

Scottish Climate Change Bill – Call for Evidence

The Scottish Government has committed to introducing a new Scottish Climate Change Bill. Recognising progress in Scotland and the Paris Agreement, this will include an ambitious new target of reducing emissions by more than 50% on a gross basis against 1990 levels by 2020. In early 2017 the Government plans to publish a new Climate Change Plan and a new Energy Strategy, which together will set out their low-carbon infrastructure priorities.

The Committee on Climate Change has been asked by the Scottish Government to provide advice on how the new Bill may look and is seeking evidence to help with that task.

Scotland's current Climate Change Act sets a long-term target to reduce emissions of greenhouse gases by at least 80% in 2050 relative to 1990, with an interim target to reduce emissions by 42% in 2020.[1] Secondary legislation has also set a series of annual emission reduction targets for 2010 to 2032.

Since the Act was passed, the Scottish Government has failed to meet annual targets for 2010 to 2013, but met the 2014 target by a wide margin with reductions of 45.8% since 1990 – outperforming the level of the 2020 interim target.[2]

The measure of Scottish emissions under the existing Act has been subject to considerable variability over this period, masking underlying progress in reducing emissions. This has been due to revisions to the Scottish greenhouse gas inventory and changes in the EU Emissions Trading System (EU ETS) that affect the Scottish share of emissions in some years, together with variations in annual temperatures. The changes in the emissions inventory reflect improvements in scientific understanding which led to changes in the methodology for estimating emissions. Such improvements are welcome but they have made the existing annual targets, which are set on an absolute basis, more difficult to achieve. The fact that targets in 2010 to 2013 have been missed is largely due to these revisions. **The deadline for responses is 12 noon on 1 February 2017.** For information about how to submit your response to this call for evidence, see: <https://www.theccc.org.uk/2016/12/14/call-for-evidence-scottish-climate-change-bill/>

QUESTION PROFORMA

QUESTIONS

a. Appropriate level of future emissions (“targets”)

A new Scottish Climate Change Act would likely be passed in 2019 and so there will not be much time for new policies to affect progress towards a 2020 target. There is scope for the new Act to include further interim targets between 2020 and 2050 (e.g. for 2030 and 2040).

In previous work for Scotland¹ we have developed a “High ambition” scenario for Scotland, through which it would be possible for Scotland to achieve a 47% reduction by 2020, on a net basis, outperforming the current 42% target.

On a gross basis our High Ambition scenario identifies a possible reduction of 57% in 2020 relative to 1990 emission levels (from emissions in 2014 that were 39.5% below 1990). This includes abatement from all sectors of the economy, with the largest abatement from the continuing decarbonisation of the power sector and increased abatement in transport.

The current 2050 target in Scotland, for a reduction of at least 80%, is based on a global path that keeps central (i.e. 50% likelihood) estimates of global temperature rise close to 2°C. The Paris Agreement contains a set of new long-term aims to limit warming, which are more ambitious than previous UN agreements. The Agreement aims to keep the global temperature rise to well below 2°C, pursuing efforts to limit it to 1.5°C. To achieve this, the Agreement aims to balance sources and sinks of greenhouse gases in the second half of the century (i.e. net zero global emissions by 2050-2100).

The CCC published a report on the implications for UK climate ambition on the 13th October.² This concluded that it is not appropriate to set new UK-wide emissions targets now, but agreed with the intention to set a new UK target in future that reflects the global aim of reaching net zero emissions. To be credible, such a target needs to be evidence-based, accompanied by strong policies to deliver existing nearer-term targets and a strategy to develop greenhouse gas removals. The five-yearly cycle of pledges and reviews created by the Paris Agreement provides regular opportunities to consider increasing ambition.

The Scottish context differs from that of the UK, both in terms of the existing legislation and in terms of the policy landscape. The different target mechanisms within the 2009 Scottish Act have proven to be more sensitive to inventory revisions, as set out above. Scottish Ministers have made statements regarding their wish to remain at the forefront of global ambition,³ and have committed to a new Bill in response to the Paris Agreement.

