotland, estimated at 1.7 million hectares, potentially resulting in significant additional emissions for Scotland.

The number, magnitude and timing of these revisions is not known with certainty at this point. It is therefore advisable to minimise the impact of revisions by ensuring the target framework is as resilient as possible.

Our recommendation is that progress on targets will be assessed not against the official GHG inventory, but against a 'GHG Account'.

This account would be produced by adjusting the annually published GHG inventory so that it becomes consistent with a 'base' inventory, the inventory methodology used when the targets were set. We recommend that the initial base inventory is the inventory that will be published in June 2018.⁵ At least every five years, the base inventory should be re-aligned to match the latest available GHG inventory so that the divergence between the GHG Account and the latest inventory does not grow too large.

To produce the GHG Account, the published inventory is adjusted step-by-step to match the scientific circumstances of the base inventory (Figure). The level of emissions for the 1990 baseline⁶ would be that fixed at the base inventory level, i.e. the inventory published in June 2018.

Each time a new version of the emissions inventory is published (i.e. in June each year), it will include estimates of annual emissions from 1990 to the latest year on the basis of the latest methodology. Taking the difference in the estimates for estimated recent emissions between a consecutive pair of inventory publications produces an adjustment that allows translation from one inventory methodology basis to another:

- For example, the inventory published in June 2019 will provide estimates on the latest methodology for years up to 2017. Calculating the difference between the estimate of

⁴ <https://www.theccc.org.uk/publication/quantifying-greenhouse-gas-emissions/>

⁵ We recommend the initial base inventory to be the inventory that will be published in 2018 ('the 2016 inventory'). If the inventory published in 2018 differs significantly from the one published in 2016 (i.e. the inventory that was used to set the targets), the Committee would have to update its analysis on the target level. Alternatively, the inventory published in 2016 could be used as the base inventory. The inventory published in 2017 should not be used as the base inventory, as it underestimates the forestry sink.

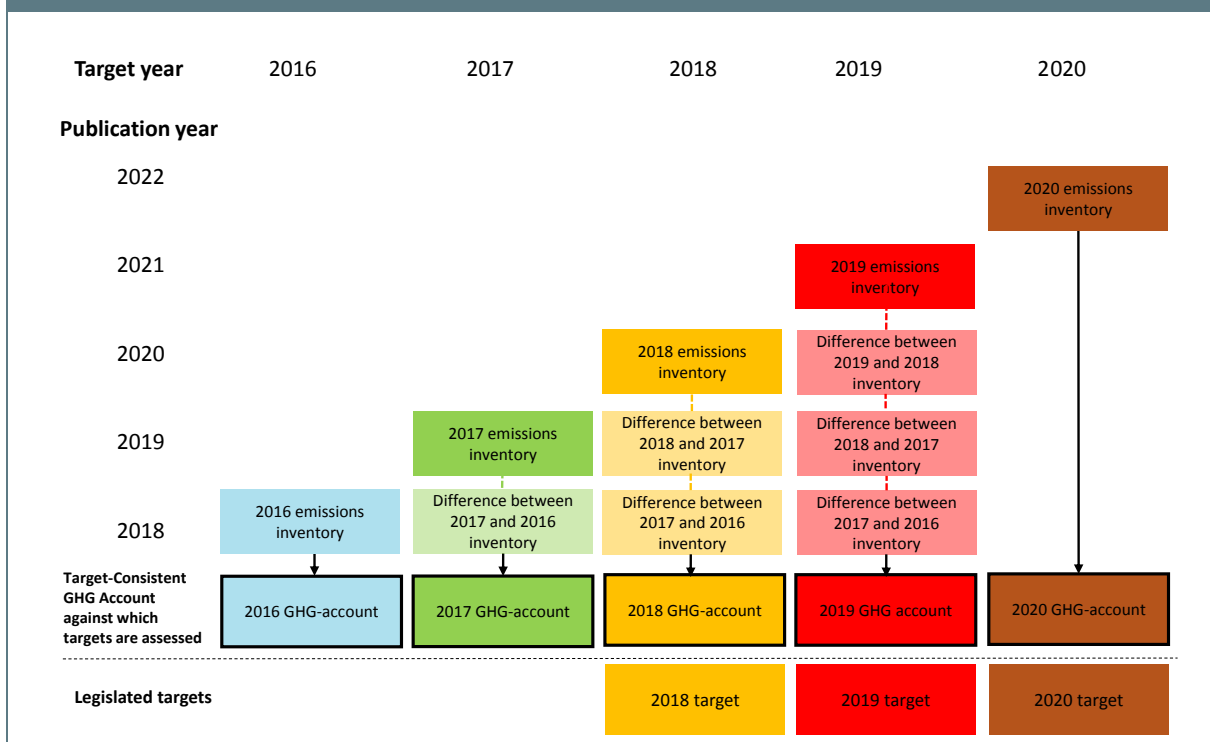
⁶ While the baseline for emissions reductions is 1990 for most greenhouse gases, it is 1995 for HFCs as this is the earliest year for which data are available.

2016 emissions previously published (i.e. in June 2018) and the latest estimate for 2016 emissions will provide an adjustment that can be used to translate from the inventory methodology used for the inventory published in 2019 to that used for the 2018 publication.

- Following the same procedure in June 2020 for estimates of 2017 emissions will provide an adjustment to translate from the inventory methodology used for the 2020 publication to that used in 2019. Combining this with the earlier adjustment, allows translation from the 2020 publication methodology to the 2018 one.
- The GHG Account for a given year's emissions would be the emissions estimate for that year when first published, adjusted to be consistent with the methodology used in the 'base' inventory (initially the 2018 publication).

This enables the GHG Account to be calculated transparently based on published data.

Figure 1. Example of adjusting the GHG inventory to create the GHG Account for 2016-2020



Source: CCC analysis.

Notes: This illustrates the process of adjusting the GHG inventory to create the GHG Account, showcasing the years 2018-2022. The inventory published in 2018 is the base inventory. Emission estimates in subsequent years are adjusted to meet the scientific methodology used in 2018, using a set of adjustments derived from the differences in emissions estimates for a given year in consecutive inventories. After a maximum of five years, in this example by 2022, the base inventory is updated to realign with the latest available scientific methodology (potentially together with changes to the legislated targets). In this case, the estimate for 2020 emissions made in 2022 would not be adjusted, and the inventory published in 2022 would become the new base inventory.