



Net Zero Carbon Emissions Target and Climate Change: Role of Technological and Lifestyle Efforts Debate on 6 February 2020

On 6 February 2020, the House of Lords is due to debate a motion moved by Lord Browne of Ladyton (Labour) that “this House takes note, further to the report by UK FIRES, *Absolute Zero*, published in November 2019, of technological and lifestyle efforts (1) to address climate change, and (2) to meet the 2050 net zero carbon emissions target”.

Summary

UK FIRES is a research collaboration between five UK universities, the purpose of which is to investigate how to improve resource efficiency in industry. In November 2019 it published *Absolute Zero*, a report that describes how the UK could eliminate all its greenhouse gas emissions by 2050. The authors contend that the UK should aim to reduce greenhouse gas emissions to absolute zero, rather than the “net zero” target specified in the Climate Change Act 2008 (as amended). This would mean not using carbon credits and including international shipping and aviation in the UK’s carbon calculations.

UK FIRES also argues that politicians and other commentators have placed too much confidence in technologies that are not proven at scale to significantly reduce greenhouse gas emissions. For example, *Absolute Zero* does not include any role for carbon capture and storage or hydrogen as a source of energy in its description of how to reduce greenhouse gas emissions. In contrast, the Committee on Climate Change states that these technologies will be key in reducing the UK’s net carbon emissions.

This briefing provides an overview of the *Absolute Zero* report, background to the UK greenhouse gas emissions target and an overview of the Government’s clean growth strategy. It then provides brief descriptions of some of the technological and lifestyle measures that have been advocated to reduce the UK’s greenhouse gas emissions. It compares assessments by UK FIRES, the Committee on Climate Change and the Centre for Alternative Technology about the potential and suitability of these measures.

Further reading on the net zero target, the Clean Growth Strategy, and various technologies is suggested in the relevant sections. General further reading is suggested at the end of the document.

Emily Haves | 30 January 2020

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I. UK FIRES Report

I.1 What is UK FIRES?

UK FIRES (UK Future Industrial Resource Efficiency Strategy) is a collaboration between the universities of Cambridge, Oxford, Nottingham, Bath and Imperial College London.¹ It is funded by the Engineering and Physical Sciences Research Council.

UK FIRES aims to help the UK achieve its commitment to reach net zero carbon emissions by 2050 by increasing resource efficiency in industry. It plans to do this by bringing together businesses across the UK's industrial supply chain "to pose strategic challenges to leading academics and test emerging solutions in practice".² This will be done in a "living lab", in which industry representatives will work with academics to test proposed solutions and suggest improvements. It also publishes research reports on reducing greenhouse gas emissions.

I.2 What Does the Report Say?

Absolute Zero, a report by UK FIRES, addresses the question of how best to eradicate the UK's greenhouse gas emissions by 2050. The Climate Change Act 2008 (as amended) sets a UK target of "net zero" greenhouse gas emissions by 2050, calculated as the total emissions generated in the UK minus any offsets purchased. The report argues that this target is not sufficiently ambitious.³ This is because it allows the Government to purchase carbon credits to offset any remaining emissions, and because it restricts the target to emissions that occur in the UK. This means the net zero measure excludes emissions from international shipping, international aviation and those generated abroad in making products for UK consumers.⁴ The report argues that the UK should instead aim for "absolute zero" carbon emissions, phasing out aviation and shipping and not relying on carbon credits to offset any remaining emissions.

UK FIRES also argues that politicians and other commentators have placed too much confidence in technologies that are not proven at scale to significantly reduce greenhouse gas emissions. *Absolute Zero* argues that "politicians in the UK and internationally talk about climate change as if it can be solved by new energy technologies alone, and UK government reports are over-confident about how much progress has been achieved".⁵ According to the report, "breakthrough technologies", which would dramatically decrease emissions without requiring major lifestyle changes, cannot be delivered at a large enough scale to eradicate all the UK's greenhouse gas emissions by 2050. The authors write that they are "concerned that most plans for dealing with climate change depend on breakthrough technologies—so won't deliver in time".⁶ Instead, they argue, "the only solutions available in the time remaining require some change of lifestyle".⁷

¹ UK FIRES, ['About Us'](#), accessed 22 January 2020.

² *ibid.*

³ UK FIRES, [Absolute Zero](#), 29 November 2019, p 4.

