The Committee will meet at 9.30 am in the Robert Burns Room (CR1).

1. **Climate Change (Emissions Reduction Targets) (Scotland) Bill:** The Committee will take evidence on the Bill at Stage 1 from—

   Andrew Midgley, Environment and Land Use Manager, NFUS;

   Pete Ritchie, Director, Nourish Scotland;

   Katy Dickson, Head of Policy, Scottish Land and Estates;

   Kate Rowell, Chair, Quality Meat Scotland;

   Patrick Krause, Chief Executive, Scottish Crofters Federation;

   Professor David Reay, University of Edinburgh;

   Professor Eileen Wall, SEFARI;

   and then from—

   Dr Andy Jefferson, Programme Director, Sustainable Aviation;

   Rebecca Kite, Environment Policy Manager, Freight Transport Association;

   Martin Reid, Policy Director, Road Haulage Association;

   and then from—

   Ian Findlay, Chief Officer, Paths for All;

   Keith Irving, Chief Executive, Cycling Scotland;

   Andy Cope, Director of Insight, Research & Monitoring Unit, Sustrans;
Bruce Kiloh, Head of Policy and Planning, Strathclyde Partnership for Transport;

Jess Pepper, Enterprise Manager, Transform Scotland.

2. **Climate Change (Emissions Reduction Targets) (Scotland) Bill (in private):**
   The Committee will consider evidence heard earlier in the meeting.

---

Lynn Tullis
Clerk to the Environment, Climate Change and Land Reform Committee
Room T3.40
The Scottish Parliament
Edinburgh
Tel: 0131 348 5240
Email: ecclr.committee@parliament.scot.
The papers for this meeting are as follows—

**Agenda item 1**

Climate Change (Emissions Reduction Targets) (Scotland) Bill cover note

PRIVATE PAPER
Environment, Climate Change and Land Reform Committee

32nd Meeting, 2018 (Session 5)

Tuesday 13 November 2018

Climate Change (Emissions Reductions Targets) (Scotland) Bill

Introduction

1. The Climate Change (Emissions Reductions Targets) (Scotland) Bill was introduced on 23 May 2018 and under rule 9.6 of the Standing Orders, the Parliamentary Bureau referred the Bill to the Environment, Climate Change and Land Reform Committee to consider and report on the general principles.

2. The Scottish Government has published the following documents in relation to the Bill:
   - Climate Change (Emissions Reductions Targets) (Scotland) Bill
   - Policy Memorandum
   - Explanatory Notes
   - Financial Memorandum
   - Delegated Powers Memorandum
   - Statement on Legislative Competence

3. In addition, the Cabinet Secretary for Environment, Climate Change and Land Reform wrote to the Committee to highlight an information and analysis document to support discussion of the Bill. This is included at Annexe A.

4. No secondary Committee was appointed to scrutinise the Bill. However, the Finance and Constitution Committee will consider the Financial Memorandum to the Bill. Provisions relating to delegated powers within the Bill will be considered by the Delegated Powers and Law Reform Committee at Stage 1.

5. This paper sets out the purpose of the meeting and background to the Bill and the Environment, Climate Change and Land Reform Committee’s approach to consideration of the Bill at Stage 1.

Purpose of the Meeting

6. At this meeting, the Committee will hear about the agriculture and transport sectors, the changes required to meet more challenging climate change targets, and how they can be governed, motivated and supported. The Committee will hear from three panels:
Panel One - Agriculture

- Professor Eileen Wall, SEFARI
- Patrick Krause, Chief Executive, Scottish Crofter’s Federation
- Katy Dickson, Head of Policy, Scottish Land and Estates
- Andrew Midgley, Environment and Land Use Manager, NFUS
- Professor David Reay, University of Edinburgh
- Pete Ritchie, Director, Nourish Scotland
- Kate Rowell, Chair, Quality Meat Scotland

Panel Two – Freight Transport

- Rebecca Kite, Environmental Policy Manager, Freight Transport Association
- Martin Reid, Policy Director, Road Haulage Association
- Dr Andy Jefferson, Programme Director, Sustainable Aviation

Panel Three – Active and Public Transport

- Keith Irving, Chief Executive, Cycling Scotland
- Jess Pepper, Enterprise Manager, Transform Scotland
- Ian Findlay, Chief Officer, Paths for All
- Andy Cope, Director of Insight, Research & Monitoring Unit, Sustrans
- Bruce Kiloh, Head of Policy and Planning, Strathclyde Passenger Transport

7. Written submissions from witnesses can be found at Annex B.

8. To support the Committee’s scrutiny of the Climate Change Bill, on Friday 9 November, SPICe will publish a briefing paper on Climate Change and Agriculture, as well as the first in a series of blogs in which Professor Jennie Macdiarmid from The Rowett Institute, University of Aberdeen explores dietary choices, and meeting climate change targets.

Background

Information Centre (SPICe) produced a briefing on provisions of the Paris Agreement and what these might mean for Scotland.

10. The key provisions of the agreement were:

- Global temperature rises should be limited to “well below” 2\(^\circ\)C and to “pursue efforts” to limit temperature increase to 1.5\(^\circ\)C above pre-industrial levels (See Article 2);

- Parties to the agreement are to aim to “reach global peaking of greenhouse gas emissions as soon as possible”;

- Parties are to take action to “preserve and enhance” carbon sinks;

- To conduct a “Global Stocktake” every five years, starting in 2023;

- For developed countries to provide financial support for developing countries to mitigate climate change;

- Creation of goal of “enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change”.

11. Following the adoption of the agreement, the First Minister (who attended the summit) welcomed the agreement and said:

“COP21 has, as we had hoped, achieved a big step forward in the international fight against climate change…..Devolved administrations, like the Scottish Government, will be strong drivers of a progressive climate agenda. We look forward to working with our international partners to secure the successful implementation of the Paris agreement.”

12. In its Programme for Government 2016-17, the Scottish Government signalled its intentions to legislate to create new, more pressing climate change targets via new legislation in order to address the Paris Agreement. In its 2017-18 Programme for Government, the Scottish Government stated the Bill would be included in the programme of legislation that year and said:

“The Climate Change Bill will respond to the historic Paris Agreement by setting more ambitious targets to reduce greenhouse gas emissions. The Bill will increase transparency, demonstrate our commitment to sustainable economic growth and signal to the international community that Scotland is the place to do low carbon business.

13. The Scottish Government requested advice from the Committee on Climate Change (CCC) in October 2016 and received this advice in March 2017. Between 30 June and 22 September 2017, the Scottish Government consulted on provisions and policy for inclusion in the Bill. The main themes of the consultation were:

- Updating the 2050 target in the Climate Change (Scotland) Act 2009 by increasing this from 80% to 90% lower than baseline levels;
- Whether the Bill should contain provisions to allow for a net zero emissions target to be set at a later date;
- To update the interim target for 2020 contained in the Climate Change (Scotland) Act 2009 from 42% to 56% lower than baseline levels;
- To add further interim targets of 66% by 2030 and 78% by 2040;
- To change the presentation of annual targets from tonnes of emissions to percentages to be consistent with the interim targets;
- For these annual targets to be presented as equidistant linear points between the interim targets;
- For targets to be set on the basis of actual emissions, rather than adjustments for crediting systems such as the European Union Emissions Trading Scheme (EU ETS);
- Whether the interim and 2050 emissions targets should be allowed to be changed;
- Reporting, including Climate Change Plans; and
- The impacts of the Bill on people, businesses and the environment.

14. The Scottish Government received 19,365 responses, of which 273 were non-campaign generated. An analysis document published in December 2017 highlighted the views of consultees.

15. In October 2017, the Scottish Government sought further advice, due to revisions to emissions estimates, which was received in December 2017. The Environment, Climate Change and Land Reform Committee took evidence on this advice from the Cabinet Secretary for Environment, Climate Change and Land Reform on 8 May 2018.

**Content of the Bill**

16. The Bill proposes to increase the 2050 target for reduction of greenhouse gas emissions from the 1990 baseline from 80% (as laid out in the Climate Change (Scotland) Act 2009) to 90%. The Bill also allows for a target of the 100% reduction (known as a net zero target) from the baseline to be created at a future date.

17. The Bill contains 5 Parts and 1 Schedule.

- **Part 1** allows for the creation of a net zero emissions target at a future date and updates the 2009 Act 2050 target from 80% to 90%. It also creates new interim targets for 2030 and 2040, as well as updating the previous 2020 interim target. The Bill creates a new provision for modification of these targets. Part 1 also includes sections proposing annual targets be presented in percentage terms in future and on advice the Scottish Government must seek in setting targets.
- **Part 2** is concerned with Emissions Accounting and how the emissions will be calculated in relation to the targets. This includes restricting the use of carbon units which can be purchased to contribute towards emissions reductions.

- **Part 3** is about the reporting and planning duties of the Scottish Government on the targets. It also includes detail of proposals for how reports on policies and proposals, suggested to be renamed Climate Change Plans, will be created and published in the future.

- **Part 4** provides further detail on the meaning of terms within the Bill and further consequentials to the 2009 Act.

- **Part 5** contains final general and miscellaneous provisions such as:
  
  i. Meaning of the 2009 Act
  
  ii. Ancillary Provision
  
  iii. Commencement
  
  iv. Short title

**Environment, Climate Change and Land Reform Committee Scrutiny**

18. The Committee has agreed to conclude its evidence taking at Stage 1 of the Bill prior to Christmas 2018. The Committee’s timetable for consideration of the Bill at Stage 1 is:

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 June 2018</td>
<td>Bill team evidence session</td>
</tr>
<tr>
<td>26 June 2018</td>
<td>Consideration of approach paper</td>
</tr>
<tr>
<td>June August 2018</td>
<td>Call for views</td>
</tr>
<tr>
<td>October November 2018</td>
<td>Evidence sessions</td>
</tr>
</tbody>
</table>

19. In addition, the Committee held a call for views in July and August 2018. You can read the responses received [here](#).

20. The Committee plans to consider its draft Stage 1 report following the Christmas recess 2018 and report to Parliament by the end of January 2019.

**Evidence sessions**

21. At its meeting on 19 June 2018, the Committee heard from the Scottish Government Bill Team. In advance of the meeting, the Committee [wrote](#) to the Bill
Team and received a response on 12 June 2018. The Committee also wrote to the Bill Team after the session and received a response on 27 July 2018.

22. On 23 October, the Committee heard from:

- ClimateXChange
- Intergovernmental Panel on Climate Change
- The Committee on Climate Change

23. The official report of the meeting can be found here.

24. Following the meeting, the Committee wrote to the Scottish Government on the Financial Memorandum to the Bill and to the Committee on Climate Change.

25. On 30 October, the Committee heard from:

- Anders Wijkman, Chair, Climate-KIC and former Swedish Parliamentarian; and
- Stefan Nyström, Director of Department for Climate Change and Air Quality at the Swedish Environment Protection Agency

26. The official report of the meeting can be found here.

27. On 6 November the Committee heard from:

Panel One - Behaviour Change

- Dr Rachel Howell, Lecturer in Sociology/Sustainable Development
- Mary Sweetland, Chair, Eco-Congregation Scotland
- Shane Donnellan, Senior Behaviour Change Specialist, Changeworks
- Jamie Stewart, Policy Officer, Citizens Advice Scotland

Panel Two - Governance

- Chris Wood-Gee, Chair of the Sustainable Scotland Network
- Mai Muhammad, Energy Manager, Aberdeen City Council
- Tom Thackray, Director of Infrastructure and Energy, CBI Scotland
- Paul Gray, Chief Executive, NHS Scotland

28. The Official report of the meeting can be found here

Clerks, Environment, Climate Change and Land Reform Committee
Dear Graeme,

When to set a net-zero greenhouse gas emissions target year: Information and analysis to support discussion of the Climate Change (Emissions Reduction Targets) (Scotland) Bill.

As you will be aware the Climate Change (Emissions Reduction Targets) (Scotland) Bill was introduced to the Scottish Parliament on 23 May 2018.

The Bill includes the target levels that were advised by the UK Committee on Climate Change and that the Scottish Government consulted on last year, including a 90% emission reduction target for 2050.

The Bill establishes a net-zero target but it does not set a date for that target. In light of the large number of consultation responses calling for a net-zero target to be set for 2050 or sooner, the Bill requires that Ministers regularly consider the earliest achievable year for such a target.

I considered a range of information and analysis in coming to my view on the target levels, and to support the Committee in debating the issue I have today laid a paper in Parliament that summarises that information and analysis. The paper is annexed to this letter for your ease of reference.

Yours,

ROSEANNA CUNNINGHAM

PAPER LAID IN SCOTTISH PARLIAMENT – “WHEN TO SET A NET-ZERO GREENHOUSE GAS EMISSIONS TARGET YEAR: INFORMATION AND ANALYSIS TO SUPPORT DISCUSSION OF THE CLIMATE CHANGE (EMISSIONS REDUCTION TARGETS) (SCOTLAND) BILL”
Annexe B

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SUBMISSION FROM SEFARI

Introduction

1. **SEFARI** (Scottish Environment, Food and Agriculture Research Institutes) is a collective of six Research Institutes, each with global capability, expertise and reputation. These are:
   - Biomathematics and Statistics Scotland;
   - The James Hutton Institute;
   - Moredun Research Institute;
   - The Rowett Institute;
   - Royal Botanic Garden Edinburgh;
   - Scotland’s Rural College.

2. **Launched** in 2017, SEFARI is underpinned by the strapline “Leading Ideas for Better Lives”, and works across the following subject areas:
   - Plant and Animal Health;
   - Agriculture;
   - Land and Communities;
   - Climate and the Environment;
   - Rural Economy;
   - Food and Drink Innovation;
   - Healthier Foods;
   - Science Education.

3. SEFARI Gateway, funded by the Scottish Government, is the knowledge exchange and impact hub for SEFARI and works closely with, and across, the four Scottish Government funded Centres of Expertise on climate change, animal disease outbreaks, plant health, and water.

Background

4. This submission details areas of research on the measurement, modelling and mitigation of climate change – research underpinning measures which could help in meeting the targets proposed in the Climate Change (Emissions Reduction Targets) (Scotland) Bill.

5. The submission draws predominantly on examples from the Scottish Government funded Strategic Research Programme (SRP), which is delivered by SEFARI and HEI partners. The current SRP runs from 2016-2021, and the breadth and depth of the research presented also reflects SEFARI’s core strength of being able to build on the findings and innovations from previous SRPs. This submission also includes information on some externally co-funded research.
6. Through the SRP, SEFARI and partners deliver a wide research programme on the measurement, modelling and mitigation of greenhouse gas emissions from agriculture. This work addresses policy and societal interests in reducing emissions from the agricultural sector, and delivers to land managers by reducing the energy input required for their activities. The research involves direct close engagement with the agricultural sector, and this also contributes to wider theoretical and modelling work.

7. The farm practices which can reduce greenhouse gas emissions, and the effectiveness of policies promoting such change, is a crucial aspect of achieving mitigation targets in Scotland. One overarching project being undertaken by SEFARI is looking at the effectiveness of the Farming for a Better Climate programme\(^1\) - a study which is being conducted to estimate the future uptake of five mitigation practices under future policy scenarios\(^2\).

8. Work has also been carried out around the use of marginal abatement cost curves (MACCs)\(^3\) to communicate options on national levels of mitigation, and related costs. Whilst such tools are integrative and visual, and have been used in many countries to inform policy makers, the many and varied assumptions used to construct MACCs usually remain hidden, imposing a challenge on the dialogue between policy and research. To overcome this problem, guidelines have been developed by SEFARI researchers for the creation and use of MACCs, drawing from international experience\(^3\).

9. As well as work on the reduction of greenhouse gases from agricultural practices, this submission also includes some related examples of SEFARI natural environment and food-consumer research. Further information on either the examples cited, or broader aspects of greenhouse gas emission (GHG\(\text{e}\)) research within SEFARI can be supplied if required on: improved environmental resource use and climate resilience within crops\(^4\), integrated pest management (IPM)\(^4\), and animal welfare.

**Greenhouse gas emissions from agriculture - measurement, modelling and mitigation**

10. The main greenhouse gases are: carbon dioxide (\(\text{CO}_2\)), methane (\(\text{CH}_4\)), nitrous oxide (\(\text{N}_2\text{O}\)) and fluorinated gases. Global emissions from agriculture are mainly in the form of methane and nitrous oxide arising from ruminant enteric fermentation (digestion in a multi-chambered stomach). Synthetic and organic fertiliser applications (e.g. manure) can also be significant contributors.

**Greenhouse gas emissions from soils, crops and pastures**

11. In order to make the most appropriate land management choices, there is a critical need to better understand how and why soils change over time. Work

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\(^1\) [https://www.srsc.ac.uk/info/120175/farming_for_a_better_climate](https://www.srsc.ac.uk/info/120175/farming_for_a_better_climate)

\(^2\) Current PhD at SRUC

\(^3\) [https://www.srsc.ac.uk/info/120352/greenhouse_gases/341/marginal_abatement_cost_curves](https://www.srsc.ac.uk/info/120352/greenhouse_gases/341/marginal_abatement_cost_curves)
assessing the changes in the quantity of organic matter in Scotland’s soils has been carried out using samples collected from over 180 locations throughout Scotland, where the soils at each of these locations were sampled 30 years apart. Further research using “stable isotope" approaches on these soils allows for better prediction of the loss of carbon, and associated organic matter, from soils in response to changes in land use.