The Climate Change (Scotland) Act 2009 allows for annual targets (i.e. those currently set for each year to 2032) and the interim target (for 2020) to be amended, within certain limits, via secondary legislation. By contrast, the long-term target for an emissions reduction of at least 80% by 2050 cannot be amended, and no further long-term targets can be added.

¹ <https://www.theccc.org.uk/publication/scottish-emissions-targets-2028-2032-the-high-ambition-pathway-towards-a-low-carbon-economy/>

² <https://www.theccc.org.uk/publication/uk-action-following-paris/>

³ For example, <http://news.gov.scot/speeches-and-briefings/first-minister-address-to-seanad>

Question 1: To what extent is there scope to increase emission reductions now to meet a more ambitious 2020 target? (Please provide evidence where relevant.)

ANSWER:

There are a number of strategies which would aid the reduction of emissions in the short term leading up to 2020.

There is evidence for reducing emissions through changes to diet^{1,2}. Springman et al.¹ identify that significant GHG emission reductions are possible through a shift to vegetarian diets and vegan diets. Springman et al.¹ have also identified a number of health and economic co-benefits from a shift towards vegetarian and vegan diets. Indeed the health and economic benefits of this dietary shift are significant enough to justify the promotion of vegetarian and vegan diets, irrespective of the emission reduction potential. The Scottish government should adjust its dietary advice to promote vegetarian and vegan diets and develop effective strategies to roll the policy out as suggested by Ranganathan et al.² to invoke a healthy and low emission dietary change in Scotland.

The growing of organic food at home can be promoted to reduce CO₂ emissions associated with agriculture. This will have the added co-benefit of improved mental health.

Building Standards should be altered. The explicit removal of the permitted use of fossil fuels in heating/hot water for new buildings would aid emission reductions and is essential in order to reach net-zero emissions. Alternative technologies in terms of heat pumps, biomass, solar DHW are all very well established and make the continued use of fossil fuels unjustifiable in new builds. Energy efficiency in building standards should be improved further with the adoption of the Passivhaus standard offering the co-benefit of significant air quality and comfort improvements in the buildings.

Air Passenger Duty should be increased as an interim measure to stop the growth of emissions from the aviation industry in preparation for longer term demand management strategies.

Increased roll out of electric vehicle charging points will be essential to accommodate the electrification of the car network.

¹ Springman et al. 2015 'Analysis and valuation of the health and climate change co-benefits of dietary change', pnas, vol.113 no.15, doi: 10.1073/pnas.1523119113

² WRI Ranganathan 2016

:http://www.wri.org/sites/default/files/Shifting_Diets_for_a_Sustainable_Food_Future_1.pdf

Question 2: To what extent do you support further interim targets between 2020 and 2050 (e.g. for 2030 and 2040)?

ANSWER:

Interim targets are essential. Total cumulative emissions are key to the level of climate change generated. Having a long term target with no interim targets would legitimise higher emissions in the short to medium term with a rapid last minute reduction in emissions, this pathway would result in higher overall cumulative emissions. This is also not in line with the evidence that earlier mitigation is cheaper and more cost effective than late mitigation.

Question 3: What are the opportunities to reduce emissions to 2050 that go beyond our High Ambition scenario, including opportunities for greenhouse gas removal? (Please provide evidence where relevant.)

ANSWER:

There is evidence that the aviation industry provides an opportunity to reduce emissions beyond the “High Ambition Scenario”¹. Current self-regulated aviation emission reduction strategies are not commensurate with even a 2°C target^{1,2} let alone a 1.5°C target, indicating significant further action is required. Emission reductions through technology advances or fuel replacement cannot be deployed quickly enough plus there are serious questions about the impact of using large quantities of biofuel for aviation would have on food production and ecosystems. The emissions from the aviation industry however can be reduced by demand management. Two opportunities for managing demand in the aviation industry are:

1. A personal carbon quota scheme¹
2. An incremental Air Passenger Duty scheme, whereby the Air Passenger Duty paid by an individual for a flight increases with each flight taken by that individual within a particular year.