⁴ UK FIRES, [Absolute Zero](#), 29 November 2019, p 4; and Climate Change Act 2008, s 30 (as amended).

⁵ UK FIRES, [Absolute Zero](#), 29 November 2019, p 4.

⁶ *ibid.*

⁷ *ibid.*, p 10.

The report sets out the changes the authors believe will be required to eliminate the UK's greenhouse gas emissions, addressing the industrial sector and individuals separately. The report's key message for the industrial sector highlights challenges for certain industries:

Absolute Zero creates a driver for tremendous growth in industries related to electrification, from material supply, through generation and storage to end-use. The fossil fuel, cement, shipping and aviation industries face rapid contraction, while construction and many manufacturing sectors can continue at today's scales, with appropriate transformations.⁸

The report's key actions for individuals include lifestyle changes such as reducing travel and the consumption of meat:

The big actions are: travel less distance, travel by train or in small (or full) electric cars and stop flying; use the heating less and electrify the boiler when next upgrading; lobby for construction with half the material for twice as long; stop eating beef and lamb. Each action we take to reduce emissions, at home or at work, creates a positive ripple effect.⁹

2. UK's Emissions Reduction Target and Climate Change

2.1 Background

Climate Change Act 2008

The Climate Change Act 2008 (as enacted) set a target for the UK to reduce its "net carbon account" to 80 percent lower than the 1990 baseline by 2050.¹⁰ In the Act, the term "1990 baseline" is defined as the aggregate amount of net UK emissions of carbon dioxide in 1990, as well as net UK emissions of each of the other targeted greenhouse gases, the base years of which are set out in the Act.¹¹

The Act also established the Committee on Climate Change (CCC), an independent body. Its purpose is to advise the UK Government and devolved administrations on emissions targets and report to Parliament on progress made in reducing greenhouse gas emissions and preparing for climate change.¹²

2016 Paris Agreement and Committee on Climate Change Recommendation

The UK is a party to the United Nations Framework Convention on Climate Change, which recognised the existence of anthropogenic climate change and set out a need to reduce greenhouse gas emissions.¹³ In 2016, the UK signed the Paris agreement, a further UN instrument to tackle

⁸ UK FIRES, [Absolute Zero](#), 29 November 2019, p 2.

⁹ *ibid*, p 3.

¹⁰ Climate Change Act 2008, s 1(1) (as enacted).

¹¹ *ibid*, s 1(2).

¹² Committee on Climate Change, '[About the Committee on Climate Change](#)', accessed 24 January 2020.

¹³ United Nations Treaty Collection, '[United Nations Framework Convention on Climate Change](#)', accessed 24 January 2020; and United Nations Climate Change, '[What Is the United Nations Framework Convention on Climate Change?](#)', accessed 24 January 2020.

climate change.¹⁴ The overall aim of the Paris agreement is to limit global warming to below 2 degrees Celsius (2°C) above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C.¹⁵ Article 4 of the agreement states that to achieve this the parties must aim “to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century”, ie achieve net zero carbon emissions by 2050.¹⁶

In October 2016, following the adoption of the Paris agreement, the Committee on Climate Change published a report recommending that the then Government not set a target for reducing the UK’s greenhouse gas emissions to net zero at that time.¹⁷ The committee wrote:

We agree with the Government’s intention to set a new target in future that reflects the global need to reach net zero emissions. However, to be credible it needs to be evidence-based, accompanied by strong policies to deliver existing targets and a strategy to develop greenhouse gas removals.¹⁸

2018 Intergovernmental Panel on Climate Change Report and Updated Committee on Climate Change Recommendation

In October 2018, the Intergovernmental Panel on Climate Change, the United Nations body for assessing the science related to climate change, published a special report into the impact of global warming of 1.5°C above pre-industrial levels.¹⁹ The report highlighted a number of climate change impacts that could be avoided by limiting global warming to 1.5°C rather than 2°C or more:

For instance, by 2100, global sea level rise would be 10cm lower with global warming of 1.5°C compared with 2°C. The likelihood of an Arctic Ocean free of sea ice in summer would be once per century with global warming of 1.5°C, compared with at least once per decade with 2°C. Coral reefs would decline by 70–90 percent with global warming of 1.5°C, whereas virtually all (> 99 percent) would be lost with 2°C.²⁰

The report found that limiting global warming to 1.5°C would require global net anthropogenic carbon emissions to be zero by 2050.²¹ However, the report also found that to limit global warming to 1.5°C “would require rapid and far-reaching transitions in energy, land, urban [environments] and infrastructure (including transport and buildings) and industrial systems”.²²

Following the publication of this report, the then Minister of State for Energy and Clean Growth, Claire Perry, along with then Scottish Government Cabinet Secretary for Environment, Climate

¹⁴ United Nations Treaty Collection, ‘[Paris Agreement](#)’, accessed 24 January 2020.