12. As part of this work, SEFARI researchers are developing tools to predict the consequences of land management decisions on soil functions - including how well soil absorbs and retains greenhouse gases. These tools include: digital soil maps, localised spatial information, soil risk maps and models to predict impacts of environmental variables (i.e. climate change) on soil functions, including carbon cycling and loss of carbon from soil.

13. An improved understanding of the processes contributing to greenhouse gas emissions has been achieved through SRUC’s carbon calculator ‘AgRe Calc’
5. Assessments of emissions have been compared on a set of different farms using different carbon calculators and demonstrated that ‘Agre Calc’ offers many advantages over other comparable carbon footprinting tools.

14. Utilising the Centre for Sustainable Cropping, based at the James Hutton Institute, conventional crop management is being compared with alternative (lower input) approaches. This work is establishing how these approaches impact on crop production, and associated greenhouse gas emissions.

15. SEFARI researchers have been linking crop nitrogen use to nitrous oxide emissions, as influenced by different fertiliser inputs. In spring barley, Scotland’s major arable crop, nitrogen use efficiency is increased in new high yielding varieties. Although site and seasonal variation in greenhouse gas emissions is large, there is evidence that novel approaches such as nitrification inhibitors\textsuperscript{#}\# can reduce nitrous oxide emissions, without compromising crop yield.

16. Crop residues are the materials left in an agricultural field after the crop has been harvested. These residues include stalks, stubble, leaves, and seed pods. The importance of crop residues and residue management in contributing to greenhouse gas emissions are being explored in a project involving collaborations between SEFARI and partners across Europe. The importance of different residue types and methods of physical incorporation (i.e. ploughing, digging etc.) on greenhouse gas emissions and carbon sequestration is currently being investigated\textsuperscript{8}.

\textsuperscript{4} Stable isotopes are light and heavier nuclides of a specific element (e.g. C\textsuperscript{13} and C\textsuperscript{12}) and can be used as a research tool\textsuperscript{5}.

\textsuperscript{5} \url{http://www.agrecalc.com/}

\textsuperscript{6} \url{https://www.sciencedirect.com/science/article/pii/S0959652617313677}

\textsuperscript{7} \url{http://www.hutton.ac.uk/about/facilities/centre-sustainable-cropping}

** A Marginal Abatement Cost Curve is a way of presenting carbon emissions abatement options relative to a baseline such as business-as-usual**

\textsuperscript{8} Research involves Defra.
17. A national programme of review, soil sampling, analysis and modelling has been undertaken to establish factors contributing to carbon sequestration in UK grasslands. The result of this extensive evaluation has shown that the grasslands which have remained undisturbed for more than 10 years contain significantly greater carbon stocks than those with disturbance⁹.

18. On grasslands, preliminary results demonstrate significant variation in soil carbon dioxide/nitrous oxide fluxes as a function of the plant species growing in the pasture. Work is planned to link this with ongoing research investigating the potential of management of field margins for reduction of greenhouse gas emissions, and to support other ecosystem services.

19. Further studies are underway to establish the extent to which liming of grassland soils (to increase soil pH and reduce acidity) can help reduce nitrous oxide and other greenhouse gas emissions. Different approaches to, and rates of, liming are being compared (precision and standard liming) and measurements are being made of changes in soil fertility, biology, greenhouse gas emissions and grass yield. This work explores the implications of Scottish Government proposals to introduce a programme of Scottish soil testing for pH.

20. During the previous SRP (2011-16), experiments investigating grassland management in the uplands were conducted at the SRUC Kirkton site. These experiments, which are in the process of being reported, found that reseeding old permanent pastures results in an increase in nitrous oxide emissions from the soil (three times as much was emitted from the reseeded plots compared to the permanent pasture plot).

21. The results indicate that at this site (Kirkton Farm, 2012-2013) there was no significant difference between the productivity of the grassland in the ploughed and minimum tilled plots, although the cost of establishing the minimum tilled reseed was half that of the ploughed reseed. However, it was shown that it was only through ploughing that arable weed species were able to germinate. It was noted that some of these weed species were of conservation value and provide an important nectar source for bumblebees and other insects.

**Greenhouse gas emissions from livestock**

22. Tools are being developed to help in the breeding of ruminants with lower methane emissions. Projects include (i) Nuclear Magnetic Resonance (NMR)-based analysis of rumen contents for markers for emissions; (ii) Laser methane detector for rapid low-cost measurement of methane emission; (iii) Analysis of the rumen microbiome (microbial community analysis) and microbial genes¹⁰; and (iv) X-ray CT scanning of rumen material.

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⁹ Research involves BEIS. Department for Business, Energy and Industrial Strategy

**Nitrification inhibitors are compounds added to nitrogen fertilisers to reduce the rate at which ammonium is converted to nitrate.**

¹⁰ Research involves BBSRC and University of Aberdeen and Edinburgh.
23. SEFARI researchers won the prestigious PLOS Genetics Research Prize 2017 for their work on the potential use of rumen microbial information to reduce methane emissions in beef cattle\(^{11}\). This was based on research findings from the 2011-16 and 2016-2021 SRPs, and Scottish Government underpinning of externally funded research. The external funders were BBSRC, Defra and the devolved administrations (through the UK Agricultural Greenhouse Gas Inventory Research Platform).

24. As well as animal genetics, what livestock eat also has an impact on methane emissions. The diet of livestock is being studied, as is the effect of additives to the diet on emissions. This includes work exploring the effects of forage\(^{12}\) legumes\(^{13}\) on methane (CH\(_4\)), emissions. Work is also underway on dietary additives which reduce methane emissions through a variety of mechanisms.

25. Work is being carried out on breeding to increase feed conversion efficiency, since by reducing the amount of feed required to produce a kg of beef/lamb or litre of milk, emissions intensity is reduced. Projects in this area include Defra-funded work (led by SRUC and AHDB) to establish feed efficiency protocols, and a national testing infrastructure for beef cattle. Work is also being conducted on the development of a simple proxy (blood-based test) for feed efficiency\(^{14}\).

26. A programme of measurements of greenhouse gas emissions from dairy farming has recently been completed at SRUC’s Crichton Farm in Dumfries. This work has focused on emissions of nitrous oxide (N\(_2\)O), and also on carbon sequestration. Other measurements allowed the quantification of livestock emissions from cattle and an overview of system level emissions to be built.

27. SRP research on breeding and genetics delivers key support to Beef Efficiency Scheme (BES) within the Scottish Rural Development Programme\(^{15}\). The previous SRP 2011-16 provided significant assistance to policy teams in the development of the scheme, and, working through the BES steering Group, directly informed the formation of the policy, including cross Scottish Government-portfolio working with ClimateXChange on the benefit of enhanced data recording and genomics as tools to improve environmental efficiency and sustainability of the beef industry.

**Animal Health and greenhouse gas emissions**

28. Animal health research is quantifying the multiple benefits that can be achieved for livestock production efficiency and reduced greenhouse gas emissions through improved animal health.

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\(^{11}\) [http://journals.plos.org/plosgenetics/article?id=10.1371/journal.pgen.1005846](http://journals.plos.org/plosgenetics/article?id=10.1371/journal.pgen.1005846)

\(^{12}\) Forage is a plant material (mainly plant leaves and stems) eaten by grazing livestock.

\(^{13}\) Legumes are plants in the pea family that produce pods with seeds inside.

\(^{14}\) Research includes industry-led project with Innovate-UK
29. SEFARI scientists within the SRP, and working with the Centre for Expertise on Climate Change (ClimateXChange), have produced an assessment of the role of improved animal health in the reduction of greenhouse gas emissions from livestock. This work was at the request of the Scottish Government.

30. Climate chamber studies have shown that gastrointestinal parasitism accounts for ~10% GHGe from adult sheep and even more from lambs. Parallel field/modelling studies have shown that effective gastrointestinal parasite control can reduce GHGe by an equivalent amount.

31. Research is also currently exploring the impacts of key endemic diseases (i.e. liver fluke, parasitic worms and bovine viral diarrhoea) on the carbon footprint of grazing livestock in Scotland, using industry datasets.

National reporting of agricultural greenhouse gas emissions

32. Much of the SRP work described above, together with an earlier programme of work (called the Greenhouse Gas Platform Programme) is helping to improve our knowledge and understanding of greenhouse gas emissions in agriculture, and is allowing us to improve approaches to national emissions reporting. SEFARI researchers are working to improve reporting systems and help build a better basis for understanding mitigation approaches15.

Natural environment, land management and consumer research relevant to greenhouse gas emissions from agriculture

33. The following additional examples illustrate the breadth of the SRP work across food production, food supply, consumption and related natural assets to improve Scotland’s approach to understanding, and responding to, climate change.

Distillery by-product use and greenhouse gas emissions

34. SEFARI researchers have carried out work examining the potential for the use, as cattle feed, of by-product from Scottish malt whisky production. The use of such by-products in the beef supply chain indicates that use as animal feeds leads to a similar reduction in net emissions as using them in bio-energy generation.

Peatlands

35. Peatlands cover nearly a quarter of Scotland, containing over half of the total carbon in Scottish soil. Recent SEFARI research has dramatically improved the ability to model peatland carbon stocks and emissions. In collaboration with ClimateXChange, recent SRP research has shown the benefits of peatland restoration on carbon management, thus helping to support the

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14 Funding is also from Defra, NERC, EU, GRA, BEIS
reduction targets in greenhouse gas emissions required by the Climate Change (Scotland) Act 2009.

36. The use of revised emission factors and peatland area data in the energy modelling system, TIMES\textsuperscript{16}, was used to update scenarios for the recently published Climate Change Plan\textsuperscript{17}. SRP researchers are currently producing an updated version of the WISE Peatland choices model\textsuperscript{18}, which will provide the likelihood of a given location being in good condition, or conversely, highly ranked in terms of restoration potential. This model should be available in 2018.

Delivery of Ecosystem Services

37. SEFARI research is assessing, through the lens of ecosystem services\textsuperscript{19}, the impact on carbon stocks/emissions, nutrient retention and sediment retention from current land cover, and how these might alter with climate change. The trade-offs or synergies between agriculture/woodland expansion/peatland restorations are the main focus of the work. This approach is being tested on SEFARI farms at Balruddery, Glensaugh and Auchnerran (Tarland).

38. SEFARI researchers have contributed to the development of the first Global Soil Organic Matter map – this was launched on World Soil Day 2017 by the United Nations Food and Agriculture Organisation (FAO). The map is the first of its kind to be produced on a common grid for the whole planet, and involved over 100 countries. It allows scientists and policy makers to identify degraded areas and explore the potential for soils to store soil carbon to help reduce atmospheric carbon dioxide\textsuperscript{20}.

Food waste

39. Food waste research undertaken through the SRP has been awarded funding for an Interreg Europe project, ‘Dairy-4-Future’\textsuperscript{21}, and a PhD studentship on innovation and collaboration to mitigate food waste in the fruit and vegetable supply chain. Research published on food waste and losses in primary production has revealed that farmers do not consider food waste to be an issue of primary concern, but perceive it to be an intrinsic part of farming.

40. Results indicated that farmers do not routinely record waste and have difficulty in providing estimates for food waste and losses. However, many of the causes of food waste identified are due to factors further along the food supply chain, including cosmetic specifications by retailers, and a lack of

\textsuperscript{16} \url{http://www.parliament.scot/ResearchBriefingsAndFactsheets/S5/SB_17-07_Draft_Climate_Change_Plan_and_Scotlands_Climate_Change_Targets.pdf}
\textsuperscript{17} \url{http://www.gov.scot/Publications/2018/02/8867}
\textsuperscript{18} \url{http://www.climatexchange.org.uk/files/9514/2312/9972/WISE_leaflet_v2_Sep_2014.pdf}
\textsuperscript{19} Ecosystem services are the many and varied benefits that humans freely gain from the natural environment and from properly-functioning ecosystems.
\textsuperscript{20} In collaboration with Cranfield University, Agri-Food and Biosciences Institute and the Centre for Ecology and Hydrology.
\textsuperscript{21} \url{http://www.dairy4future.eu}
processing facilities. Farmers expressed an interest in adding value to how food waste is used on their farms, but identified several barriers to this.

**Understanding and communicating healthy and sustainable diets**

41. The human diet and associated dietary choice can have an impact on greenhouse gas emissions. Achieving a healthier and more environmentally sustainable diet has potential to bring benefit to Scottish, UK and EU citizens. SRP research has addressed the often complex relationships between greenhouse gas emissions and healthy diets.

42. Building on this ground-breaking research underpinned by the 2011-2016 SRP and working with Newcastle University (the developers of INTAKE 24\(^{22}\); an online method for assessing dietary intake by individuals), SEFARI researchers are currently linking available greenhouse gas emissions data with the National Diet and Nutrition Survey (NDNS\(^{23}\)) and the nutrient data bank behind INTAKE 24. This work has considerable potential for determining the influence of dietary change/advice on greenhouse gas emissions.

**Summary and conclusion**

43. SEFARI, working with HEI partners and the Centres of Expertise, is delivering integrated, cross-disciplinary research, exploring the interface between agriculture, land management, food supply and consumption, to provide the evidence to understand the consequences of greenhouse gas emissions and ways to reduce them and their impacts. This research is set within SEFARI’s wider strategic research aims for enhancing environmental sustainability for farming and food.

44. If the Committee so wished, we would be delighted to host a visit to any SEFARI location to demonstrate or discuss our research further. We would equally be delighted to give oral evidence if required.

**SUBMISSION FROM SCOTTISH LAND AND ESTATES**

**Introduction**

Scottish Land & Estates (SLE) welcomes the opportunity to provide evidence to the Environment, Climate Change and Land Reform Committee on the Climate Change (Emissions Targets) (Scotland) Bill.

SLE is a membership organisation which represents rural land-based businesses, primarily farms and estates. Our members are involved in a diverse range of sectors and activity such as agriculture, forestry, peatland restoration, tourism, housing and development.

\(^{22}\) [https://intake24.co.uk](https://intake24.co.uk)

Views on the Bill

SLE supports the Bill’s objective to raise the ambition of greenhouse gas emissions reduction in line with an appropriate contribution to limiting global temperature rises to 1.5 degrees Celsius above pre-industrial levels. Specifically, SLE considers that the commitment to achieving net-zero emissions “as soon as there is sufficient evidence that doing so would be credible” is a reasonable approach. In this context we have taken credible to mean where scientific evidence and technology allows the target to be achieved without having a detrimental impact on each sector. This is perhaps best summarised by paragraph 21 of the Policy Memorandum which states “The CCC go on to say that “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”.”

Farmers and land managers are at the sharp end of climatic changes, for example this year having to work with a severe winter and then summer drought. We recognise that the sector has a vital role to play in efforts to tackle climate change both in reducing emissions and increasing carbon sequestration for example in forests, peatland and soils. We are committed to supporting members in the drive towards emissions reductions as set out in the Bill. There is the opportunity to do more and with the right policies, support, advice and training in place, farmers and land managers can deliver a great deal in implementing the change that is needed to deliver these ambitious targets.

In her statement to the Scottish Parliament on 12 June 2019 the Cabinet Secretary for the Environment, Climate Change and Land Reform Committee said that if Scotland is to set targets too high it is perfectly possible that these targets could not be achieved other than reducing food production. Given the additional challenges that the agriculture sector may face as a consequence of Brexit we agree that extra pressure in the form of a net-zero emissions date should not be included in the Bill until such a time as it can be proved achievable.

SLE is still supportive of the “fair and supportive” approach described in the letter from NGOs, farmers and rural groups calling on the Scottish Government to drive a Just Transition towards carbon-neutral farming. We agree that in such a transition there should be a national nitrogen balance sheet to help the Government develop evidence-based policy; continued investment in soils to lock in carbon; promotion and support of a move towards productive and profitable low-carbon farming practices; and promoting and supporting agro-forestry to enable a transition into carbon-neutral farming.

We urge reconsideration of the way that agricultural carbon is measured. We understand that greenhouse gas inventories do not currently reliably reflect the activities that the agricultural sector undertakes to help mitigate climate change through soils, peatland, forestry and renewable energy production for example. This results in a one sided balance sheet which only shows the emissions associated with production.

To enable sector-wide change farm businesses must also be empowered to look at their whole farm system so that they understand where nutrient, energy, carbon and water flows into and out of their farm, enabling them to identify where savings and
efficiencies could be made to benefit their business as well as the environment. We are also of the opinion that agriculture should not be viewed in isolation but should be considered as part of a pan-Scotland approach to achieving net-zero emissions.

**SUBMISSION FROM NFUS**

**Introduction**

NFU Scotland welcomes the opportunity to provide evidence on this Bill. Climate change is one of the greatest challenges that we face and in setting more stretching targets for emissions reductions this Bill will play an important part in framing future farm policy decisions.

Climate change is a critically important issue for Scottish farming because, on the one hand, the farmers and crofters of Scotland are on the front line in experiencing the impacts of climate change. They will increasingly have to adapt to changing weather patterns and increased volatility in order to maintain their businesses and to continue to produce high quality food. On the other hand, agriculture is a source of greenhouse gas emissions and farmers and crofters also have an important role to play in helping tackle the collective challenge that we face. The policy decisions that could be made to secure reductions in emissions from agriculture will potentially have a major impact on the industry.