Both mechanisms can be administered by a credit card scheme, with the carbon quota or air passenger duty adjusted to manage demand to levels commensurate with pursuing a 1.5°C target achieved through mitigation.

The Scottish Government is also in a unique position in terms of owning Prestwick Airport. An opportunity exists to reduce the absolute number of flights into and out of the UK and therefore reduce emissions from Aviation by closing the airport.

Negative Emission Technologies (NETs) should not be relied upon in emission reduction policies as the large scale deployment of NETs is unproven and has many potential problems³. That said Scotland has a genuine opportunity to lead the world in negative emissions in terms of establishing BECCS. Biomass can be grown locally in Scotland and there is a significant Storage facility under the North Sea with a currently existing infrastructure in place. Longannet is an ideal location for a pilot plant, with an existing grid connection nearby and nearby access to the Forties Pipeline System. Peterhead also offers an ideal location to trial a large scale BECCS plant. If this opportunity is taken to develop BECCS rapidly then this would allow an expertise to be developed which would be saleable around the world, and it would offer a genuine future for offshore oil workers, and offer increased employment in Scotland's rural communities involved in the biomass production.

Many of the opportunities identified in the CCC's high ambition scenario are sensible and valid, they just need to be implemented on a much more rapid timescale than currently proposed (see answer to question 4 for justifications for rapid deployment).

¹ Alice Bows-Larkin (2015) All adrift: aviation, shipping, and climate change policy, *Climate Policy*, 15:6, 681-702, DOI: [10.1080/14693062.2014.965125](https://doi.org/10.1080/14693062.2014.965125)

² Larkin, A, Mander, S, Traut, M, Anderson, K & Wood, F 2016, *Aviation and Climate Change—The Continuing Challenge*. in *Encyclopedia of Aerospace Engineering*., Capitalism and Commerce in Imaginative Literature, Wiley-Blackwell. DOI: [10.1002/9780470686652.eae1031](https://doi.org/10.1002/9780470686652.eae1031)

³ Anderson, K & Peters, G 2016, 'The trouble with negative emissions' *Science*, vol 354, no. 3609, pp. 182-183. DOI: [10.1126/science.aah4567](https://doi.org/10.1126/science.aah4567)

Question 4: Should the 2050 target be more ambitious than the existing level of 'at least 80%'?

ANSWER:

The COP21 agreement reached in Paris clearly states that we should pursue efforts to limit warming to 1.5°C. As a result the 2050 target for Scotland is required to be in line with pursuing a temperature limit of 1.5°C. The IPCC has published indicative carbon budgets for limiting warming to 1.5°C with the size of the budgets varying according to the stated temperature limit and the fraction of simulations that meet that particular temperature limit (Table 2.2)¹.

Table 2.2 | Cumulative carbon dioxide (CO₂) emission consistent with limiting warming to less than stated temperature limits at different levels of probability, based on different lines of evidence. [WGI 12.5.4, WGIII 6]

Cumulative CO ₂ emissions from 1870 in GtCO ₂									
Net anthropogenic warming ^a	<1.5°C			<2°C			<3°C		
Fraction of simulations meeting goal ^b	66%	50%	33%	66%	50%	33%	66%	50%	33%
Complex models, RCP scenarios only ^c	2250	2250	2550	2900	3000	3300	4200	4500	4850
Simple model, WGIII scenarios ^d	No data	2300 to 2350	2400 to 2950	2550 to 3150	2900 to 3200	2950 to 3800	n.a. ^e	4150 to 5750	5250 to 6000
Cumulative CO ₂ emissions from 2011 in GtCO ₂									
Complex models, RCP scenarios only ^c	400	550	850	1000	1300	1500	2400	2800	3250
Simple model, WGIII scenarios ^d	No data	550 to 600	600 to 1150	750 to 1400	1150 to 1400	1150 to 2050	n.a. ^e	2350 to 4000	3500 to 4250
Total fossil carbon available in 2011 ^f : 3670 to 7100 GtCO ₂ (reserves) and 31300 to 50050 GtCO ₂ (resources)									