¹⁵ *ibid.*

¹⁶ United Nations, [Paris Agreement](#), article 4.

¹⁷ Committee on Climate Change, [UK Climate Action Following the Paris Agreement](#), 13 October 2016, p 7.

¹⁸ *ibid.*

¹⁹ Intergovernmental Panel on Climate Change, ‘[Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C Approved by Governments](#)’, 8 October 2018.

²⁰ *ibid.*

²¹ *ibid.*

²² Intergovernmental Panel on Climate Change, [Summary for Policymakers](#), 2018, p 15.

Change and Land Reform Roseanna Cunningham and then Cabinet Secretary for Energy, Planning and Rural Affairs Lesley Griffiths, wrote to the chair of the Committee on Climate Change, Lord Deben, to request updated advice on the UK's greenhouse gas emissions reduction target.²³

In response to this request, in May 2019 the Committee on Climate Change published a report suggesting the UK adopt a target of net zero greenhouse gas emissions by 2050. The report said:

A net zero [greenhouse gas] target for 2050 will deliver on the commitment that the UK made by signing the Paris agreement. It is achievable with known technologies, alongside improvements in people's lives, and within the expected economic cost that Parliament accepted when it legislated the existing 2050 target for an 80 percent reduction from 1990.

However, this is only possible if clear, stable and well-designed policies to reduce emissions further are introduced across the economy without delay. Current policy is insufficient for even the existing targets.²⁴

The committee recommended that the 100 percent reduction target should cover all sectors of the economy, including international aviation and shipping.²⁵ It also stated that "the aim should be to meet the target through UK domestic effort, without relying on international carbon units (or credits)".²⁶

Climate Change Act 2008 Amended

In June 2019, the Government laid before Parliament a statutory instrument to amend the greenhouse gas emissions reduction target.²⁷ The Climate Change Act 2008 (2050 Target Amendment) Order 2019 changed the target in section 1(1) of the Climate Change Act 2008 from an 80 percent reduction in the UK's "net carbon account" by 2050 to a 100 percent reduction by 2050.²⁸

For more information on the UK's net zero target, see the House of Commons Library briefing [Net Zero in the UK](#) (16 December 2019).

3. Government's Clean Growth Strategy

In October 2017, the then Government published a clean growth strategy. This document set out the actions the Government intended to take to enable it to meet its greenhouse gas emissions reduction target, which at that time was 80 percent lower than 1990 levels. The Government stated that its approach to reducing emissions had two guiding objectives:

- I. to meet our domestic commitments at the lowest possible net cost to UK taxpayers,

²³ Minister of State for Energy and Clean Growth, '[Letter to Chairman of the Committee on Climate Change](#)', 15 October 2018.

²⁴ Committee on Climate Change, [Net Zero: The UK's Contribution to Stopping Global Warming](#), May 2019, p 11.

²⁵ *ibid*, p 15.

²⁶ *ibid*.

²⁷ UK Parliament, '[Climate Change Act 2008 \(2050 Target Amendment\) Order 2019](#)', accessed 24 January 2020.

²⁸ Climate Change Act 2008 (2050 Target Amendment) Order 2019, SI 2019/1056.

- consumers and businesses; and
2. to maximise the social and economic benefits for the UK from this transition.²⁹

In the strategy the Government set out its policies to reduce the country's greenhouse gas emissions, in eight policy areas:

- accelerating clean growth;
- improving business and industry efficiency;
- improving our homes;
- accelerating the shift to low-carbon transport;
- delivering clean, smart, flexible power;
- enhancing the benefits and value of our natural resources;
- leading in the public sector; and
- government leadership in driving clean growth.³⁰

In September 2019, Lord Duncan of Springbank, Parliamentary Under Secretary of State (Minister for Climate Change), responded to a question asked by Lord Teverson (Liberal Democrat) about whether the Government was planning to update its clean growth strategy in light of the revised emissions reduction target. Lord Duncan said:

We will have an updated clean growth strategy because it is absolutely vital. We will need to be bold about taking ourselves forward to net zero by 2050, because our present initiatives are not adequate to deliver that. There will need to be a significant refresh not just of the wider clean growth strategy but of all aspects of this covering all government departments.³¹

For more information on the clean growth strategy, see the House of Commons Library briefing [Energy Efficiency and the Clean Growth Strategy](#) (7 March 2018).