It is right and proper that Scottish agriculture shows willingness to play its part in addressing the challenges presented by climate change and opportunities exist for farmers and crofters to do this in a way that is also to the benefit of their businesses. NFU Scotland is committed to playing a positive role in that effort.

**Views on the content of the Bill**

NFU Scotland supports the approach taken by the government in the Bill.

The government had a range of choices from keeping the 80% target with subsequent reviews to increase ambition, setting a ‘stretch’ target for a reduction in greenhouse gas emissions of 90% by 2050, or setting an even greater stretch target of 100% reduction from baseline by 2050 (net-zero). There is a great deal of pressure for a net-zero target, but the government has chosen 90% as the realistic option given the Committee on Climate Change’s advice that even that is on the limits of feasibility.

Clearly there are debates to be had about the merits of setting aspirational targets for the future that might not be feasible at the moment but which might be achievable with future technological development. Aspirational targets are intended to pull in the right direction, however putting aspirational targets into legislation is fraught with danger and potentially creates problems for future administrations should the hoped for technological developments not emerge.

NFU Scotland has a great deal of sympathy and common cause with some in the environmental movement that are calling for a net-zero target. We acknowledge the challenge that we face and recognise that more work needs to be done to reduce
agricultural emissions. We even joined forces with many environmental organisations to emphasise the need for a just transition towards carbon-neutral farming.

Subsequent discussions with Scottish Government have, however, highlighted that a net-zero or 100% target for the economy as a whole would require the government to put in place a range of mechanisms in a revised Climate Change Plan that would be harmful to Scottish agriculture and to the food and drink sector. That sector, which is aiming to double the value of the industry to £30bn by 2030, is hugely important to the Scottish economy and, crucially, depends on agricultural production. We also understand that it is not the case that those measures could be ‘end-loaded’; they would need to be implemented quickly to ensure that the industry gets on the right trajectory to meet the targets.

In this context, we very much welcome the fact that the Scottish Government recognises and accepts the challenges that exist in reducing emissions in the agriculture industry. The Cabinet Secretary for the Environment, Climate Change and Land Reform has acknowledged that if we set targets too high it is perfectly possible that these targets could not be achieved other than by reducing food production in Scotland, which will not assist us either nationally or globally. We would, in effect, be exporting our emissions.

We understand that if a net-zero target were set, the sequestration that would be possible through tree planting, for example, is not likely to be enough to reach net-zero and so reductions in emissions in all sectors would be required and while there is much that could be achieved through efficiency savings the scale of the reductions required takes us into the realm of having to find ways of reducing output. That translates to a declining agricultural and food sector.

Consequently, while NFU Scotland remains committed to seeking to do all it can to help move the industry in the right direction, we support the government’s approach of setting a 90% target by 2050 rather than net-zero (albeit accepting that the Bill provides for the government re-visiting the target and potentially setting a net-zero target in future). The 90% target is already extremely stretching and will present the agricultural industry with a very large challenge. Legislating to make that challenge even greater takes us into the realms of undermining an industry we should be nurturing.

We need more resources, not evermore stretching targets

The agricultural sector is criticised for its poor performance in terms of reducing emissions. The latest Committee on Climate Change report (which refers to the UK as a whole rather than just Scotland) said that cost-effective reductions of agricultural emissions are not being delivered with emissions unchanged in 2016 and that agricultural emissions are above all indicators that would be needed to ensure the appropriate reductions path. Consequently, one argument that might be made is that a net-zero target is needed because it will force the government into policy decisions that enhance emissions reductions.

However, NFU Scotland believes that we need more resources, not evermore stretching targets.
The Scottish Government has so far focused on following a voluntary approach. We strongly support this. We believe that we will achieve much better outcomes in the long run if people are encouraged to tackle emissions rather than be forced to through the use of regulation. By taking a voluntary approach we are encouraging farmers to change practice in a way that potentially also enhances their business; tackling climate change can be seen as a positive.

While the voluntary approach is criticised by the Committee on Climate Change, we believe we have not really given it a proper chance to work. This is partly because of the resources devoted to it. At present, the main mechanism that the government utilises to achieve behaviour change amongst farmers is the Farming for a Better Climate (FFBC) initiative which raises awareness of climate friendly farming methods. We very much support this initiative, but the government currently only spends £375,000 each year on it. While there are other strands of activity that the government could point to through which climate advice is delivered, if climate change is such a high priority for the government and society as a whole, surely there is a strong justification for enhancing this funding and the capacity of the initiative substantially. There are also other options such as government/industry-led market-oriented approaches focusing on enhanced returns based on environmental performance e.g. Origin Green in Ireland.

This apparent lack of prioritisation is also reflected in the internal Scottish Government policy staffing resource devoted to agriculture and climate change, which, we understand, is 1 FTE. The government does fund a wide range of research on climate change and agriculture and teams looking at climate change in general, but there is one key person that focuses on agriculture. Again, if reducing emissions in agriculture is such a priority we might expect this to be reflected in the capacity the government devotes to supporting change in the industry.

**Let's focus on working together**

Reaching the 90% target will be very challenging for the farming industry and we believe that while the government's recognition of the challenges for farming is welcome, the government can also do much more to lead the way in this area. We acknowledge, however, that progress cannot only be about the government. NFU Scotland has an important role to play and we stand ready to play our part.

There is at present a lack of urgency and leadership. We have not, as a collective of government and industry working together, managed to develop a sense of priority and urgency about climate change. There are good reasons for this given the context of Brexit and the potential change in agricultural policy, but there is also an opportunity for government and organisations working together to set the agenda.

What we should avoid is discussion of targets getting in the way of constructive action. We have already seen that discussion of a net-zero target starts to drive a wedge between different organisations and between farming and environmental interests that need to be working together. It would be better to focus our collective efforts on delivering what is feasibly achievable today.
Social change is difficult

NFU Scotland would emphasise that achieving widespread change in an entire industry made up of thousands of SMEs is an involved social process that takes time. In this respect agriculture is very different to other industries. We need to invest a great deal of energy and resource to approach the issue in such a way that we embed thinking about reducing emission in routine decision making in a positive way. How we go about it really matters. There are opportunities here to facilitate change in the industry in a constructive and positive way, but government and industry need to work together to lead the way.

NFU Scotland believes that an enhanced voluntary approach is the best way forward. If the government were to regulate to reduce emissions the whole issue would end up being perceived as an additional burden on the farmer, potentially undermining the outcomes desired. A regulatory route might be an efficient way for the government to operate, but it is not the way to engender any sense of collective effort against a common challenge.

Carbon reporting

We believe that farmers tend to get a bad deal in climate change discussions because of the way that the inventories work and that a way needs to be found to recognise all that farmers are delivering. As we understand it from research colleagues in the research institutes and from government officials, agriculture is defined in the greenhouse gas inventories in a very specific way, such that it can only be an emitter of gases. The activities of farmers that sequester carbon or produce renewable energy are recorded in other sectors’ inventory figures. So while agriculture is responsible for emissions associated with food production—viewed as a negative—the farmers undertaking that food production will also be responsible for sequestration through tree planting, soil management and peatland restoration or protection—viewed as a positive. Yet the relative balance of those positives and negatives is not acknowledged because only one side of that balance sheet, the negative, counts as agriculture. It doesn’t matter how much sequestration a farmer might be delivering, potentially offsetting their agricultural emissions, their agricultural emissions still have to be reduced.

As such, we believe it would be useful for the government to develop and maintain a farming and climate accounting tool that re-works the inventory data so that it more clearly reflects the contribution that farming is delivering.

SUBMISSION FROM DAVE REAY

Thank you for the opportunity to submit views on the Climate Change (Emissions Reduction Targets) (Scotland) Bill. In terms of general comments on the Bill, its scope, and its structure. The below views are my own and do not represent those of my employer.

I thoroughly endorse the advice given by the Committee on Climate Change (CCC) and am heartened to see that their key recommendations on accounting and
reporting have been incorporated. These will be a great aid to clarity and consistency in the coming years and decades.

On the increase to a 90% reduction in greenhouse gas (GHG) emissions by 2050 target (on 1990 baseline), this is very welcome and helps maintain Scotland’s leading position on climate change action through legislation. The provision in the Bill to enhance this at some future date to 100% (i.e. net zero) ‘when the evidence becomes available’ is understandable but, in my view, unjustified. Mapping the policies and proposals that can achieve a net zero emission Scotland is already possible. Yes, it is difficult – some sectors, such as agriculture (see additional comments below), will remain net GHG sources post-2050 – but these unavoidable emissions can and should be balanced by net sequestration. In land use management for net carbon (C) sequestration and use of CCS in conjunction with biomass energy (BECCS), we already have strategies that could deliver a net zero Scotland.

Just as the 42% by 2020 target in the 2009 Climate Change (Scotland) Act was world-leading, so a 100% target would position Scotland as an exemplar for all developed nations on how to reduce GHG emissions in a way that is compatible with the aims of the Paris Climate Agreement. Setting such an ambitious target is the first vital step in achieving it. In Scotland we have the expertise, the track record of success, and the public and political will to set this global benchmark for climate action in the 21st century.

We should not passively wait for evidence on how to achieve a ‘net zero Scotland’, we should actively request. Doubtless advisory bodies such as the CCC will find that mitigation efforts across all sectors will need to be redoubled. That short-term costs will increase, and that unpopular decisions will need to be made. More importantly, they will likely flag the urgency of action. As the recent evidence form the CCC on a 90% target showed, the foundations of success or failure are built today, not tomorrow. If Scotland delays establishment of a net zero target then we risk locking-in failure for 2050, leaving some sectors just too much to do in too little time.

As a Scottish climate scientist and expert in carbon management I applaud our nation’s efforts to address climate change over the last decade. The rapid decarbonisation of our energy sector has been a notable achievement, and the cross-party political will for tough, evidence-based action has been hugely encouraging. In this Bill we have a short-lived opportunity to set our nation on a path to a truly sustainable climate future. I dearly hope we take this chance.

**Climate Change (emissions Reductions Targets) (Scotland) Bill – Implementation**

As stated above, agriculture and land use represent crucial sectors for Scotland its climate change mitigation ambitions. The former is a major source of GHG emissions, now representing around a quarter of the national budget and having seen relatively little progress over the last decade. The latter is central to achieving a net zero Scotland and, again, progress on enhancing our land carbon sinks in Scotland has been disappointing to date. Below I provide some more specific views
and suggestions on these sectors in the context of implementation of the new Climate Change Bill:

The Agriculture and Land-use sectors hold huge potential for helping us achieve our climate change targets while simultaneously increasing profitability and delivering wider ecosystem services. However, in both sectors progress to date has been disappointing. Scotland’s forestry targets include an increase in new planting from 10,000 to **15,000 ha** per year by 2024, with 100,000 ha of new forest by 2022. Current rates (as reported for 16/17) are less than one-third of this: **4,800 ha**. Support mechanisms, such as the SRDP and ‘sheep and trees’ now need to rapidly boost tree planting activity to the required levels. **To deliver on our climate change targets an aggressive expansion in tree planting to target levels is urgently required given the lag between planting of maximum C sequestration.**

Likewise, upland peatlands represent a huge carbon stock and their post-war drainage and degradation has resulted in substantial CO₂ emissions. Peatland restoration is quite rightly a focus of land use mitigation policy – peatland restoration can deliver 0.5 tonnes carbon (C) per ha per year and 10,000 ha have already received some restoration activity. However, switching many of these degraded peatlands from C sources to C sinks will take many years, meaning the overall Scottish emissions budgets is set to see a significant short-term increase when upland peat is included, rather than a reduction. **The agriculture sector in Scotland will play a crucial role in supporting climate change action via both forestry and peatland restoration** (e.g. by agroforestry and reduced grazing pressure approaches) – there are major opportunities here to align efforts across multiple land uses to deliver a sustainable and well-integrated contribution to our climate change targets in a post-CAP world.

Agriculture itself is a large source of GHG emissions in Scotland. As we make more progress in reducing emissions in other sectors, so the relative importance of agriculture in the Scottish budget grows further. It currently comprises around one-quarter of the national total through direct emissions and due to agriculture-related land use change. Methane (57%) and nitrous oxide (32%) are the main GHGs emitted by agriculture, with livestock and arable agriculture, respectively, being the main sources. **Since 1990 emissions from this sector have fallen by 14%, but since 2008 there has been little change. Future emissions targets for this sector are unambitious. More progress is now urgently required.**

Scottish farmers are a diverse group having to cope with a wide range of soil types, weather conditions and food production systems, along with a rapidly changing market, policy and regulatory landscape. They also face risks and opportunities from climate change itself.

**The UK’s exit from the EU and replacement of the CAP represents an opportunity to improve support for farmers in Scotland** which simultaneously raises profitability, long-term sustainability of Scottish farming, and helps Scotland achieve its climate change targets. Central to this will be support and incentives that derive from a robust evidence base, avoid unintended consequences, and that are applicable to local contexts. Current support mechanisms focussed on climate-smart farming practice in Scotland include the Farming For a Better Climate (FFBC) programme designed to encourage voluntary uptake of good practice through
support and demonstration. Since its inception this programme has directly involved around a dozen farms, but this is nothing like the scale required for sector-wide progress.

Awareness and application of such climate-smart farming practices is low right across the UK. For instance, only around half of farms currently use nutrient management plans, calibrate their spreaders or attach any importance to GHG emissions (Farm Practices Survey 2017). With the replacement of the CAP there is likely to be a renewed emphasis on support for farming practice that delivers on climate change and environmental protection targets alongside increases profitability. Scotland has an opportunity to set the standard for such a transition given the overall ambition of its targets and the greater importance of the agriculture sector compared to England.

Recommendations

- Development of a Scotland-specific post-CAP strategy that fully aligns with our climate change targets, acknowledges the diversity of local contexts, and integrates with wider land-use policy such as forestry.

- Assess the impact of existing voluntary measures to support climate-smart farming in the context of the above, identifying successes and overtly question whether their speed and scale is fit for purpose in the context of the Climate Change Bill.

- Consider whether mandatory measures are required and appropriate, and how any such measures could be integrated with emerging financial and extension support programmes.

- Ensure that agriculture (i.e. our farmers) in Scotland are not treated as the problem in delivering on our climate change targets, but actually the solution. Invest in capacity-building that focuses on the multiple benefits to farmers and the nation, through increased profitability, resilience, and reduced emissions at the same time (i.e. the climate-smart approach).

- Take a systems approach, that integrates environmental regulation (e.g. biodiversity and air & water quality) with policies designed to deliver climate-smart farming.

Fully utilise the wealth of academic, policy and farming expertise in Scotland to develop and implement the Scottish replacement of the CAP.
SUBMISSION FROM NOURISH SCOTLAND

About Nourish Scotland

Nourish Scotland is an NGO campaigning on food justice issues in Scotland. We believe tasty and nutritious food should be accessible to everyone, be sustainable, and be produced, processed, sold and served in a way that values and respects workers. We campaign for solutions that work across the board: we take a systems approach toward food and health, poverty, fairness, workers’ rights, rural economy, environment, climate change, land use, and waste.

Nourish is a member of the Stop Climate Chaos Scotland coalition and Scottish Environment LINK, and endorses the detailed evidence provided by these coalitions. The position in this submission is our own.

Summary

The Bill in its current form fails to meet Scotland’s international obligations under the Paris Agreement. Nourish Scotland calls for targets that reflect our moral duty and capacity to mitigate climate change: targets of at least 80% reduction in emissions by 2030 and net-zero emissions by 2040.

Nourish also calls for a package of measures to drive a just transition in agriculture and ensure a coherent approach across agricultural, land use, and forestry policies:

- Duty for all agriculture and rural policies to contribute to mitigating climate change and meeting Scotland's emissions reduction targets.
- Duty to produce a nitrogen balance sheet and statutory targets for nitrogen efficiency improvements
- Statutory targets for land in organic management
- Statutory targets for agroforestry
- Statutory cap on methane emissions and long-term reduction targets
- A coherent policy framework that joins up agriculture, land use, and forestry
- Duty to report on consumption emissions

Full response

The Bill as published by the Scottish Government does not contain the ambition or action required to deliver the Paris Agreement. According to the Fairshares analysis, the UK should be aiming for reductions of between 65% and 75% by 2025 and 76% and 86% by 2030.24 We therefore urge the Scottish Parliament to raise the targets to at least 80% emissions reductions by 2030 and net-zero emissions by 2040. Instead of a linear, gradual approach to emission reductions, we need to put the focus of climate action on the next 5-10 years. These targets would ensure that Scotland meets its moral duty and remains a true leader in climate change action.

Farming and land use are key to Scotland’s climate leadership

Urgent action in the agriculture and land use sectors is critical for the success of a net-zero target for Scotland, but is lacking from current policies. This Bill should therefore include a package of actions that will set Scotland on the right path over the next 5-10 years. These sectors have the potential not only to reduce current levels of greenhouse gas emissions, but also to sequester significant amounts of carbon. Although we will continue to emit some methane and nitrous oxide in agriculture as these gases are produced by biological and chemical processes inherent to food production, there is significant scope for reductions in emissions and offsetting of what remains through sequestration in soils and forests.