Clearly the target for 2050, as a minimum, needs to be commensurate with the Paris agreement of pursuing a temperature limit of 1.5°C which in turn implies the target set for 2050 needs to be in line with a total global carbon budget of less than 2250 GtCO₂ from 1870. Historical emissions (1870-2016) are 2100 GtCO₂², so there is a remaining global carbon budget of 150 GtCO₂. Article 2 of the Paris agreement also states the agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances. Considering Scotland's national circumstances as a developed nation that has great potential for renewable deployment, it would be reasonable to expect that Scotland should exceed the average global rate of mitigation to allow less developed countries a slower rate of mitigation.

Given the challenge of limiting emissions to only a further 150 GtCO₂ there is a strong temptation for policies to rely on the future deployment of Negative Emissions Technologies (NETs). However, there is an increasing body of evidence questioning the viability and ecological impact of large scale NETs³. In addition if NETs are relied upon as a mechanism to allow "overshoot" then there is evidence that even greater levels of NETs will be required to lower atmospheric CO₂ levels as the land and ocean sinks become less effective, or even positive carbon emitters, when reducing atmospheric CO₂ levels^{4,5}. As a result, policies should avoid overshoot scenarios.

It is also of the utmost importance that emission targets avoid warming of 2°C. There is significant and compelling evidence that a 2°C world is highly dangerous and will have long lasting impacts on ecosystems and society^{6,7,8}. It is also important that emission targets avoid relying upon a low equilibrium climate sensitivity (ECS) or continued atmospheric cooling generated by human emitted aerosols produced through large scale coal combustion⁹. Indeed, Michael E. Mann suggests that even a moderate value for ECS of 3°C could result in temperatures well above 2°C with an atmospheric concentration of 450ppm (~RCP2.6)⁹.

Thus the evidence and basic maths implicit in a carbon budget demonstrates that the current target of 'at least 80%' needs to be tightened significantly. There are many ways of utilising a carbon budget over time,

but an indicative steady year on year mitigation strategy would imply a target of zero emissions by 2025 for a 50% chance of limiting warming to 1.5°C. However, zero emissions by 2025 does not take into account any adjustment for equity and differentiated responsibilities and capabilities as per the Paris agreement so a target in order to be commensurate with the Paris agreement needs to be before this date. Zero emissions would then need to be maintained to and past 2050. This has profound implications for Scotland and it is highly questionable as to whether it is achievable or not. But the CCC and Scottish Government should accept the reality of where we are and have the courage to break the self-defeating duality identified by Kevin Anderson⁹ and set targets that are in line with the Paris agreement in order to start protecting the future generations of the world.

In summary the 2050 target needs to be more ambitious and should be net zero emissions in 2050.

¹ IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

² Global Carbon Project (2016) Carbon budget and trends 2016. [www.globalcarbonproject.org/carbonbudget] published on 14 November 2016

³ Anderson, K & Peters, G 2016, 'The trouble with negative emissions' *Science*, vol 354, no. 3609, pp. 182-183. DOI: [10.1126/science.aah4567](https://doi.org/10.1126/science.aah4567)

⁴ Jones, C *et al* 2016 'Simulating the Earth system response to negative emissions' *Environ. Res. Lett.* 11 095012

⁵ Tokarska, K & Zickfeld, K 2015 'The effectiveness of net negative carbon dioxide emissions in reversing anthropogenic climate change' *Environ. Res. Lett.* **10** 094013

⁶ Hansen J, Kharecha P, Sato M, Masson-Delmotte V, Ackerman F, *et al.* 2013 'Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature'. *PLoS ONE* 8(12): e81648. doi:10.1371/journal.pone.0081648

⁷ Hansen *et al.* 2016 'Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modelling, and modern observations that 2°C global warming could be dangerous' *Atmos. Chem. Phys.*, 16, 3761–3812, 2016

⁸ Clark *et al* 2016 'Consequences of twenty-first century policy for multi-millennial climate and sea-level change' *Nature Climate Change* 6, 360 369 doi:10.1038/nclimate2923

⁹https://www.scientificamerican.com/sciam/assets/Image/articles/earth-will-cross-the-climate-danger-threshold-by-2036_large.jpg

¹⁰Anderson, K 2015 'Duality in Climate Science' *Nature Geoscience* 8, 898-900

Question 5: Should there be a target for net-zero emissions for Scotland, and if so for when and on what basis?