4. Technology

This section provides a brief overview of some areas where technology could help reduce greenhouse gas emissions, as well as areas where no technological solutions currently exist.

4.1 Reducing Energy Demand

All models for significantly reducing the UK's greenhouse gas emissions and reaching the net zero target necessitate significantly reducing energy demand. UK FIRES argues that by 2050 the UK's energy demand will need to be reduced to 60 percent of its current level.³² The Centre for Alternative Technology's model for meeting the net zero target requires the UK's energy demand to

²⁹ Department for Business, Energy and Industrial Strategy, [Clean Growth Strategy](#), April 2018, p 10.

³⁰ *ibid*, pp 12–17.

³¹ [HL Hansard, 9 September 2019, col 1288](#).

³² UK FIRES, [Absolute Zero](#), 29 November 2019, p 14.

be approximately 49 percent of its current value.³³ The CCC's scenarios for meeting the net zero target include a significant reduction in energy demand, particularly in buildings.³⁴

Buildings account for approximately 34 percent of greenhouse gas emissions in the UK.³⁵ Technologies for reducing energy demand include heating delivered by heat pumps, improved efficiency of appliances, design of new buildings to minimise heating and cooling need, insulation and improved lighting efficiency.³⁶

4.2 Electricity Generation

There is disagreement about the required composition of the UK's future energy supply to enable the UK to meet its emissions reduction target. In particular, there is disagreement about the extent to which renewable energy, a source of emission-free energy, can be scaled up by 2050. In *Absolute Zero*, UK FIRES states that if current trends continue then the UK can be expected to generate around 580 terawatt-hours (TWh) of electricity without emissions per year by 2050. This would be composed of wind, solar, nuclear and biomass.³⁷ In contrast, the Centre for Alternative Technology has projected a greater role for renewable energy technologies in meeting the net zero target, particularly: liquid fuels produced from biomass; wave and tidal electricity generation; and offshore wind power.³⁸ The Centre for Alternative Technology predicts the UK could generate 780 TWh per year from renewables, and a further 365 TWh per year from biomass and ambient heat.³⁹

In its technical note accompanying its recommendation that the UK adopt a net zero target the CCC suggests that renewables and nuclear power together could provide most of the energy needed to reduce the UK's emissions from energy production to "close to zero".⁴⁰ However, it also states that a significant proportion of energy generation would need to be provided by gas-fired plants fitted with carbon capture and storage.

4.3 Carbon Capture, Usage and Storage

Carbon capture and storage (CCS) refers to technologies that can capture carbon dioxide from waste gases at industrial facilities, and store it in offshore geological storage sites indefinitely.⁴¹ It could also be reused in industrial processes, a process which is referred to as carbon capture and usage (CCU). The two technologies are sometimes referred to together as CCUS.

The Government and the CCC are counting upon significant deployment of CCS technology to meet

³³ Centre for Alternative Technologies, [Zero Carbon Britain](#), 2019, p 39.

³⁴ Committee on Climate Change, [Net Zero Technical Report](#), May 2019, pp 23 and 69.

³⁵ Committee on Climate Change, [Factsheet: Buildings](#), July 2015.

³⁶ UK FIRES, [Absolute Zero](#), 29 November 2019, p 17.

³⁷ *ibid*, p 11.

³⁸ UK FIRES, [Absolute Zero](#), 29 November 2019, p 42; and Centre for Alternative Technologies, [Zero Carbon Britain](#), 2019, p 56.

³⁹ Centre for Alternative Technologies, [Zero Carbon Britain](#), 2019, p 56.

⁴⁰ Committee on Climate Change, [Net Zero Technical Report](#), May 2019, p 40.