Greenhouse gas emissions from agriculture have not been tackled as efficiently as in other sectors, and have only gone down marginally in the last decade. Agriculture is now the second largest emitting sector in Scotland, responsible for 26% of emissions. Yet, the Scottish Government’s Climate Change Plan only proposes a 9% reduction in emissions from agriculture by 2032 and a weak package of non-compulsory measures. Voluntary measures have shown their limitations, it is now time for higher ambition in agriculture and land use so that these sectors can contribute a fair share of efforts towards Scotland becoming a net-zero economy.

This ambition can only be achieved through a coherent approach to land use, agricultural, and forestry policies in which climate change mitigation is a key priority. A just transition is needed in agriculture, with adequate advice and support for farmers, crofters, and land managers, alongside compulsory measures and statutory targets to ensure a level-playing field and to set a clear long-term direction. Finally, climate mitigation measures taken by farmers, crofters, and land managers should be adequately recorded, through better emissions accounting in the agriculture sector. Nourish would recommend a modernisation of the inventory to better reflect the complexity of land-based emissions and sequestration; close dialogue with the UKCCC to improve how different greenhouse gases are recorded is also important.

Failure is not an option. Scotland’s tourism and food and drink are fast growing sectors, but their success is closely tied to our continued reputation as a green and clean country. A net-zero emissions target by 2040, matched by equally ambitious action in the agriculture and land use sectors, would ensure our prestige as a climate world-leader and a land of food and drink continues to underpin profitable industries that are vital to our rural and wider economy.

Comments on agricultural greenhouse gas emissions

While we may not know all the solutions to achieve net-zero emissions today, there is a lot we know farming can do but is not doing, and must do urgently in order to meet our international and national climate change obligations.

Methane (44% of farming emissions) is emitted by livestock. Breeding, animal feed, animal health and manure management can all reduce methane emissions per unit

of output, and there may be scope to increase methane oxidation$^{26}$, but this is still an underdeveloped area of scientific knowledge. Remaining methane emissions can also be offset through carbon sinks: for example 2 acres of woodland can offset the CO$_2$e emissions of one dairy cow$^{27}$.

**Nitrous oxide** (29%) is emitted by agricultural soils, especially those rich in nitrogen. These emissions can be reduced by using less or no chemical fertilisers, applying fertiliser to fields through precision techniques; getting the soil pH right; managing manure and slurry better; using clovers in grass mixes; and intercropping. The need for chemical fertilisers can be reduced by improving our circular economy of nutrients (animal manures, compost, and digestate from food waste, upscaling our anaerobic digestion capacity).

**Carbon dioxide**’s main sources (27%) in agriculture are from the use of fossil fuels in powering farm machinery and from the manufacture of chemical fertilisers (which accounts for around 5% of global energy use). These sources can be entirely mitigated through a shift to clean energy sources. Furthermore, farmers and land managers can become net producers of renewable energy.

**Soil carbon sequestration** is a critical strategy for climate change mitigation and much under invested in. Since the industrial revolution, the way we’ve managed our soils has released almost as much CO$_2$ into the atmosphere as all the burning of fossil fuels$^{28}$, with 25-75% of the original soil carbon lost. A recent study of Scotland’s soils$^{29}$ suggests soil carbon levels have been stable over recent decades, but with many soils containing less than 3% carbon there is room to restore earlier losses. Land managers and owners should be incentivised to use their land to sequester important amounts of carbon dioxide by building up organic matter in soils and adopting agroforestry practices at a large scale.

Other countries have shown leadership on this front, and Scotland should urgently increase efforts. France, for example, launched the ‘4 per 1000’ initiative$^{30}$ launched at COP21, which highlights the role of agricultural soils in mitigating climate change and recommends practices such as agroecology and agroforestry. Increasing the amount of carbon matter in soils by 0.4% per year could stabilise concentration of CO$_2$ in the atmosphere. Around 40 countries have signed up to the initiative, but Scotland is not amongst them. In Austria, the humus building project run by Ecoregion Kaindorf rewards farmers who verifiably increase soil carbon through a voluntary carbon trading scheme. 200 farmers currently take part, and improved

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$^{26}$“Soils contain populations of methanotrophic bacteria that can oxidise methane, by a process known as ‘high affinity oxidation’. These bacteria consume methane that is in low concentrations, close to that of the atmosphere. The bacteria favour upland soils, in particular forest soils. (...) Exposure of soils to high ammonium concentrations leads to a loss of methanotrophic bacteria and a subsequent reduction in the rate of methane oxidation. The use of artificial fertilisers containing ammonia is therefore detrimental to the removal of methane.”

http://www.eci.ox.ac.uk/research/energy/downloads/methaneuk/chapter02.pdf

$^{27}$Own calculation based on

https://www.forestry.gov.uk/pdf/6_planting_more_trees.pdf

$^{28}$https://www.nature.com/articles/s41598-017-15794-8#Fig1

$^{29}$http://iopscience.iop.org/article/10.1088/1755-1315/25/1/012016/meta

$^{30}$https://www.4p1000.org/
management practices have resulted not only in extra income but also in higher yields.\textsuperscript{31}

None of the measures listed above are currently compulsory nor sufficiently promoted or incentivised.

**Action on agriculture and land use in the Climate Change Bill**

The asks below outline key measures which need to be adopted now to take us on the right pathway over the next ten years towards net-zero emissions by 2040.

1. **Duty for all agriculture and rural policies to contribute to mitigating climate change and meeting Scotland's emissions reduction targets.**

Agricultural policy has done too little to date to advise and support farmers in developing and implementing plans for climate change mitigation and adaptation. The Land Rights and Responsibility Statement highlights Scotland's land owners' duty to be good stewards of our natural resources\textsuperscript{32}, but this is insufficiently implemented and enforced. As we design our farming and rural policies for post-Brexit, we must ensure they contribute to the delivery of Scotland’s ambitious climate change targets. This is all the more important as official figures show that still half of farmers do not think it important to consider GHGs when making farm business decisions\textsuperscript{33}. Meanwhile, in a recent public survey 77\% of respondents said they would like to see farm support be conditional to land managers showing that they are supporting wildlife and are reducing climate impacts\textsuperscript{34}.

To urgently improve knowledge about climate change mitigation measures in the agricultural sector, the Climate Change Bill should place a duty on all publicly funded advisory services and educational institutions to prioritise education in, and dissemination of, best practice in climate mitigation and carbon sequestration through agriculture.

To ensure the majority of farmers adopt best practice, the Climate Change Bill should place a duty on the Scottish Government to publish an environmental and climate change impact assessment for its agricultural and rural policy, and demonstrate how its farming support system is supporting the objectives of this Bill.

2. **Duty to produce a nitrogen balance sheet and statutory targets for nitrogen efficiency improvements**

Reactive nitrogen is highly volatile, and pollutes our environment in many different ways, as ammonia, nitrogen oxides, nitrates, and nitrous oxide. Nitrous oxide accounted for 6.6\% of Scotland's gross greenhouse gas emissions in 2016, a share

\textsuperscript{31} http://www.oekoregion-kaindorf.at
\textsuperscript{34} http://www.scotlink.org/public-documents/77-of-scots-want-farming-to-deliver-for-our-environment-and-climate-poll-suggests/
which is increasing year on year as other emissions are cut rapidly.\textsuperscript{35} This pollution can be mitigated by using fertiliser more efficiently, cutting losses to the natural environment, and recycling nutrients better\textsuperscript{36}. Understanding how nitrogen reacts and moves in our environment is a prerequisite for effective action to reduce nitrous oxide emissions.

The Climate Change Plan published in February 2018 sets the policy outcome that “Emissions from nitrogen fertiliser will have fallen through a combination of improved understanding, efficient application and improved soil condition”, with the following policy to achieve this goal: “Work with the agriculture and science sectors regarding the feasibility and development of a SMART (specific, measurable, achievable, relevant and time bound) target for reducing Scotland’s emissions from nitrogen fertiliser.” While this is welcome, the lack of a clear timeline for action and of details on the level of ambition are of concern.

The Climate Change Bill should set a duty on the Scottish Government to regularly commission and publish nitrogen balance sheets, with the first one published no later than 2020. Iterations of the balance sheets should match climate change reports of policy and proposals cycles.

This Bill should also set a duty on the Scottish Government to set a pathway, including binding targets and policy measures, for how nitrogen use efficiency will be improved in Scotland. This pathway should be published no later than one year after the publication of the first nitrogen balance sheet, and reviewed with each iteration of the balance sheet.

3. Statutory targets for land in organic management

Boosting the organic farming sector is a proven effective mitigation strategy for agriculture. Research consistently demonstrates that organic farming uses less energy and delivers lower greenhouse gas emissions per unit of area and in some cases per unit of product.\textsuperscript{37} In addition, organic management typically leads to higher soil carbon sequestration\textsuperscript{38}. Nourish presented more detailed evidence in our submission to the Rural Economy and Connectivity Committee on the draft Climate Change Plan in 2017\textsuperscript{39}.

The land area under organic management in Scotland has been declining for the past 8 years consecutively, coming down to only 2.2% in 2016.\textsuperscript{40} Scotland is thereby lagging behind the rest of the UK (2.9%) and Europe, with the EU average

\textsuperscript{38} Gattinger, A. et al http://www.pnas.org/content/109/44/18226
increasing by 21% between 2011-2015 to over 6% of agricultural land currently.\textsuperscript{41} In addition to demonstrated environmental benefits, organic farming brings multiple economic co-benefits, from rural employment and higher farm margins, to tourism and export markets opportunities. Given the importance of European markets for Scottish agricultural exports, we cannot afford to lag behind in the environmental standards of food production; the Scottish organic sector needs an urgent boost. Demand for organic food is high and rising, and not met by Scottish production.

The Climate Change Bill should therefore set an ambitious statutory target for land under organic management. We recommend a target for 20% of region 1 land\textsuperscript{42} to be under organic management by 2030

4. Statutory target for agroforestry

“Agroforestry systems can provide multiple benefits, including diversification of farm income, shelter for livestock, fuelwood, carbon sequestration, nutrient management, reductions in soil erosion and leaching, biodiversity enhancement, and amenity value.”\textsuperscript{43} Agroforestry systems produce up to 30% additional biomass per hectare\textsuperscript{44} – and thus have a potential to increase carbon sequestration by comparison with conventional pasture and cropping systems. At a UK level, the UK Committee on Climate Change estimates that a reduction of 0.16 MtCO\textsubscript{2}e can be delivered by 2030 by establishing agroforestry on 0.6% of the agricultural land area\textsuperscript{45}.

The 2018 Climate Change Plan recognises the potential for agroforestry to contribute to carbon sequestration on agricultural land, and commits to the following policy “Explore with the farming and forestry sectors how best to increase planting of trees and hedgerows which optimise carbon sequestration, including the role of agroforestry.” Again, while the intention is positive, the lack of timed and measurable ambition is disappointing.

Agroforestry at scale could make a significant contribution to meet our ambitious planting targets and would increase the sequestration of carbon necessary to achieve net-zero emissions.

The Climate Change Bill should therefore set a statutory target for on-farm afforestation so that 5% of Scottish agricultural land is managed as agroforestry by 2030.

5. Statutory cap on methane emissions and long-term reduction targets

Livestock farming emitted 4.4 MtCO\textsubscript{2}e of methane in 2016, 8.5% of Scotland’s gross emissions. However, even with the latest inventory revision, figures are approximate, and more accurate accounting is needed in order to inform mitigation strategies and

\textsuperscript{41} http://ec.europa.eu/eurostat/statistics-explained/index.php/Organic_farming_statistics
\textsuperscript{42} Region 1 land covers 1.8 million hectares in Scotland and is better quality, productive agricultural land typically used for arable cropping, temporary grass and permanent grass https://www.gov.scot/Resource/0045/00456286.pdf
\textsuperscript{43} https://www.climatexchange.org.uk/media/2020/cxc-woodlands_agroforestry_policy_brief.pdf
\textsuperscript{44} http://www.nuffieldinternational.org/rep_pdf/1341272658Stephen-Briggs-2011-report.pdf
reflect progress made by farmers. Methane measurement on farm should become more precise and reflect on-farm management practices, not just animal numbers and weight.

The 2018 Climate Change Plan commits to two welcome policy outcomes with regards to methane: “reduced emissions from red meat and dairy through improved emissions intensity” and “reduced emissions from the use and storage of manure and slurry.” However, the policy proposals are vague and voluntary.

The Climate Change Bill should set a statutory cap and reduction targets for methane emissions. We recommend an absolute cap at the current level, so that future increases in red meat (including venison) and dairy production have to be achieved through greater efficiency or through reductions in other emissions (manure management, landfill, energy). This cap should be revised downwards in future climate plans as technical innovations to reduce methane (vaccination, feed additives, selective breeding) become available. This cap will help to drive innovation and best practice across the industry, and will require sector-wide measures to improve efficiency. There is scope to build on the Beef Efficiency Scheme to develop wider benchmarking and knowledge exchange along the lines of Origin Green in Ireland.

6. A coherent policy framework that joins up agriculture, land use, and forestry

Agriculture, land use, and forestry are closely intertwined; actions taken in one sector influence the others, and all are critical to the success of Scotland’s climate change ambitions. Soil carbon and trees are important sinks available to Scotland and span across these three sectors – yet decisions still tend to be made in silos.

Nourish recommends pulling together the agriculture and LULUCF emissions into an Agriculture, Forestry and Other Land Use category (AFOLU) as set out in the Executive Summary of the fifth IPCC report:

“Agriculture, Forestry, and Other Land Use (AFOLU) is unique among the sectors considered in this volume, since the mitigation potential is derived from both an enhancement of removals of greenhouse gases (GHG), as well as reduction of emissions through management of land and livestock (robust evidence; high agreement). The land provides food that feeds the Earth’s human population of ca. 7 billion, fibre for a variety of purposes, livelihoods for billions of people worldwide, and is a critical resource for sustainable development in many regions. Agriculture is frequently central to the livelihoods of many social groups, especially in developing countries where it often accounts for a significant share of production. In addition to food and fibre, the land provides a multitude of ecosystem services; climate change mitigation is just one of many that are vital to human well-being (robust evidence; high agreement). Mitigation options in the AFOLU sector, therefore, need to be assessed, as far as possible, for their potential impact on all other services provided by land.”

It is essential as we continue the debate on how best to achieve net-zero to consider agriculture, forestry and other land use as one system delivering multiple services.
In this context, Nourish also support RSPB Scotland’s recommendations regarding the Land Use Strategy.

Under this new coherent framework, detailed mapping and modelling of land-based carbon sinks is necessary to inform further actions to achieve net-zero emissions targets.

The 2018 Climate Change Plan committed to ambitious afforestation targets; however targets to increase woodland cover come across as both arbitrary and abstract in the absence of mapping at regional and national level, informed debate to show how a range of targets might be achieved, and how the costs and co-benefits would be fairly shared. The current Highland Council consultation on its Highland Forest and Woodland Strategy\(^{46}\) shows a good example of how mapping can help inform discussions and decisions about how land is used.

The Scottish Government should be required to publish transparent modelling of different scenarios for afforestation which assess the impact on farming output, livelihoods, biodiversity and carbon sequestration over the coming decades.

### 7. Duty to report on consumption emissions

A globally responsible approach to climate change has to tackle consumption emissions. A significant part of Scotland's consumption is responsible for a growth of emissions abroad. This would be unchallenged by policies that focus solely on domestic, production emissions.

The data shows that, while our territorial emissions have been falling, extra-territorial emissions from consumption are rising: a report by the Committee on Climate Change on consumption reporting for the UK as a whole found that the UK’s carbon footprint has increased over the past two decades, and, strikingly, growth in imported emissions has more than offset reductions in production emissions.\(^{47}\)

The Climate Change Bill should require Ministers to measure and report annually not only on Scotland’s production emissions but also its consumption-based emissions. There should also be targets in the Bill for reducing consumption emissions, and strategic actions to meet these targets should be incorporated into the policy making process.

### SUPPLEMENTARY SUBMISSION FROM NOURISH SCOTLAND

**Key points:**

- Farmers manage 75% of Scotland’s land area. As land-based carbon sequestration is critical to mitigating climate change, farmers have an important role to play.

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Agriculture and related land-use is Scotland’s second largest emitting sector, and will remain a large emitter of non-CO₂ gases – methane and nitrous oxide. However, the sector must deliver a fair share of emissions reductions, and must start now.

We propose a 3-tiered approach to mitigation in the agriculture and land-use sector:

1. Enforce efficiency improvements, starting now, to reduce non-CO₂ emissions. These are no-brainer approaches which are well known but not widely implemented to improve farm profitability and maintain output, while reducing emissions.

2. Roll out agricultural practices to sequester carbon, starting now. Solutions in this tier are tried and tested but have little take up due to lack of incentives.

3. Invest in research, feasibility studies, and dissemination of new knowledge and technologies. These are solutions which are in the pipeline and will give a competitive advantage to early adopters.

We estimate tier 1 could abate up to 30% non-CO₂ emissions by 2030 while maintaining the same output. 10 Mt CO₂e / year could be sequestered by 2030 through tier 2 and an additional 10 Mt CO₂e by 2050 through tier 3. See calculations in Appendix 1.