ANSWER:

As per the answer to question 4, there should be a net-zero emissions target for Scotland. It should be set at a date prior to 2025. This is because the COP21 agreement reached in Paris clearly states that we should pursue efforts to limit warming to 1.5°C. As a result, the 2050 target for Scotland is required to be in line with pursuing a temperature limit of 1.5°C. The IPCC has published indicative carbon budgets for limiting warming to 1.5°C with the size of the budgets varying according to the stated temperature limit and the fraction of simulations that meet that particular temperature limit (Table 2.2) ¹.

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responsibilities and respective capabilities, in the light of different national circumstances. Considering Scotland's national circumstances as a developed nation that has great potential for renewable deployment, it would be reasonable to expect that Scotland should exceed the average global rate of mitigation to allow less developed countries a slower rate of mitigation.

Given the challenge of limiting emissions to only a further 150 GtCO₂ there is a strong temptation for policies to rely on the future deployment of Negative Emissions Technologies (NETs). However, there is an increasing body of evidence questioning the viability and ecological impact of large scale NETs³. In addition if NETs are relied upon as a mechanism to allow "overshoot" then there is evidence that even greater levels of NETs will be required to lower atmospheric CO₂ levels as the land and ocean sinks become less effective, or even positive carbon emitters, when reducing atmospheric CO₂ levels^{4,5}. As a result, policies should avoid overshoot scenarios.

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Thus the evidence and basic maths implicit in a carbon budget demonstrates that the current target of 'at least 80%' needs to be tightened significantly. There are many ways of utilising a carbon budget over time, but an indicative steady year on year mitigation strategy would imply a target of zero emissions by 2025 for a 50% chance of limiting warming to 1.5°C. However, zero emissions by 2025 does not take into account any adjustment for equity and differentiated responsibilities and capabilities as per the Paris agreement so a target date in order to be commensurate with the Paris agreement needs to be before this date. Zero emissions would then need to be maintained to and past 2050. This has profound implications for Scotland and it is highly questionable as to whether it is achievable or not. But the CCC and Scottish Government should accept the reality of where we are and have the courage to break the self-defeating duality identified by Kevin Anderson⁹ and set targets that are in line with the Paris agreement in order to start protecting the future generations of the world.

In summary Scotland should have a target of zero emissions before 2025.

¹ IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

² Global Carbon Project (2016) Carbon budget and trends 2016.

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⁷ Hansen *et al.* 2016 'Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modelling, and modern observations that 2°C global warming could be dangerous' *Atmos. Chem. Phys.*, 16, 3761–3812, 2016

⁸ Clark *et al* 2016 'Consequences of twenty-first century policy for multi-millennial climate and sea-level change' *Nature Climate Change* 6, 360 369 doi:10.1038/nclimate2923

⁹ https://www.scientificamerican.com/sciam/assets/Image/articles/earth-will-cross-the-climate-danger-threshold-by-2036_large.jpg

¹⁰ Anderson, K 2015 'Duality in Climate Science' *Nature Geoscience* 8, 898-900

Question 6: If it is not currently appropriate to set a target for net-zero and/or to adopt a more ambitious 2050 target, should provision be made within the new Bill to do so at a later date?

ANSWER:

It is currently appropriate to set a target for net zero emissions. Any delay has severe and pervasive repercussions for current and future generations of this planet.

b. Duration and form of future carbon targets (one year or multi-year, absolute or percentage)

Scottish targets for 2020 and 2050 are currently set as percentage reductions from a 1990 baseline. Annual targets have been set on an absolute (MtCO₂e) basis.