⁴¹ House of Commons Business, Energy and Industrial Strategy Committee, [Carbon Capture Usage and Storage: Third Time Lucky?](#), 25 April 2019, HC 1094 of session 2017–19, p 5.

the country's net zero target. The CCC states that “achieving deep emissions reductions in the UK's power sector is contingent on CCS infrastructure and deployment support being available by 2030”.⁴² A report by the House of Commons Business, Energy and Industrial Strategy Committee in April 2019 concluded that “carbon capture usage and storage is necessary to meet national and international climate change targets at least cost”.⁴³ It also contended that not using CCS would double the cost to the UK of meeting its previous commitment of an 80 percent reduction of greenhouse gas emissions by 2050, and would mean it “could not credibly adopt a ‘net zero emissions’ target in line with the Paris agreement’s 1.5°C aspiration”.⁴⁴

In contrast, the *Absolute Zero* report warns against relying on CCS to significantly reduce greenhouse gas emissions in the UK by 2050. The report argues that while the technological elements of CCS have all been proven at some scale, “until a first fleet of full-scale power-plants are operating, the risks and costs of further expansion will remain high and uncertain”.⁴⁵

The Government has stated its support for CCUS, but has said that its commitment to deploying CCUS in the UK is “subject to cost reduction”.⁴⁶ In its report on CCUS, the House of Commons Business, Energy and Industrial Strategy Committee said that the lack of specificity in the Government’s ambitions does not indicate a commitment commensurate with the importance of this technology. It recommended that the Government “prioritise the development of clear ambitions to kick-start CCUS”.⁴⁷

4.4 Electrification

If the UK is to meet the net zero greenhouse gas emissions target, a significant proportion of future energy demand would need to be in the form of electricity as opposed to gas, petrol or other fossil fuels.⁴⁸ In UK FIRES’ model for eliminating emissions, all energy demand must be in the form of electricity; they argue that this is because renewable and nuclear-produced electricity are the only proven scalable sources of emission-free energy.⁴⁹ The Committee on Climate Change states that to meet the target would require “extensive electrification, particularly of transport and heating”.⁵⁰ The Centre for Alternative Technology’s model requires 66 percent of the UK’s future energy demand to be in the form of electricity, with the rest composed of biogas, synthetic gas and liquid fuels.⁵¹ The Centre for Alternative Technology maintains that these other fuel types are necessary for industry, transport and energy back-up.

⁴² Committee on Climate Change, [Net Zero Technical Report](#), May 2019, p 44.

⁴³ House of Commons Business, Energy and Industrial Strategy Committee, [Carbon Capture Usage and Storage: Third Time Lucky?](#), 25 April 2019, HC 1094 of session 2017–19, p 3.

⁴⁴ *ibid*, p 5.

⁴⁵ UK FIRES, [Absolute Zero](#), 29 November 2019, p 9.

⁴⁶ Department for Business, Energy and Industrial Strategy, ‘[UK Carbon Capture, Usage and Storage](#)’, 1 February 2019.

⁴⁷ House of Commons Business, Energy and Industrial Strategy Committee, [Carbon Capture Usage and Storage: Third Time Lucky?](#), 25 April 2019, HC 1094 of session 2017–19, p 3.

⁴⁸ UK FIRES, [Absolute Zero](#), 29 November 2019, p 8.

⁴⁹ *ibid*, p 14.

⁵⁰ Committee on Climate Change, [Net Zero: The UK’s Contribution to Stopping Global Warming](#), May 2019, p 11.

⁵¹ Centre for Alternative Technologies, [Zero Carbon Britain](#), 2019, p 55.

Heating

Most homes in the UK are heated with natural gas-powered boilers.⁵² These could be replaced by electric heat pumps, or heat networks and hydrogen boilers. Heat pumps are already an established technology in many other countries.⁵³ However, the CCC highlights that in the UK installation of heat pumps remains at very low levels “despite generous funding under the renewable heat incentive”.⁵⁴ The CCC also notes that “it is not feasible to ramp up installation rates of heat pumps straight away to the current level of gas boiler sales (over a million per year) from the current level of 20,000 per year, not only due to the lack of market development but also because there are not enough qualified heat pump installers”.⁵⁵

Transport

Almost all transport currently involves the direct combustion of fossil fuels in the vehicle; only 1 percent of transport is powered by electricity.⁵⁶ Transport is currently the largest source of UK greenhouse gas emissions, and emissions from transport rose between 2013 and 2017.⁵⁷ To significantly reduce greenhouse gas emissions, most transport would need to be powered by electricity. UK FIRES argues that all transport must either be electrified or phased out.⁵⁸ The CCC’s scenario for meeting the net zero target would require all cars and vans to be electric and the “vast majority” of heavy goods vehicles to be either electric or hydrogen-powered by 2050.