Greater effort-sharing by farmers and land managers will not hurt Scotland’s food production or its farmers. It will help them in four main ways:

1 Increasing efficiency will reduce emissions per unit of production and make farms more profitable and viable, especially those which are currently underperforming;
2 Demonstrating best practice in climate-friendly farming safeguards the reputation of our key products in both domestic and export markets;
3 With 78% of Scots thinking tackling climate change is a priority, making climate change mitigation a priority for agriculture is important for the long-term financial and policy support for the sector;
4 Farmers should be paid for actions which reduce emissions or sequester carbon.

None of the above can happen without support from the public purse. Commensurate investment to the size of the challenge ahead is needed, to build consensus among farmers, finance the necessary changes in practice, and continue to deliver world-leading research in agricultural climate change solutions.
Full evidence

In a briefing published alongside the Climate Change Bill last May\(^{48}\), the Scottish Government argued that setting an emission reduction target above 90% would jeopardise Scottish food production:

“It is not possible to produce food without generating greenhouse gas emissions. [...] Requiring reductions in emissions from farming beyond what can be achieved through efficiency and technology would mean reducing the amount of food produced in Scotland.”

Yet, while ambitious action on climate change is not a threat to Scottish agriculture, as we argue below, inaction is an existential threat to Scottish agriculture, in two main ways.

First, if we fail to deliver our fair share of mitigation, we cannot expect others to do better. This would have devastating consequences, with up to 4°C of warming by the end of the century and an unstable climate jeopardising our ability to produce high quality food into the future.

Second, ongoing trends in meat consumption and consumers demands for strong sustainability credentials are putting pressure on farmers, and are unlikely to fade away. Failing to engage with these major trends is a losing strategy for livestock and dairy industries in Scotland and around the world. Countries such as Ireland\(^{49}\) and New Zealand\(^{50}\) which are recognising and acting on these changing consumer demands are likely to gain a competitive advantage. We must also address the incoherence between the food industry’s strategy, and our climate responsibility. It makes no sense for food and farming businesses to work toward doubling meat and dairy production when consumers are moving in the other direction.

We must aim higher and advance faster to reduce the climate impact of our food production to safeguard our international reputation and competitive advantage. Our agriculture will reap the benefits, as public money supports farmers in delivering climate mitigation, more efficient farms become more profitable, cutting-edge solutions are developed in Scotland, giving our farming sector a competitive advantage, and the Scottish brand demonstrates its truly green credentials, safeguarding domestic and foreign markets. These changes will not happen spontaneously, political leadership and investment in upskilling and continuing professional development for farmers are urgently needed.

There is an urgent need to build consensus with farmers around their role in tackling climate change. A helpful first step would be to improve how agriculture-related emissions are accounted and reported on in the current inventory, to reflect fairly farmers’ efforts. Currently, mitigation measures are either reflected in other sectors, eg. tree planting in LULUCF, or not reflected at all, eg. methane emissions do not take account of genetic differences, or feeding strategies.

\(^{48}\) Scottish Government, When to set a net-zero Greenhouse Gas emissions target year

\(^{49}\) Origin Green
https://www.origingreen.ie/who-is-involved/meet-a-member/

\(^{50}\) https://www.wwf.org.uk/sites/default/files/2016-12/NewZealand%20-%20agriculture.pdf
Agriculture is a key part of the solution: the sector holds significant potential for emissions reductions and carbon sequestration. The pathway can be seen as a 3-tiered approach.

1) Improving resource use efficiency in low- and medium-performing farms to reduce emissions quickly and cost-effectively.

Optimising fertiliser use and improving animal health are elementary and cost-efficient solutions to produce the same level of output with less emissions and lower input costs – meaning greater profitability.

Quality Meat Scotland’s Cattle and Sheep Enterprise Profitability figures\(^5\) show that while some farmers are already doing well, there is a long tail of underperforming farm businesses (see graphs). Performance figures show that the top 1/3 performing businesses are able to produce beef and lamb with up to 30% lower emissions and much higher profit margins (detail collated in Appendix 1) than the bottom third. Methane and nitrous oxide emissions from livestock can be reduced significantly by closing this productivity gap.

Nitrogen fertiliser is used very wastefully in Scotland (and much of the rest of the world), causing water and air pollution harmful to human health and ecosystems, as well as greenhouse gas emissions as nitrous oxide. Research\(^5\) estimates that during manure or mineral fertilizer use, 2% or 2.5% of the nitrogen is converted to $\text{N}_2\text{O}$, respectively. In 2015, 326Kt of N were applied to agricultural land in Scotland (half as manure and half as mineral N fertiliser), of which only half was taken up by crops. This excess N, 92kg per hectare on average, ends up in watercourses, groundwater, and the atmosphere. Inefficient use of fertilisers is costing farmers £70 per hectare to pollute the environment\(^5\).

Although $\text{N}_2\text{O}$ emissions in 2016 were 13% lower than in 1990, N surpluses have been going up year on year since 2011, with $\text{N}_2\text{O}$ roughly stagnant over that period.

\(^5\) https://www.qmscotland.co.uk/sites/default/files/cattle_and_sheep_enterprise_profitability_in_scotland_2017.pdf
\(^5\) Ammonium Nitrate containing 34.5% N costs £260 per tonne (August 2018). AHDB UK Fertiliser Price Series September 2018 report
Yet, the figures above show there is considerable scope for improvement. Tackling inefficient use of nitrogen in Scottish agriculture must become a top priority, a recommendation also made by the UK Committee on Climate Change in their last Progress Report to this Parliament.

2) Rolling out agricultural practices which sequester carbon.

Scottish agriculture will always produce GHG emissions – the UK CCC estimates 6 MtCO$_2$e will remain in 2050$^{54}$. The only way to go further down would be to reduce our production, which is not desirable. However, the sector can sequester about as much carbon by adopting tried and tested practices which lock up carbon in soils and biomass. This can and should be implemented at scale within the next ten years. Unfortunately, the UK CCC did not consider this abatement potential in their advice on this Bill.

**Soil carbon sequestration** is critical for climate change mitigation and much underinvested in. Alcalde and colleagues estimate Scotland’s potential ‘negative emissions’ from soil carbon sequestration range between 0.22 and 7.2Mt CO$_2$e/year$^{55}$. Other countries have shown leadership on this front: France, for example, launched the ‘4 per 1000’ initiative$^{56}$ at COP21, which highlights the role of agricultural soils in mitigating climate change and recommends practices such as agroecology and agroforestry.

**Agroforestry** (combining trees with pastures and crops), is recognised as an effective way to increase carbon sequestration in soils and biomass, with multiple added benefits, such as diversification of farm income, nutrient management, reductions in soil erosion and leaching, and biodiversity enhancement$^{57}$. Agroforestry systems produce up to 30% additional biomass per hectare$^{58}$, and increase carbon sequestration without reducing production.

**Organic farming**, a form of agroecology, typically leads to higher soil carbon sequestration$^{59}$. In addition, research consistently demonstrates that organic farming uses less energy and delivers lower greenhouse gas emissions per unit of area and in some cases per unit of product.$^{60}$

We also need mechanisms which make it easy for farmers to sequester carbon on land that is only marginally suited for food production. With minimal impact on food production, this would help deliver national targets for peatlands restoration and tree planting.


$^{56}$ [https://www.4p1000.org/](https://www.4p1000.org/)

$^{57}$ [https://www.climatexchange.org.uk/media/2020/cxc-woodlands_agroforestry_policy_brief.pdf](https://www.climatexchange.org.uk/media/2020/cxc-woodlands_agroforestry_policy_brief.pdf)


$^{59}$ Gattinger, A. et al [http://www.pnas.org/content/109/44/18226](http://www.pnas.org/content/109/44/18226)

3) Investing in the development and dissemination of new agricultural technologies.

There is a wealth of emerging knowledge and technologies which are likely to get us well behind the net-zero line by 2050 (provided we take necessary action to decarbonise our economy in this half of the century). Yet, only BECCS is included in the UK CCC scenarios – arguably the least secure carbon abatement method of the ones listed below.

**Biochar** is a charcoal that can be made by heating biomass in a zero-oxygen environment, locking up the carbon from the biomass into solid char. It is a proven and low-cost technology with triple wins\(^61\) for: 1) climate mitigation: it provides long-term carbon storage, 2) agricultural productivity: it is an excellent soil improver, as it can act like a slow-release 'sponge' for water and useful soil nutrients, and 3) the circular economy: it can be made from almost any type of dry biomass, including waste materials.

Alcalde and colleagues estimated that if deployed at scale on agricultural land marginally suited for food production, this technology could sequester up to 5.5Mt CO\(_2\)e/year. Biochar could also be produced using biomass from agroforestry, short coppice rotations, and other green waste.

**Methanotrophs** are bacteria which oxidise methane from the atmosphere. They are naturally present in soils, but their activity can be hindered by certain agricultural practices, such as tillage and application of nitrogen fertilisers\(^62\). Understanding better how these bacteria work is a vital area of research, as new insights may lead to biotechnological applications that would allow us to reduce methane emissions in agriculture\(^63\).

Scottish research institutes are developing technologies to reduce methane emissions from livestock: from feed additives, to using genetics to breed low-methane cattle, many more solutions to help the livestock industry cut its emissions intensity are in the pipeline.

**Enhanced weathering** is another upcoming Negative Emissions Technology with great potential in Scotland. It involves speeding up the geological carbon cycle by spreading rock dust on farm land or beaches. Alcalde and colleagues estimated that this technology could lead to between 5 and 8 Mt CO\(_2\)e/year sequestered.

Finally, **Bioenergy with Carbon Capture and Storage**, BECCS, is another emerging technology with great abatement potential, which could be deployed later in this century to get to and stay at net-zero emissions. Scotland could develop a competitive advantage by investing in R&D for BECCS, we have considerable storage capacity and world-leading geologists.

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\(^61\) UK Biochar Research Centre: [https://www.biochar.ac.uk/what_is_biochar.php](https://www.biochar.ac.uk/what_is_biochar.php)


Concluding remarks

To sum up, ‘uncertain feasibility’ cannot hold us back in setting and delivering a net-zero target for Scotland. There is a wealth of practices and technologies already at our disposal to reduce and offset emissions, and many more on the horizon. What is holding us back, is that we are not currently implementing these tier 1 and 2 actions seriously, or across the whole sector. Mitigation efforts have so far mainly been driven by voluntary measures and learning opportunities, which have shown their limitations with low take-up & stagnating emissions.

It would be disingenuous to pretend that nothing will change for Scotland’s farmers and rural communities by 2050. In addition to the social and economic challenges linked to an ageing farming population and low farm-gate prices, the rise of flexitarian diets in recent years is already showing that the status quo on our plates will not last forever.

Scottish livestock and dairy producers will have to differentiate their produce with credible climate credentials to thrive. Some will need support to diversify their business, or retire. Our countryside will not look the same in 2050, but the change is in our hands. This is a challenge and an opportunity. It is paramount that farming communities are supported through the transition to the low-carbon economy, with commensurate investment to the scale of change required and advice from the Just Transition Commission, like other sectors which are having to adapt to the post-fossil fuels area.

Appendix 1

Tier 1

Better nitrogen use efficiency could halve N₂O emissions = -1.3 Mt CO₂e/year
Better efficiency in livestock and dairy could cut methane emissions by 20% = -0.9 Mt CO₂e/year
→ Achievable cuts by 2030 = 2.1 Mt CO₂e = 30% of total non-CO2 emissions in 2016

Tier 2

LULUCF -6 to -6.9MtCO₂e/year (Climate Change Plan)
Soil Carbon Sequestration -0.22 to -7.2Mt CO₂e/year (Alcalde et al.)
Agroforestry ?
→ Achievable yearly sequestration by 2030 (assuming we achieve 50% of technical potential range for SCS) = - 6.9 - 3.5 - ? = 10.4 + agroforestry

Tier 3

LULUCF -6.8 Mt CO₂e/year (Tyndall)
Agroforestry ?
Biochar - 0.84 to -5.5 Mt CO$_2$/year (Alcalde et al.)

EW -5 to -8 Mt CO$_2$/year (Alcalde et al.)

BECCS -4.4 Mt CO$_2$/year (UK CCC)

→ Potential yearly sequestration by 2050 (assuming we achieve 50% of technical potential range for Biochar and EW) = - 6.8 - ? - 2.3 - 6.5 - 4.4 = 20 + agroforestry

Appendix 2

Net margins & emissions intensity in beef and lamb production, figures from QMS$^{64}$

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Extensive upland suckler herds selling weaned calves

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Upland suckler herds selling yearling calves

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Non-LFA lowground suckler herds

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Rearer finisher herds

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Cereal-based cattle finishing enterprises

$^{64}$ https://www.qmscotland.co.uk/sites/default/files/cattle_and_sheep_enterprise_profitability_in_scotland_2017.pdf
Forage-based cattle finishing under 22 months

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Forage-based cattle finishing over 22 months

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LFA hill ewe flocks

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LFA upland ewe flocks

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Store lamb finishing (average only)

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**SUBMISSION FROM QUALITY MEAT SCOTLAND**

Quality Meat Scotland is the Red Meat Levy Body in Scotland and operates as a Non Departmental public Body. We are funded primarily through a statutory levy on all bovine, porcine and ovine animals slaughtered in Scotland. We use these funds to promote our world renowned Scottish Red Meat Brands and also assist the red meat sector with measures to improve profitability, efficiency and productivity whilst maintaining or enhancing our already world leading environmental and animal welfare standards.

This response will focus on the red meat aspect of Scottish agriculture, (Beef, Lamb and Pork) which make up around 38% of Scottish agricultural output. To further
emphasise the importance of animal production in Scotland, when dairy and poultry are added to the figure, animal agriculture in Scotland is responsible for 58% of total economic output at farm level. (Scottish Government figures for 2017).

Crucially, the majority of this production takes place on land which is only fit for livestock grazing, due to its soil depth, topography, rainfall or other disadvantages "enjoyed" or "endured" by around 85% of Scotland’s agricultural land.

It is far too easy to forget that agriculture is about food production and that food production is a non-disccretionary activity. It is also important to recognise the role of food production in sustaining employment in rural areas, and its contribution to the wider Scottish economy and balance of trade. The wider food and drink industry has set itself the ambition of more than doubling its turnover by 2030. Setting a net zero GHG emissions target year would have significant consequences for this ambition which is recognised on page 8 of the “Information and analysis to support discussion of the Climate Change Bill” publication. We fully support this analysis.

While considering climate change targets we also need to reflect on the targets impact on other key resources, like water and landscape, and the relationship between climate change targets and economic activity.

By reducing food production in Scotland to meet climate change targets, we are simply exporting the emissions and the economic activity associated with that production to other countries with less stringent climate policies or lower agricultural efficiencies. The risk of landscape degradation that would accompany the end, or even the substantial reduction, of livestock production in Scotland similarly cannot be ignored.

Less than 0.5% of global water consumption is drinking water. Over 60% of global water consumption is water embedded in the growing and production of our food, with livestock products being particularly consumptive, when measured on a whole of life basis.

The movement of food around the world is therefore the movement of the water embedded in that food, very often from water deprived areas to areas of plentiful water supply.

We note the UK Committee on Climate Change’s recommendation that “A net-zero target should not be set now, but the possibility to set one in the future should be allowed in the bill”. We also draw attention to the recommendation that the “overall accounting framework shift to one based on actual emissions”. We support these recommendations because of the difficulties that currently exist in estimating emissions from the agricultural sector.

The emissions from Scottish agriculture reported in the annual Scottish Greenhouse Gas Emissions Estimates have already fallen by a large percentage since 1990, but not because we are more efficient, though we undoubtedly are, and not because we have reduced our emissions per unit of production, although we undoubtedly have.
Our emissions are down because the current blunt instruments for assessing emissions from food production only measure livestock numbers and fertiliser use, and these are both markedly lower.

For these reasons we consider the system we currently have for measuring emissions from agriculture is not fit for purpose. They work on the basis of standard coefficients being applied to key agricultural indicators (e.g. stock numbers, crop areas, estimates of fertiliser use) rather than considering emissions on the basis of output. Furthermore, they do not recognise the role of grassland and crop management in the sequestration of carbon as part of the natural growing cycle.

If we used the current agriculture and food method for measuring emissions from transport for example, instead of measuring emissions at the car exhaust pipe in grams of CO$_2$ per kilometre travelled which takes account of the cars efficiency, we would simply be saying “how many cars are there?” No account would be taken of whether they were electric, petrol or diesel or V12 or 1.0 litre.

Scottish Government has the opportunity to lead the world by commissioning research from our world leading Scottish research institutes to develop a system of properly measuring emissions from food production, taking into account emission intensity as well as the availability of water, the carbon being sequestered in the growing of grass and forage on our upland livestock farms, and the conversion of inedible forage protein into high quality red meat protein through the medium of the rumen.

Until we have a much better means of assessing agricultural emissions we cannot support a move to a zero emissions target. Instead we would support the view of the Committee on Climate Change that “A target should be set now for emissions reduction of 66% by 2030 on 1990 levels” and that an “interim target for 2040 to be set at a later date as part of a review of 2050 ambition” hopefully when a better method of estimating agriculture’s emissions has been established.