Annual targets allow for continued assessment of progress and provide greater certainty as to the magnitude of emission reductions that need to be made at any given time. However the ability to meet them can be affected by annual fluctuations in emissions caused by weather or unforeseen factors, while the delay in greenhouse gas inventory data for Scotland means that progress against targets is assessed two years after the target year.

Multi-year targets, such as five-year budgets under the UK-wide Climate Change Act, provide greater smoothing of these annual fluctuations, while allowing for monitoring of progress towards longer-term emission reduction targets.

Targets on an absolute basis allow for assessment towards total cumulative emissions; however, revisions to the greenhouse gas inventory can make them harder or easier to meet without reflecting actual progress in reducing emissions. This can be more pronounced in Scotland, which as compared with the UK as a whole has a much higher share of emissions from agriculture and land use, in which most revisions occur.

Percentage reductions would be less affected by these revisions, but targets on a percentage basis are less strongly linked to the best scientific estimates of the absolute level of emissions, which are the fundamental driver of climate change.

When the current 2009 Act was set annual absolute targets and interim percentage targets aligned. However, subsequent revisions to the greenhouse gas inventory have 'shifted' the baseline and led to these targets diverging from each other, potentially creating confusion and a loss of transparency.

Question 7: Should Scottish targets be set on an annual basis or covering multiple years? If on an annual basis, what can be done to minimise the impact of confounding short-term factors (e.g. weather) on meeting them?

ANSWER:

Question 8: Should targets be set on percentage or absolute terms?

ANSWER:

Question 9: What else can be done to make targets resilient to future revisions to the emissions inventory?

ANSWER:

c. Future accounting framework

The Scottish Government has committed to moving to a gross emissions accounting framework (i.e. actual emission reductions from all sectors of the economy will count towards the targets), as opposed to the net basis used in the 2009 Act.¹ A move to a gross framework aims to increase transparency around progress to targets in Scotland.

A change to gross accounting framework raises issues of;

- Whether there remains a role for credit purchase in such an accounting framework. The existing Act allows for credit purchase as a means to meet targets, although it also places further targets for “domestic effort” alone. To date, the Scottish Government has not purchased any such credits. Were it to do so, these would need to be procured through a programme that meets a required standard.
- How the role of emissions trading schemes (such as the EU ETS) should be reflected in such an accounting framework

Depending on the future relationship with the European Union, participation in the EU Emissions Trading System (EU ETS) may or may not continue.

Question 10: What is the role for credit purchase to supplement action to meet gross targets?

ANSWER:

Credit purchase should not be used as there is a risk that absolute emissions will not fall.

Question 11: How should the role of the EU ETS, or other trading schemes, be reflected in the emissions accounting framework used for reporting progress to targets?

ANSWER:

Question 12: Are there any competitiveness implications for current traded sector business (e.g. industry) to moving to gross targets in Scotland, and if so how could they be minimised?

ANSWER:

d. Criteria for setting future targets

The current Climate Change Act includes target setting criteria which must be taken into account prior to targets being legislated. These are:

- a. Scientific knowledge about climate change
- b. Technology relevant to climate change
- c. Economic circumstances, in particular the likely impact of targets on –
 - The Scottish economy
 - The competitiveness of particular sectors of the Scottish economy
 - Small and medium-sized enterprises
 - Jobs and employment opportunities
- d. Fiscal circumstances, in particular the likely impact of targets on taxation, public spending and public borrowing
- e. Social circumstances, in particular the likely impact of targets on those living in poorer or deprived communities
- f. The likely impact of targets on those living in remote rural and island communities
- g. Energy policy in particular the likely impact of the target on energy supplies, the renewable energy sector and the carbon and energy intensity of the Scottish economy
- h. Environmental considerations and, in particular, the likely impact of the targets on biodiversity
- i. European and international law and policy relating to climate change

Question 13: Are the current target setting criteria listed in the Act still appropriate? Are any missing?

ANSWER:

There is currently no explicit account of the impact of climate change on future generations and ecosystems in Scotland or around the world in the criteria. This should change.