In 2018, the then Government published a strategy for increasing ownership of electric vehicles, entitled *Road to Zero*.⁵⁹ This document set out the Government’s ambition for “almost every car and van” to be zero emission by 2050.⁶⁰ The Government stated it would offer grants and other consumer incentives for certain types of low emission vehicle, support research in the industry and invest in charging infrastructure. For more information on the Government’s policy on low emission vehicles, see the House of Commons Library briefing [Electric Vehicles and Infrastructure](#) (13 January 2020).

4.5 Hydrogen

Some fossil fuels could be replaced with hydrogen. The combustion of hydrogen produces almost no greenhouse gases, providing an emission-free source of energy. However, the production of hydrogen itself can lead to greenhouse gas emissions, depending on the method used.⁶¹ Hydrogen could be used in the UK to replace natural gas and liquid fuels.⁶² Hydrogen gas does not currently supply the UK gas

⁵² Committee on Climate Change, [Net Zero: The UK’s Contribution to Stopping Global Warming](#), May 2019, p 187.

⁵³ *ibid*, p 178.

⁵⁴ *ibid*, p 48.

⁵⁵ *ibid*, p 176.

⁵⁶ UK FIRES, [Absolute Zero](#), 29 November 2019, p 18.

⁵⁷ Committee on Climate Change, [Net Zero: The UK’s Contribution to Stopping Global Warming](#), May 2019, p 48.

⁵⁸ UK FIRES, [Absolute Zero](#), 29 November 2019, p 8.

⁵⁹ Office for Low Emission Vehicles, [The Road to Zero](#), 12 September 2018.

⁶⁰ *ibid*, pp 2–4.

⁶¹ Parliamentary Office of Science and Technology, [Decarbonising the Gas Network](#), November 2017, p 2.

⁶² Committee on Climate Change, [Hydrogen in a Low-Carbon Economy](#), November 2018, p 8.

network, though it is used by industry in Europe and North America.

The CCC's scenario for meeting the net zero target includes the development of a "hydrogen economy" to provide energy in sectors where gas or other fuel use cannot be eliminated, such as long-distance shipping and some industrial processes.⁶³ UK FIRES contends that "the hydrogen economy", along with CCUS, is an important development opportunity and may be significant beyond 2050, but will not play any significant part in national emissions reduction by 2050 because implementation at a meaningful scale will take too long.⁶⁴

For more information on hydrogen as a source of energy, see the briefing by the Parliamentary Office of Science and Technology, [Decarbonising the Gas Network \(15 November 2017\)](#).

4.6 Industrial Processes: Cement and Iron

The *Absolute Zero* report highlights the greenhouse gas emissions associated with certain industrial processes, particularly making cement and iron. In addition to the emissions related to the energy required from these processes, blast furnaces making steel from iron ore and coke release carbon dioxide, and half of the emissions from cement production come from the chemical reaction as limestone is calcined to become clinker.⁶⁵ There are currently no proven, scalable alternatives to these processes, therefore reducing the UK's emissions to absolute zero would require no cement-based mortar or concrete, and no new steel.⁶⁶ UK FIRES states that "the absence of cement is the greatest single challenge in delivering absolute zero, as it is currently essential to delivering infrastructure, buildings and new energy technologies".⁶⁷

The CCC acknowledges that greenhouse gas emissions cannot be eliminated from these processes. Its scenario for reaching net zero includes using CCS for certain industrial processes, including the production of cement and iron.⁶⁸

5. Lifestyle

This section provides a brief overview of two of the areas where UK FIRES recommends the most significant lifestyle changes in order to reduce the country's greenhouse gas emissions.

5.1 Air Travel and Shipping

The net zero target in the Climate Change Act 2008 (as amended) does not include emissions from international air travel or shipping.⁶⁹ However, UK FIRES argues that for the UK's efforts to eliminate carbon emissions to be meaningful carbon emissions from aviation and shipping cannot be ignored. In

⁶³ Committee on Climate Change, [Net Zero: The UK's Contribution to Stopping Global Warming](#), May 2019, p 23.