If targets are to be set though we consider that at the same time a programme of detailed guidance and support will be needed to help the red meat supply chain to make its fair contribution to the target. Nevertheless, in assessing performance against targets for red meat production, and agriculture, it will be important to recognise the natural variation in animal and crop production due to climate variation, as illustrated by the climate of 2018 and its impact on livestock productivity and crop yields, and we would urge that some form of averaging is used when assessing emissions.
SUBMISSION FROM FREIGHT TRANSPORT ASSOCIATION

Logistics operators and those businesses in Scotland that operate and rely on commercial goods vehicles are an integral part of the economy who are involved in every part of the national supply chain.

From transporting raw materials for processing, last mile deliveries in our urban centres to parcel deliveries in rural Scotland, the economy and the general public depend on the efficient and sustainable movement of goods.

Because the transport industry is always evolving and looking at ways to minimise cost, reducing carbon emissions is a priority for our members.

Over 30% of the total operating costs for a 44 Ton artic lorry is fuel therefore it is obvious that as an industry, a key priority is to reduce our reliance on diesel and make the change to sustainable fuels.

The current problem for our industry in achieving net zero emissions is that there are no electric trucks in the market

- Despite promotional test models being publicly announced, electric is, in reality, not currently a viable option for heavier trucks. However, by the 2040/50 timeframe (or earlier if technology allows) this may no longer be the case.
- Prior to that, members are developing two main options: One is electric hybrid, with the vehicle capable of running in zero-emission mode for a set number of miles, enough to compete journeys in urban centres, thus exponentially helping on air quality issues. The other is gas. Depending on results from the DfT vehicle tests this year, it is hoped natural gas (both CNG and LNG) will provide suitable options through the 2020s and beyond.
- Alternatively fuelled commercial vehicles are still a niche area and are not a part of the main supply chain at present – for example gas powered vehicles currently constitute 0.4% of the HGV fleet. They also come with a significant additional cost to a standard diesel-engine tractor unit.

We do expect 100% electric to be in use by 2050 however not to have replaced the whole fleet

- It is one thing to say that all new vehicle registrations from 2050 must be zero emission but it is unrealistic to expect all existing vehicles to be zero emission by the same date
- Fleet turnover on average is 5-7 years
- This can be on average 10-12 years but can be up to as much as 15 for specialist vehicles that aren’t used regularly
- Private cars- this will target those who can’t afford to upgrade their car or those who have vintage, specialist vehicles
- In order for operators to transition to zero emission vehicles the vehicles must be
  - Available
  - Affordable - as zero emission vehicles become more commonplace and less of a niche market, this should start to happen. However, for
fleet operators, the business case for new vehicle purchases is not just based on purchase price, but payback period and residual value. Currently, the purchase price for electric vans for example are far higher than standard diesel, the payback period longer (even taking into account the reduced running costs), and the residual values uncertain. Electric vans for example are far higher, the payback p

Reliable - diesel is a trusted fuel, operators know it will perform, alternatives fuels by comparison are more unknown and a riskier option.

Practical terms and consequences or adopting a net zero change - what would it take for our industry to achieve net zero emissions?

- We expect electric to be the main alternative for lighter commercial vehicles, however the cost of procuring these vehicles is prohibitively more expensive than their diesel counterparts currently (though this should change in time).
- As well as investment in supportive infrastructure for an electric fleet, the capacity of the grid needs to be assessed in each area and upgraded where required.
- Many members who have explored making the transition to electric have reported that they have also been required to pay for the upgrade to the grid beyond their own site. It should be the responsibility of the network provider, and not the vehicle operators, to ensure there is sufficient power supply.
- Policy options to support the uptake of alternatively fuelled vehicles/zero capable emission vehicles include the roll out of alternative fuelling / powering infrastructure, and access to infrastructure such as bus lanes.
- In order for industry to transition across to alternative fuels in the medium term (i.e. 2020s), it is essential that Government provides a definition of an Ultra-low emission Truck (ULET) – the type of vehicle it is prepared to support. There is still a high level of uncertainty over the Government’s view. Therefore, manufacturers do not have certainty about what to produce, and operators do not have certainty over what to buy. The Government must set a definition so that the necessary infrastructure can be planned.

Without some form of flexibility for commercial goods vehicles with regards to vehicle emissions then we would face a market with limited supply of vehicles at higher cost. This would result in more journeys due to lower payload thus adding to congestion. The cost would also be added to the overall supply chain therefore increasing the cost for moving goods and the cost of goods for consumers. Rural regions would also suffer due to limited range and payload available if only certain types of goods vehicles were permitted for use.

Rail-

- Rail will need to transition to more environmentally friendly power sources than diesel over the very long term – possibly through progressive electrification of the network. The cost of electrification of the network has thus far proved prohibitively expensive, so development of alternative on board power sources may have to be pursued.
• The Clean Air Strategy 2018 has already outlined the Government’s plans to test alternatives for trains, looking at the viability of using alternative fuels, including hydrogen fuel cells through research.

Power for ships and planes:

• Power for ships is subject to regulation at the global level, complemented by EU (and in the future UK-only) regulation. Ships have a long service life (depending on the type and use) and turnover is slower than in the road vehicle market. The UN agency for shipping the IMO recently adopted an initial strategy to reduce greenhouse gas (GHG) emissions from shipping by at least 50% by 2050. If Scotland unilaterally moved to a zero-GHG emissions approach by the same date it would entail significant market distortion. The timescale on GHGs is driven by the fact that most ships will be using conventional fuels by this date hence air emissions will also continue to be an issue. They will be greatly reduced but not to zero.

• Planes pose a similar challenge to ships for nations looking to set challenging targets in this space. Like shipping, global rules for GHGs are set by the UN agency for aviation, ICAO, which has only recently set a global fuel-efficiency standard for new aircraft. This will apply from designs from 2020, and to aircraft type designs already in-production as of 2023. Those in-production aircraft which by 2028 do not meet the standard will no longer be able to be produced unless their designs are sufficiently modified. It is unrealistic to anticipate new zero-carbon aircraft would be available to serve the Scottish market by 2050. The trend is toward more efficient conventional fuel aircraft rather than alternative fuels, which are highly challenging to introduce in the aviation sector.

SUPPLEMENTARY SUBMISSION FROM FREIGHT TRANSPORT ASSOCIATION

Summary of FTA View

• FTA does not oppose the change, but the logistics industry meeting the consequential demands upon us for greenhouse gas emission reduction will be dependent on new technologies being developed and deployed.

• Investment in infrastructure and capacity of the grid is vital to support the change to the necessary future fleet.

• In the shorter-term congestion reduction measures would ensure the free flow of traffic and reduce costs and emissions.

• Promoting fuel efficient schemes such as LERS and Eco Stars will help operators to reduce their emissions.
About FTA

The Freight Transport Association (FTA) is one of Britain’s largest trade associations, and uniquely provides a voice for the entirety of the UK’s logistics sector. Its role, on behalf of over 16,000 members, is to enhance the safety, efficiency and sustainability of freight movement across the supply chain, regardless of transport mode. FTA members operate over 200,000 goods vehicles - almost half the UK fleet - and some 1,000,000 liveried vans. In addition, they consign over 90 per cent of the freight moved by rail and over 70 per cent of sea and air freight.

Role of Logistics

Logistics operators and businesses in Scotland that operate and rely on commercial goods vehicles are an integral part of the economy who are involved in every part of the national supply chain.

From transporting raw materials for processing, components to manufacturing centres, last mile deliveries in our urban centres, to parcel deliveries in rural Scotland; the economy and the general public depend on the efficient and sustainable movement of goods.

Scotland requires over 150 million tonnes of goods to be moved each year by HGV to be able to function – that is almost 600,000 tonnes every working day of the year. It is also important to recognise contributions from other transport modes; 8.43 million tonnes of freight was moved by rail in 2013, 56 thousand tonnes of freight were carried by air in 2015 and 44 million tonnes of freight were transported by water in Scotland in 2015, accounting for a quarter of the total of freight moved in Scotland, including exports.

Logistics and Decarbonisation

Transport is the most difficult sector to change due to the varied nature of its operation and it is always on the move. Within transport the larger the vehicle, the more problematic decarbonising becomes, as heavier vehicles require more energy load to move, which makes many alternative power sources more difficult to use. However, heavier freight vehicles are vital to reducing emissions as they are the most energy and road space efficient way of moving freight on a per tonne basis.

Reducing carbon emissions is a priority for our members and FTA is committed to helping them to make their operations greener. At our recent round of Transport Manager events, we advised members how FTA can help them to reduce their emissions, and on the 29 November we are hosting a Realities of Going Green event, which will help operators understand the governments Road to Zero document and the low emission alternatives available to them.

FTA manages the Logistics Emissions Reduction Scheme which is an industry led, voluntary scheme focusing on recording, reporting and reducing emissions from freight operations. The scheme currently represents 133 members, who account for 87,929 commercial vehicles (heavy goods vehicles and vans), and represents a broad range of sectors and vehicle fleet sizes. In 2017, members achieved an
impressive 4 per cent reduction in their CO₂ emissions, reducing their average kg of CO₂e per vehicle km to 0.72, down from 0.75 in 2016 and 0.76 in 2015. Whilst the 2016 and 2017 figures for industry as a whole are not yet available, it is clear that LERS member average emissions are close to 13 per cent lower per vehicle km than the industry average.

**Figure 5: Emissions per Vkm for Industry vs. LERS members**

Scheme members have utilised multiple emission reduction measures to ensure they are operating as efficiently as possible;

- Investing in fuel efficient driving training courses for their drivers,
- Monitoring their drivers behaviours via telematics
- Appointing an efficiency champion to optimise route planning
- Tyre management processes
- Aerodynamics such as boat tails, side skirts and body deflectors to reduce vehicle drag and improve performance
- Members are continuously trialling alternatively fuelled vehicles and technologies
- Implementing modal shift where possible in their operations, rail and water freight deliver significant carbon savings

**FTA Response**

Whilst we are not opposed to increasing the 2050 target from 80 per cent to 90 per cent, it is important to recognise that all targets are demanding and in order for industry to achieve them, they must be realistic and workable with the technology available.

We anticipate over the next five to ten years, that electric will become the primary alternative for vans and lighter commercial vehicles. Whilst electric currently isn’t an option for heavier vehicles, we anticipate there could be a hybrid electric alternative developed for heavier vehicles, which would enable zero emissions in city centres,
with the added range extender fuel. The UK Department for Transport are currently developing a definition of an Ultra-Low Emission Truck, once agreed this will provide the fundamental requirement for industry, without it manufacturers and technology developers will not be able to build the next generation of heavy goods vehicles. The definition is also expected to inform policy decisions when deciding the standards for Low Emission Zones.

We also anticipate that rail and water to play a bigger part within the supply chain, as both can offer significant carbon and emissions savings and a reduction of road miles.

Looking ahead to 2050, all road vehicles will be zero emission capable, whilst other modes will working towards significantly reduced levels of emissions, ensuring the least amount of energy is required to maximise efficiency and reduce emissions.

**What is needed from Scottish Government to enable transport to change**

1. **Current efficiency**

**Manage Congestion**

The single most important measure when reducing emissions is to reduce congestion, ensuring all available road space is utilised to maximum capacity and enabling the free flow of traffic. This can be improved by reviewing one way systems, synchronising traffic lights, and ensuring efficient use of road space between all road users. Stop-start traffic has a significant impact on fuel consumption, emissions and air quality. According to information supplied to FTA by manufacturers, if you compare an HGV travelling at 30mph that stops three times a mile, then gets back up to speed, and one that just cruises at 30mph, you see a tripling of emissions. Therefore, any reduction in congestion will have very significant positive effects on emissions - both air quality and carbon.

It is vital to judge a vehicle by what they are doing, whilst an electric van is capable of zero emissions, it is not always the most efficient use of road space. A medium sized heavy goods vehicle can carry as much as 10 vans and the larger heavy vehicles can carry the equivalent of 25 vans. If heavier vehicles were banned in favour of vans, or forced to distribute their loads onto multiple electric vans, congestion will be significantly increased, and so will emissions.

FTA supports any improvements made to cycling infrastructure and public transport, in particular the intention to improve safety for cyclists and to encourage more people to switch from private cars to bikes or buses. There is also the potential for improved infrastructure to increase the use of cycles for deliveries, though this will only ever be a somewhat niche activity, not a replacement for motor vehicles en masse.

However, it is essential that a sensible balance is achieved between the needs of different road users so that best use is made of limited road space. FTA’s areas of concern are twofold: access to the kerbside for deliveries and servicing activity and potential increases in journey times.
Promoting energy efficiency

Whilst switching to alternative fuels will yield significant emissions savings, it is not currently a viable option for all vehicles and there are still savings to be achieved through fuel efficiency. The Euro VI truck has achieved 80-90 per cent reduction in NO\textsubscript{x} and PM emissions compared to Euro V. Fuel efficient driving and the fitment of aerodynamic technologies can also further improve a vehicles diesel efficiency and schemes like the Logistics Emissions Reduction Scheme and Eco Stars both aim to help fleet operators improve their efficiency, reduce fuel consumption and emissions. By promoting these schemes, more operators will receive guidance and support on how to make their operations greener.

Support Mode Shift – rail and water

Transporting goods by rail and water significantly reduces HGV road miles. Every freight train able to carry the same amount as up to 60 HGVs, and on average a gallon of fuel will move a tonne of goods 246 miles on the railway compared to 88 miles by road. Rail delivers substantial savings in fossil fuel, CO\textsubscript{2} emissions and is also beneficial to local air quality and road congestion. Massive efficiency can also be achieved through use of waterways where possible. However, it is important to note that the vast majority of urban freight is carried by road due to its ‘to the door’ nature.

FTA would be supportive of any developments to make rail a more cost-effective option to enable more freight to shift from road to rail. However, these must be realistic. Rail freight is more efficient over long distances, but in urban areas, which tend to be congested, rail freight has to compete for access with passenger trains.

2. Future efficiency

Alternative fuels

The government are currently running the Gas Truck Trial to establish the best performance understanding of the latest range of gas powered heavy goods vehicles to see if they perform any better than earlier models. The test is due to conclude in March 2019, depending on the results, the test could confirm if gas will provide an alternative to diesel until electric technology has been developed. Supportive refuelling structure would need to be strategically positioned in order to support the future generation trucks.

Electricity supply for electrification

Many operators are looking to utilise cleaner vehicles in their operations, however the lack of supporting infrastructure is still one of the primary barriers to the uptake of these vehicles. Members who have invested in electric vans, have also invested in electric charge points at their depots to support the vehicles. However, there is then the issue of the potential additional cost of upgrading the electrical grid to ensure there was sufficient energy supply. Our members are unwilling and unable to pay to upgrade someone else’s infrastructure.
Many van operators park their vehicles at home, and not all have the advantage of a personal off-road parking space. Further investment is needed to support those vans which are parked on street overnight.

**Priority access to infrastructure for Ultra Low Emission Vehicles**

To incentivise the uptake and use of alternatively fuelled Ultra Low Emission Vehicles, what is currently bus-only infrastructure and signalling could be opened up cleaner heavy goods vehicles. By offering the use of bus lanes outside of commuting peak hours for example, would further reduce the stop-start driving caused by congestion and could encourage more operators to use cleaner delivery vehicles within city centres.

**Tax incentives**

The purchase price of electric vehicles ranges between six to ten times more expensive than a standard diesel-engined van. Whilst costs are improving, there is still work to be done in order for these vehicles to be more commercially viable. Businesses will need financial support in order to invest and will need to be incentivised to make the change, rather than penalised.

**Planning support**

The absence of supporting infrastructure is also key barrier limiting the uptake of alternatively fuelled vehicles. So, support for the installation of electric vehicle charging facilities (for smaller commercial vehicles) and gas fuelling (for heavier) would be welcome. Consideration must also be given to van drivers who take their vehicles home and have no access to off road parking. Refuelling infrastructure would need to be strategically placed in order for it to be effective and would be dependent on the types of vehicle servicing an area.

Allowing some deliveries to take place at night will remove some delivery vehicles off the roads during peak hours. The key determinant for freight is service, and is dictated by the customers’ requirements, so whilst this may not be a solution for all delivery vehicles allowing some flexibility will be beneficial to many operations. Assessment of all vehicles servicing an area will enable successful delivery planning and ensure all road space is being used as efficiently as possible.

**SUBMISSION FROM ROAD HAULAGE ASSOCIATION**

The Road Haulage Association’s (RHA) members and the haulage industry in general operate fleets of vehicles for hire & reward, moving goods for profit and maintaining supply chains across all sectors. In order to continue to remain complaint and to for the industry to survive and flourish haulage companies have traditionally been early adopters of the latest and best technology. This has been clearly evidenced in the adoption of telematics and management systems, looking for greater efficiencies for the substantial investment required to maintain and improve their fleets.
By continuing its natural progression of fleet renewal and purchasing the latest & best technology, hauliers are now operating some of the cleanest vehicles on Scotland’s roads. Speedier reduction in their environmental footprint would potentially require a move away from diesel, to largely unproven & untested technology. When these businesses commonly operate on margins of two to three percent, a move towards unproven and expensive technology with little or no idea of return on investment figures, it is no surprise that appetite for change does not match Government expectations.

Unlike the bus fleet, there is no approved retrofit option for HGVs on the Commercial Vehicle Retrofit Accreditation Scheme (CVRAS) meaning upgrading to a new truck is the only alternative for hauliers who wish to futureproof their fleet in line with muted targets.

Without retrofit options hauliers are forced to buy new in order to comply with low emission zones. The cost of a new a brand-new Euro VI diesel HGV, is in excess of £120,000. For many SMEs to even contemplate this financial outlay means having to sell on their old Euro V or IV trucks but the knock-on effect of not being able to operate Euro IV or V vehicles in city centres without penalty means they are now worthless in the second-hand market. We are already seeing this effect, making it extremely difficult for smaller hauliers to upgrade their diesel fleet to compliant levels, never mind to new & untested fuel.

There are small scale cases where fleet operators are trialling LNG solutions. To date these have mostly been by companies, such as John Lewis / Waitrose who only move their own goods and so the economies of scale are much easier to justify. For small companies moving goods commercially the risk is much higher. Refuelling infrastructure for larger vehicles is not readily available across the UK and so the cost of building your own must be added to any set up costs. One of our members who trunks goods North / South has done this and is reporting efficiency savings operating a fleet of no more than 3 vehicles.

There are several specialist haulage operations that it will be particularly difficult to envisage being hauled by a carbon free fuel.

For example, Special Types regulations allow vehicles to operate above the weights & dimensions as set out in Road Vehicles (Construction and Use) Regulations 1986 and Road Vehicles (Authorised Weight) Regulations 1998. These are set out in 3 categories;

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<th>Category</th>
<th>Maximum gross vehicle weight (kg)</th>
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In addition to Special Types & these Abnormal Loads, the vehicle recovery sector heavily relies on diesel to complete their day-to-day activities. Not only do the engines power the vehicles, but also the towing equipment.

It is unlikely that the current options of alternative fuelled vehicles will have the capability to operate at these weights & dimensions. Likewise, the concept vehicle types that are being launched, are also not capable of operating at 150 tonnes or lifting & towing a vehicle. It will require a quantum leap of development to electric & gas-powered vehicles for these parts of the industry to adopt them and Scotland’s vehicle fleet be truly carbon neutral.

Given the flammable nature of EV’s and the recent pictures media pictures of a Tesla on fire would it at this stage be safe to allow hazardous materials to be hauled by EV’s? Currently our industry moves nearly all of our Armed Forces nuclear products by road. We also moved a high proportion of whiskey, gas and fuel by road in tankers. These are considerations that hauliers must take in to account when making business decisions, and the safety of its workforce and other road users is the primary concern.

We agree with the Governments statement that consolidation centres within the supply chain will play a role in reducing emissions in City Centres, but we question the Governments definition and understanding of how consolidation centres will work. Consolidation centres are not a panacea. We do not believe that operating a shuttle service of electric vans from CC to delivery point is more efficient or safe than allowing HGVs access to the now heavily protected city centre environment. How could the movement of construction materials, plant and soil transfer take place without HGV’s? Surely in the interim period as we all strive to achieve net-zero emissions, this will add to congestion, and increase pollution? It also must have a knock-on effect to the flexible 24-hour supply chain we’ve all become accustom to.

There are many examples of consolidation across the haulage industry which already achieves better efficiency. For example, the pallet network, where anyone can have a pallet picked up, by a lorry already carrying several other pallets and delivered overnight. Likewise, the development of “local” supermarkets. In this model, supermarkets or hauliers will deliver products to a selection of stores and return to an out of city distribution centre with the spare cardboard from a previous delivery. This limits empty running, services more than one store with one truck and is not possible with smaller vehicles.

Thus far there has been very little investment in the training of mechanics for our industry. As this carbon free technology develops, will the country have mechanics to properly maintain and repair these vehicles? This is vital to the continuing safety of our roads and the professionalism of the road haulage industry.

I hope the committee will find this information useful and it goes some way to highlighting the problems & concerns hauliers have decarbonising their fleet. If the
committee would require any clarification, or further communication with the RHA, please do not hesitate to contact us.

**SUBMISSION FROM CYCLING SCOTLAND**

Cycling Scotland welcomes the opportunity to contribute to the Committee’s call for evidence. Our key points are:

- The role of cycling and active travel should be recognised as zero-carbon option to help deliver the current targets and the aspiration for a net-zero emissions future.

- Although technology has a role to play, it should not be relied upon too heavily to achieve emission reduction targets.

- Reporting of targets should be in percentages, and annual targets should align with interim and long-term targets to ensure consistency.

- Climate Change Plans should be consistently published and clearly outline actions to reduce emissions and improve air quality, including a focus on cycling (and active travel).

- Cycling Scotland offers to use the Cycling Potential Tool to model emissions savings for a defined/specifie area from realising the cycling potential.

Cycling Scotland is the nation’s cycling organisation. Working with others, we help create and deliver opportunities and an environment so anyone anywhere in Scotland can cycle easily and safely. Our vision is for a sustainable, inclusive and healthy Scotland where anyone anywhere can enjoy all of the benefits of cycling.

**Provisions to set a Net Zero Emissions target in the future and increasing the 2050 target to 90% reduction from the baseline**

We welcome the ambition in the Bill to work towards net-zero emissions. To help achieve this, greater emphasis on cycling and active travel is needed, as zero-carbon options. Targets should be accompanied by policies and initiatives that will help achieve the targets such as the promotion of cycling and active travel, and behaviour change to facilitate modal shift.

The latest figures show that emissions from transport are increasing, with transport now accounting for more than 37% of total greenhouse gas emissions in Scotland. This represents a 7% increase from the 1990 baseline65. Road transport specifically is the largest source of emissions in Scotland. Using bikes to replace short car journeys and for city trips gives the greatest savings in emissions. Stop-start driving and short-trips (where the engine does not have time to warm up properly) results in more fuel being burnt less efficiently and thus a higher level of emissions. In Scotland, the latest available figures show that 61.4% of car journeys are less than 5

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km\textsuperscript{66, 67}, offering a real opportunity to switch to cycling, and have a significant impact on reducing transport’s contribution to carbon and other greenhouse gas emissions.

To achieve the emissions reduction required to meet these targets, and work towards net-zero, the transport sector should not rely too heavily on fuel efficiency and technology improvements, which cannot be guaranteed and may not deliver the pace of change required. Indeed, electric and other low emission vehicles still contribute to particulate matter emissions, through braking and tyres, which arise almost exclusively from vehicles. This has implications with regards to the focus on decarbonising cars and electric vehicles to reduce emissions, as they still represent traffic and such issues would remain even with these vehicles generating less exhaust emissions.

As a minimum, the target for 2050 should be 90% reduction, with incremental increases towards this, as outlined in the Bill. As the Scottish Government met its 2020 target to reduce emissions by 42% six years early, this provides an opportunity to set more ambitious targets, and demonstrates that targets can be met.

**Annual targets: 2021 to 2049 (moving to expression in percentages)**

As outlined in our response to the Scottish Government’s consultation on the Climate Change Bill, we welcome the decision to move the expression of annual targets to percentages. Percentage reductions are easier for everyone concerned to understand, and arguably more so by members of the public, who are crucial to get on board, if targets are to be achieved and be more intuitive, as their travel behaviours will have a significant impact on emissions from transport. Percentages can also be more easily tracked from one year to the next, and are easier to monitor if on track to meeting the targets. Further, it will help improve consistency of monitoring and measuring targets longer-term.

Further, annual targets should reflect and be a step towards achieving interim and long-term targets, and so should be set as a direct consequence of these. Targets set on the basis of actual emissions are more accurate and more realistic, and can be used to measure if targets are achievable.

**Publication of targets**

Targets should to be published consistently, so progress towards them can be measured and tracked over time. With regards to this, progress towards targets should be published annually, as this helps improve accountability and also further assists with tracking and monitoring.

Reporting of greenhouse gas emissions reductions should include details on all types of greenhouse gases by sector and align with the sectors outlined in Section 2 (C) E of the Bill, and also by greenhouse gas type, to track areas of action required such as transport.

\textsuperscript{66} Transport Scotland (2017) Travel and Transport in Scotland 2016, page 49
\textsuperscript{67} Car journey includes both driver car and passenger car journeys
Climate Change Plans

In our response to the Scottish Government’s consultation on the Climate Change Bill, we agreed with the proposals that the current frequency of 5 years for Climate Change Plans is appropriate as this provides enough time for evidence and actual progress towards targets to be identified and measured, and properly reported. Each plan should be focused on the time period it covers. However, there should be an annual publication of key targets and progress towards them, to accompany the Plan(s), through annual progress reports for example.

Regarding the number of days given to Parliament to review and approve Plans, in the aforementioned consultation, we agreed with the recommendation that the period of time for Parliamentary scrutiny should be 120 days. As this is not proposed in the current Bill, we welcome reference to 90 days in the Bill and believe this should be set as a minimum number of days required.

Other

Cycling Scotland operates a Cycling Potential Tool which can model emissions savings for a defined/specified area from realising the cycling potential. Going forward, we offer to use this Tool to help contribute to further evidence gathering and in any discussions on how the cycling potential tool can be incorporated more into decision making, strategic thinking, and monitoring around emissions reduction targets. We believe the Tool is of particular relevance to the Climate Change (Emissions Reduction Targets) (Scotland) Bill and ensuring that investment in cycling is prioritised where it will have the greatest impact, with regards to cutting emissions.

SUBMISSION FROM TRANSFORM SCOTLAND

About Transform Scotland

We are Scotland’s alliance for sustainable transport. We campaign for walking, cycling and public transport to be the easiest and most affordable options for everyone. Our diverse membership brings together public, private and third sector organisations from across Scotland. We are a registered charity, politically independent and strictly science-based. We are a registered Scottish charity (SC041516).

Scope of our evidence

Our evidence is limited to the Committee’s call for “ideas and views on what actions and behaviour change will be required of individuals and organisations if Scotland is to meet more ambitious climate change targets.”

In this, we repeat evidence provided to the Parliament regarding its scrutiny of the most recent iteration of the Climate Change Plan (i.e. RPP3). In this, we stress the overall lack of ambition in the Plan, which highlights the ample room for further action on reducing emissions from transport (the largest single source of emissions, yet the sector where there has been almost no progress in reducing emissions).
We do not in this evidence comment on the detailed aspects of the Bill itself, not least as we expect that a number of our member organisations (e.g. Friends of the Earth Scotland, RSPB Scotland and WWF Scotland) will providing evidence on these matters. We would be happy to be associated with the views expressed by these organisations on the Bill, and, in particular, we would be happy to endorse the views of Friends of the Earth Scotland that (i) a target should be set for emissions to be cut by 77% by 2030 (on a 1990 base), and (ii) that there should be net-zero GHG emissions target for 2040.

We would advise the Committee that there is ample expertise within Scotland on reducing emissions from the transport sector, and we would be very pleased to advise the Committee regarding witnesses that it might want to call as part of its scrutiny of the Bill. Indeed, given the almost complete failure of progress in reducing emissions from the Scottish transport sector, the Committee may even want to consider holding a specific inquiry into this matter.

Introduction

As a result of decades of inaction, carbon emissions from transport have barely fallen since 1990. Indeed, transport is now the largest source of greenhouse gas emissions in Scotland, accounting for 28% of national emissions. The Climate Change Plan (hereafter CCP) set out a number of Policies and Proposals to reduce carbon emissions from transport. However, Transform Scotland has serious concerns that the actions set out in the CCP fail in multiple areas and rely too heavily on the use of private cars.

Opportunities for Greater Ambition 1: Transport in the CCP focused nearly exclusively on private car use

As stated by the Committee in its 2017 report to the Scottish Government,68 the draft CCP failed to set out Policies to deliver a modal shift to sustainable modes of transport. Reducing the number of journeys made by car is a National Indicator of the Scottish Government -- but one upon which it is currently failing to make progress. Too many of the Policies and Proposals in the CCP are based on the assumption that current modal trends will remain the same in the future. It is highly inconsistent to base many of the Policies in the CCP on electrifying private cars, as this will do nothing to achieve the Government’s National Indicator to achieve a modal shift to active travel and public transport. The REC Committee, in its report, called on the Scottish Government to set out Policies in the CCP to increase bus use, and to specify how the Government’s target of 10% of journeys to be by bike by 2020 will be met.

Opportunities for Greater Ambition 2: The CCP ignored the multiple co-benefits offered by sustainable transport

As well as reducing carbon emissions, active travel (i.e. walking and cycling) and public transport deliver multiple social, economic and environmental benefits. Increasing rates of walking and cycling has huge potential to improve physical and mental health, as well as reducing congestion and air pollution. Likewise, buses play a key role in alleviating congestion and air pollution, particularly in urban areas. Buses are also a major contributor to sustainable economic growth, with two of the world’s large bus operators being based in Scotland (FirstGroup and Stagecoach), as well as a world leader in the manufacturing and production of low-carbon buses (ADL). Furthermore, walking, cycling and public transport are disproportionately used by people on lower incomes, offering a vital means of accessing services and employment. However, the CCP failed to acknowledge these multiple wider benefits delivered through public transport and active travel, and instead focused nearly exclusively on private cars.

**Opportunities for Greater Ambition 3: Transport ‘Policies’ were based on flawed and unrealistic assumptions regarding traffic growth**

It is clear that the outputs from the TIMES model have been reached through flawed and unrealistic assumptions regarding traffic levels. Almost all of the Policies and Proposals for reducing carbon emissions from transport appear to have been based on Transport Scotland’s forecast of a 27% increase in private car use by 2035. Given that vehicle use increased by less than 5% between 2004 and 2014, this forecast is vastly inconsistent with current traffic trends. It appears that the outputs from the TIMES model are nearly all centred around private cars, with almost no attention given to Policies to achieve a modal shift away from private car use. The clear failure of the inputs used for the TIMES model raises serious questions regarding both the forecasting used by Transport Scotland, and the process undertaken by the Scottish Government to set out the Policies and Proposals for transport in the CCP. We were pleased to see that the ECCLR Committee, in its 2017 report, also raised concerns regarding the assumptions made when calculating traffic growth forecasts in the CCP.69

**Conclusion and recommendations**

The Climate Change Plan (RPP3) failed to set out Policies and Proposals which deliver wider benefits for Scotland, with nearly all actions focused on private car use. It appears that this is the result of serious misjudgements made in traffic forecasting models, with a failure to adequately consult external stakeholders regarding these forecasts. Whilst the draft CCP sets out reasonable carbon reduction targets for transport, it was a missed opportunity to deliver wider benefits through active travel and public transport, such as reduced congestion, improved air quality, improved public health, and equalities.

As such, there is ample opportunity for greater ambition in reducing emissions from the transport sector, by amending RPP3 to include Policies which:

- Focus on traffic demand reduction.
- Achieve a modal shift away from private car use to walking, cycling and public transport.

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• Incentivise bus use and reverse the decline in bus patronage.
• Achieve the Government’s target for 10% of journeys to be by bike by 2020.

SUBMISSION FROM PATHS FOR ALL

General Comments

We welcome the opportunity to submit our views to the Committee. Our comments are limited to those aspects that have direct relevance to the work and objectives of Paths for All. We would be delighted to offer more information if required.

We welcome the Bill – there is a need for major steps to reduce emissions and limit the effects of climate change. In our area of interest, transport, behaviour change and planning are most relevant. The Bill itself makes technical changes but does not focus on specific policies – this leaves the risk of little action being taken to tackle transport.

We need strong targets on carbon emissions, with specific reference to the need to increase efforts to cut carbon emissions from transport. However, the Climate Change Bill should not be restricted solely to targets and accounting measures, but should include policies to cut our emissions. There is also a need to ensure that future finance budgets are consistent with climate targets.

Sustainable Travel

Transport became the single biggest source of emissions in Scotland for the first time in 2017, accounting for well over a quarter of emissions. It is the sector that has made least progress in cutting emissions.

Transport measures that we have recommended should be implemented to reduce both climate and air pollution emissions:

• Support and fund local authorities to create Low Emission Zones
• Invest 10% of the transport budget in safe, dedicated walking and cycling infrastructure.
• Improve bus services – walking makes up part of most travel by public transport. Bus use is in decline.
• Legislate to reduce the default speed limit in urban areas from 30mph to 20mph to support clean air, safe streets, reduced traffic and help social cohesion.

The additional health and social benefits associated with increased active travel are very significant. Increased walking and cycling will bring multiple benefits to our health, environment and economy.

Levels of walking for travel are currently stable and not increasing significantly (unlike recreational walking which has increased for the last five years). Making walking, cycling and public transport (usually encompassing walking as well) attractive options is key to encouraging less car use. There will need to be an
increase in resources to meet active travel aspirations - to that end we welcome the recent increase in the Scottish Government budget for active travel.

Active Travel

Our vision is for walking and cycling to be the natural choice for short journeys, creating a healthier, socially inclusive, economically vibrant, environmentally friendly Scotland.

Active Travel is about improving quality of life and quality of place. And with over 50% of all driven journeys in Scotland being less than 5km, and 26% less than 2km, there is plenty of scope for achieving a significant shift to walking and cycling as the most sustainable forms of transport.

Background

Paths for All is a Scottish charity founded in 1996. We champion everyday walking as the way to a happier, healthier Scotland. We want to get Scotland walking: everyone, everyday, everywhere.

Our aim is to significantly increase the number of people who choose to walk in Scotland - whether that's for leisure or walking to work, school, the shops or to a nearby public transport hub. We want to create a happier, healthier Scotland where increased physical activity improves quality of life and wellbeing for all. We work to develop more opportunities and better environments not just for walking, but also for cycling and other activities, to help make Scotland a more active, more prosperous, greener country.

Our work supports the delivery of the Scottish Government’s Active Scotland Outcomes Framework, National Walking Strategy and the Long-term Vision for Active Travel in Scotland, community and workplace health walking, path network development and active travel policy development. We are a partnership organisation with 29 national partners. Our funders include the Scottish Government, Transport Scotland, Scottish Natural Heritage, Macmillan, The Life Changes Trust and Awards for All.

If we want to get significant numbers of people more active, then walking is of overwhelming importance – as both a recreational activity and as part of everyday life. This is particularly the case if we want to get inactive people more active.

We have no objections to our comments being made public and would be pleased to discuss any points we have raised.
SUPPLEMENTARY SUBMISSION FROM PATHS FOR ALL

General Comments

We welcome the opportunity to submit our views to the Committee. Our comments are limited to those aspects that have direct relevance to the work and objectives of Paths for All. We would be delighted to offer more information if required.

We welcome the Bill – there is a need for major steps to reduce emissions and limit the effects of climate change. In our area of interest, transport, behaviour change and planning are most relevant. The Bill itself makes technical changes but does not focus on specific policies – this leaves the risk of little action being taken to tackle transport.

While we are not experts in carbon accounting and target setting we do consider that there is a need for strong targets on carbon emissions. We would therefore support the increased target of a 90% reduction and believe there is a good case for increasing this to 100%.

We consider that there must be specific reference to the need to increase efforts to cut carbon emissions from transport. However, the Climate Change Bill should not be restricted solely to targets and accounting measures but should include policies to cut our emissions. There is also a need to ensure that future finance budgets are consistent with climate targets.

Transport and climate change

Sustainable Travel

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- Invest 10% of the transport budget in safe, dedicated walking and cycling infrastructure.
- Improve bus services – walking makes up part of most travel by public transport. Bus use is in decline.
- Legislate to reduce the default speed limit in urban areas from 30mph to 20mph to support clean air, safe streets, reduced traffic and help social cohesion.

Electric vehicles are often portrayed as the solution to transport carbon emissions and other traffic related issues. We do not believe that to be the case - policies must also focus on people switching from motorised vehicles to walking and cycling alongside a shift to cleaner vehicles and public transport.
It will be necessary for significant modal shift to more sustainable options – not just “greening” what we currently do. To achieve this, we will need to rethink how we plan and design the places where we live and work – links between planning and transport policy need to be strengthened urgently. The beauty of this is that we can address climate targets and achieve a range of additional benefits – creating better places for people.

**Active Travel**

Our vision is for walking and cycling to be the natural choice for short journeys, creating a healthier, socially inclusive, economically vibrant, environmentally friendly Scotland. A shift to more walking and cycling is needed to achieve carbon emission targets.

Active travel is about improving quality of life and quality of place. And with over 50% of all driven journeys in Scotland being less than 5km, and 26% less than 2km, there is plenty of scope for achieving a significant shift to walking and cycling as the most sustainable forms of transport.

The additional health and social benefits associated with increased active travel are very significant. Increased walking and cycling will bring multiple benefits to our health, environment and economy.

Levels of walking for travel are currently stable and not increasing significantly (unlike recreational walking which has increased for the last five years). Making walking, cycling and public transport (usually encompassing walking as well) attractive options is key to encouraging less car use. There will need to be an increase in resources to meet active travel aspirations - to that end we welcome the recent increase in the Scottish Government budget for active travel.

The potential of active travel to contribute to carbon reduction is frequently under-represented in policy. We believe that increased active travel levels will be needed to reach ambitious carbon targets. As well as being important in the context of climate, increased walking and cycling will bring multiple benefits to our health, environment and economy and will also help change perceptions of where, why and how people travel.

The National Walking Strategy is key to promoting and sustaining increased levels of walking with the Cycling Action Plan for Scotland the equivalent for cycling. More resources will be needed to meet the aspiration of increased levels of walking and cycling and we therefore commend recent increased funding for active travel from the Scottish Government.

**Active travel and public transport**

Active travel and public transport are intricately linked, particularly for pedestrians. Virtually every trip by public transport involves walking at some stage. Buses are particularly important given the number of people that use them and the range of communities they serve. 76% of all public transport journeys are by bus.
Bus travel is already the lowest carbon-per-passenger-mile form of motorised transport. Clean bus technology is well ahead of car, truck and ferry technology.

However, over the last ten years bus routes have reduced by a fifth and fares have increased by 50%. Some areas, including many rural areas are poorly served by buses. This can prevent people accessing basic services, cause social isolation and increase inequality. Many people suffer from “transport poverty” due to a lack of affordable transport options.

The whole experience of using public transport and active travel needs to be more enjoyable. This means better buses but also better bus stops and shelters and better information – such as real-time timetables and journey planning and live service updates - and smart or integrated ticketing. Edinburgh and the Lothians are widely held as a good example of what is possible in delivering a quality bus service and, while by no means perfect, offer a model for a better approach in other areas.

We would like to see a better, fully-integrated, accessible and affordable public transport network for everyone in Scotland alongside promotion of active travel. We therefore would support an approach to ownership and franchises that acts in the public interest and enables the improvement of the public transport network, improving reliability and reducing fares.

**Behaviour change**

Walking is key to getting more people choosing to not use the car as it is ideal for shorter trips - and walking forms part of much public transport use – walking to and from buses, trams and trains. Positive impacts include:

- Reduced congestion
- Reduced air pollution
- Higher quality public realm
- Better physical, mental and social health

Those walking and cycling tend to spend more money locally than drivers. Increasing walking and cycling can stimulate economic growth in urban areas and benefit local shops. Investing in infrastructure and support for walking and cycling can increase economic growth and vibrancy.

Attractive and well-designed streets and places encourage people to travel actively. Increased walking and cycling also make for safer, more appealing public spaces. With less motor traffic, people interact more and feel a greater sense of community. The Glasgow Centre for Population Health (GCPH) has done excellent relevant work on active and sustainable travel in the context of Glasgow and public health.

In our experience, the top 5 “must haves” for walking infrastructure are:

- Well maintained streets, paths and public spaces – including level, smooth surfaces that are fully accessible, fit for purpose and with reduced street clutter;
- Information on walking routes to key destinations and places to walk, including more paths with signage;
• Seating, public toilets and good lighting, as a minimum provision in a high-quality, person-centred public realm;
• Safe places to cross roads with pedestrians given priority at signalized crossings;
• Vehicle speeds limited to 20mph.

Relative priorities will depend on location – the Place Standard Tool and Street Audits are good ways of exploring this.

Infrastructure is important, but people also need encouragement to take up active travel. Smarter Choices, Smarter Places (SCSP) is Paths for All’s behaviour change programme, grant-funded by Transport Scotland. It aims to get more people walking, cycling and using public transport as part of their everyday travel to make Scotland a healthier, happier country.


Success Stories: www.pathsforall.org.uk/active-travel/at-success-stories

Background

Paths for All is a Scottish charity founded in 1996. We are a partnership of 30 national organisations who share our vision for a happier, healthier Scotland. We want to get Scotland walking: everyone, everyday, everywhere.

Our aim is to significantly increase the number of people who choose to walk in Scotland - whether that's for leisure or walking to work, school, the shops or to a nearby public transport hub. We want to create a happier, healthier Scotland where increased physical activity improves quality of life and wellbeing for all. We work to develop more opportunities and better environments not just for walking, but also for cycling and other activities, to help make Scotland a more active, more prosperous, greener country.

SUBMISSION FROM SUSTRANS

Introduction

Sustrans Scotland is the charity that’s enabling people to travel by foot or by bike for more of the journeys we make every day.

This submission does not comment on the ambition or extent of emissions reduction targets. This submission is in response to the Committee’s request for views on what actions and behaviour change will be required if Scotland is to meet climate change targets.

Electric vehicles are too often seen as the single solution to transport’s major contribution to carbon emissions. It is the view of Sustrans Scotland that there is a level of ambition and expectation attached to the uptake of electric vehicles that is
not shared with walking and cycling despite the potential for “comparable impacts” on carbon reduction. ⁷⁰

**Walking and Cycling necessary to achieving carbon targets**

In order to achieve proposed carbon reduction targets, Scotland will need to rely more heavily on the potential carbon reduction offered by switching journeys from motorised vehicles to walking and cycling. Recent research indicates that policies centred on electric vehicle promotion alone will not be sufficient for Scotland to meet emission reduction targets for the transport sector. ⁷¹

In addition to current policies to promote electric vehicle uptake, significant lifestyle change will be needed that includes increases in walking and cycling, public transport use, and policies to restrict private car access to urban centres and reduce the need to travel. ⁷²

The potential of active travel to contribute to carbon reduction is frequently underrepresented in climate policy. A study conducted by the European Cyclists’ Federation found that if EU countries were able to replicate Danish levels of cycling, this would ‘achieve 12 to 26% of the [EU] 2050 target reduction set for the transport sector, depending on which transport mode the bicycle replaces’. ⁷³

Sustrans Scotland’s response to the consultation on the Climate Change Bill in September 2017 outlined how a 10% cycle mode share would lead to a 55,000 tCO₂e reduction in emissions, equivalent to a quarter of the proposed reduction in carbon emissions for transport between 2019 and 2020. ⁷⁴

A greater proportion of journeys being made by active travel means less need for vehicles and, over time, vehicles numbers can be reduced. This would make a transition of vehicle fleets to electric easier to achieve as there are fewer vehicles to replace. Additionally, there is lower demand for energy if there is lower motorised vehicle usage. Combining increases in both active travel and electric vehicles leads to modelled transport sector emissions 43% lower than expected under the current proposals, with no extraordinary assumptions about uptake of active travel. ⁷⁵

**Walking and Cycling for earlier carbon reduction**

Climate change demands cuts in carbon as quickly as possible. Compared to the time taken to decarbonise transport emissions from vehicles, increasing active travel can yield reductions in carbon emissions more quickly.

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⁷¹ Ibid
⁷² Ibid
The Scottish Government projects it will take until at least 2030 to phase-out half of fossil-fuelled vehicles from urban environments.\textsuperscript{76} Even then the electricity used to charge them will not be carbon neutral. Though the target is for half of Scotland’s heat, transport and electricity needs from renewable sources by 2030, only a 28% reduction in carbon emissions from the electricity generation is expected by 2032.\textsuperscript{77,78}

A 12% reduction in carbon emissions by 2030 is a reasonable expectation for active travel; an amount only matched by transition to electric vehicles by around 2050.\textsuperscript{79} This has an added benefit of the potential to cut yearly emissions sooner, multiplying the impact.

Conclusion

The greatest carbon reduction is achieved by pursuing both increases in walking and cycling and increases in the proportion of vehicles that are electric. This response has outlined evidence that increases in active travel will be necessary to achieve ambitious targets, and the potential of active travel for reducing carbon emissions sooner.

The Scottish government deserves credit for the commitment to phase out fossil fuel vehicles and for doubling the active travel budget to £80 million per year.\textsuperscript{80} This funding should be maintained and increases considered, especially to help local authorities with match-funding requirements.

Scotland also has strong complimentary active travel policies, and policy to support transport targets should include promotion of measures which support uptake of active travel, including default 20mph speed limits on all residential or restricted roads and reducing the access of private cars to urban centres.

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In order to achieve proposed carbon reduction targets, Scotland will need to rely more heavily on the potential carbon reduction offered by switching journeys from motorised vehicles to walking and cycling. Recent research indicates that policies centred on electric vehicle promotion alone will not be sufficient for Scotland to meet emission reduction targets for the transport sector.  

In addition to current policies to promote electric vehicle uptake, significant lifestyle change will be needed that includes increases in walking and cycling, public transport use, and policies to restrict private car access to urban centres and reduce the need to travel.

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82 Ibid
83 Ibid
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A 12% reduction in carbon emissions by 2030 is a reasonable expectation for active travel; an amount only matched by transition to electric vehicles by around 2050.\(^{90}\) This has an added benefit of the potential to cut yearly emissions sooner, multiplying the impact.

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Scotland also has strong complimentary active travel policies, and policy to support transport targets should include promotion of measures which support uptake of active travel, including default 20mph speed limits on all residential or restricted roads and reducing the access of private cars to urban centres.


SUPPLEMENTARY SUBMISSION FROM SUSTRANS

Summary

Transport is a major source of carbon emissions. The sector has made the smallest reduction of any sector since 1990 and has even risen slightly in recent years. The extent of the carbon emission reduction potential from walking and cycling is substantial.

Given the urgency of the need to reduce carbon emissions walking and cycling should be prioritised for a quicker impact than other solutions.

Key background for the transport sector

We need to act now on carbon emissions, and we need to act quickly. The effects of climate change are already causing considerable damage.

Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure including transport. Calculations recently prepared by Kevin Anderson, Tyndall Centre for Climate Change Research, suggest that Scotland will exceed even its 2°C commitment in less than 10 years if we proceed at current levels, and that we need to deliver a CO2 mitigation of 10 per cent each year, starting now.

New research shows the vulnerability of Glasgow's infrastructure to climate events. The study suggests that by 2050 the area will be hit by far more powerful storms, by regular heatwaves and by heavy winter flooding, which could see hospitals struggling to cope with abnormal temperatures or flooding, long stretches of motorway closed by floods, the West Highland line at risk of closure from coastal erosion and bridges at greater risk from gale-force winds. This is as much a local issue as a global issue.

Reducing emissions from transport

Transport is a major source of carbon emissions and the only sectoral source from which emissions continue to grow.

UK transport emissions have risen for three years in a row to their highest level since 2009 and the trajectory in Scotland is similar. This reflects rising demand for travel and a slowing of progress in improving the efficiency of new vehicles. Committee on Climate Change scenarios for meeting the fifth carbon budget require transport emissions to reduce by an average of 4% per year to 2030.

A range of solutions to the challenge of carbon emissions from transport are available:

- All scenarios for reducing carbon emissions from transport require that fewer miles are travelled by private car.

- Car fleet electrification reduces carbon emissions on a per mile basis, but some sources suggest that car use increases among electric car owners and the 'high-end' user market base for electric cars means bigger and heavier cars.
• However, governments do not have the appropriate regulatory apparatus to differentiate among electric vehicles and judge their environmental merits. Some combustion engine cars can be greener than some “zero-emission” electric vehicles because of vehicle size, production efficiency, or power sources.

• Other options for reducing carbon emissions from transport include increasing the use of public transport, increasing walking and cycling, and reducing car use.

The need to act quickly means there are clear preferences for how to prioritise solutions:

• We need to prioritise demand management and behaviour change measures above technological fixes, and to cease investment in damaging transport solutions.

• A recent study modelling pathways to lower emission futures in Scotland indicates ‘lifestyle change alone can have a comparable and earlier effect on transport carbon and air quality emissions than a transition to EVs with no lifestyle change … we cannot just wait for the “technology fix”’. It argues that energy consumption and emissions from transport are influenced not only by technical efficiency, mode choice and the carbon/pollutant content of energy but also by lifestyle choices and socio-cultural factors.

• The paper concludes that the most likely pathway to success will involve both changes to our travel demand patterns and technological improvement. Policies to change travel demand patterns can be implemented sooner, and will impact more significantly, to achieve emissions reduction.

• New research on Decarbonising Transport in Wales acknowledges that transport in Wales is dominated by the car, and that most emissions emanate from the private car, but asserts that the current reliance on technical solutions, primarily electric cars, will not reduce carbon emissions quickly enough. It suggests that electric vehicles are only an adequate solution in some settings (rural areas).

• Options for reducing car use and mitigating its negative effects are considered, including greater application of 20mph speed limits, a review of parking policy and consideration of ways of increasing the costs of car use to bring it closer in line with the costs of public transport.

• Both the Scottish paper and the Welsh paper are unequivocal about the role that walking and cycling needs to play in achieving decarbonisation of the transport system.

Carbon emission reduction potential from walking and cycling is substantial

• New research shows that, taking into account individual travel patterns and constraints, walking or cycling can realistically substitute for 41% of short car trips, saving nearly 5% of CO2e emissions from car travel. This is on top of 5% of ‘avoided’ emissions from cars due to existing walking and cycling.
• Combining increases in both active travel and electric vehicles leads to modelled transport sector emissions 43% lower than expected under the current proposals, with no extraordinary assumptions about uptake of active travel.

Social equality, carbon emission reduction and walking and cycling

Travel patterns are changing – on the motorway network there is significant traffic growth, and the baby boomers who are entering retirement now have higher car ownership levels than previous cohorts and drive more.

But in major cities, traffic levels have reduced and more people reach the centre by public transport. Young people are learning to drive later and are making fewer trips by car – young men (17-29 years) are making 44 per cent fewer trips, and young women 26 per cent fewer trips, by car than they were in 1992-94.

Recent research identified socio-economic inequalities in active travel, but with a greater likelihood of active travel in more deprived areas – this trend of greater participation in more deprived areas runs contrary to the trends for many health-beneficial behaviours. This indicates a potential contribution to protecting and improving health through active travel for those whose health status tends to be worse.

Carbon emission reduction is also an issue of social equality in which walking and cycling has a role to play. A small proportion of people are responsible for the majority of emissions. We need to focus on reducing the emissions of those responsible groups because “poor people don’t have any emissions to squeeze out”.