⁶⁴ UK FIRES, [Absolute Zero](#), 29 November 2019, p 43.

⁶⁵ *ibid*, p 15. When a material is calcined, it is reduced to quick-lime by burning.

⁶⁶ *ibid*.

⁶⁷ *ibid*.

⁶⁸ Committee on Climate Change, [Net Zero: The UK's Contribution to Stopping Global Warming](#), May 2019, p 146.

⁶⁹ Climate Change Act 2008, s 30 (as amended).

his foreword to the CCC's report on meeting the net zero target, Lord Deben, chair of the committee, also stated that it is essential that the commitment cover international aviation and shipping.⁷⁰

UK FIRES argues that there are currently no proven technological alternatives to fossil fuels for aviation and shipping, and therefore these modes of transport must be phased out entirely. The CCC argues that it is possible to reduce emissions from aviation by design and other technical changes, but some emissions would remain, and these would need to be removed from the atmosphere.⁷¹ The CCC contends that emissions from shipping could be significantly reduced by improved energy efficiency and operations and use of alternative fuels.⁷²

5.2 Diet and Agriculture

A key element of UK FIRES' strategy to eliminate the UK's greenhouse gas emissions is the phasing out of agricultural production of ruminant animals, particularly beef and lamb.⁷³ There are several processes by which the rearing of cows and sheep leads to greenhouse gas emissions:

- The way these animals digest food releases methane, a greenhouse gas.
- Converting forestry to agricultural land releases carbon stored in the forest.
- Future carbon storage is lost when trees are destroyed.
- Ploughing land releases carbon stored in the soil.
- Using nitrogen-based fertilisers leads to emissions.

Growing grain to feed to animals is particularly inefficient, as approximately 80 times more grain is required to create the same calories for a meal of meat as a meal made from grain.⁷⁴ UK FIRES argues that because of these processes, reaching zero emissions in 2050 would require "that we refrain from eating beef and lamb".⁷⁵

The CCC identifies agriculture as one of the hardest sectors in which to reduce emissions. It states that emissions from agriculture can be somewhat reduced through livestock, soils and waste manure management.⁷⁶ In addition, its scenario for meeting the net zero target includes a 20 percent reduction in consumption of beef, lamb and dairy.⁷⁷ The land released could then be converted into forest, or used for peatland restoration or the growing of energy crops. The Centre for Alternative Technology also recommends a significant reduction in consumption of animal products in favour of plant-based foods in order to meet the net zero target.⁷⁸

⁷⁰ Committee on Climate Change, [Net Zero: The UK's Contribution to Stopping Global Warming](#), May 2019, p 8.

⁷¹ *ibid*, p 148.

⁷² *ibid*, p 146.

⁷³ UK FIRES, [Absolute Zero](#) 29 November 2019, p 15.

⁷⁴ *ibid*.

⁷⁵ *ibid*.

⁷⁶ Committee on Climate Change, [Net Zero: The UK's Contribution to Stopping Global Warming](#), May 2019, p 142.

⁷⁷ *ibid*, p 147.

⁷⁸ Centre for Alternative Technologies, [Zero Carbon Britain](#), 2019, p 88.

The Government's *Clean Growth Strategy* states that the Government will introduce policies to improve efficiency in the land and agricultural sectors, including improving biosecurity and encouraging the use of low-emissions fertiliser.⁷⁹

The Agriculture Bill, introduced in the current session, includes provisions that would enable the secretary of state to provide financial assistance in connection with managing land, water or livestock in such a way as to mitigate the causes of climate change.⁸⁰ For example, this assistance could be given to promote measures that incentivise peatland restoration.

6. Further Information

- House of Commons Science and Technology Committee, [Clean Growth: Technologies for Meeting the UK's Emissions Reduction Targets](#), 22 August 2019, HC 1454 of session 2017–19; and [Government and Ofgem Response](#), 1 November 2019, HC 287 of session 2017–19
- Committee on Climate Change, [Reducing UK Emissions—2019 Progress Report to Parliament](#), 10 July 2019
- Office for National Statistics, '[Net Zero and the Different Official Measures of the UK's Greenhouse Gas Emissions](#)', 24 July 2019
- House of Commons Library, [Brexit: Energy and Climate Change](#), 5 September 2019
- House of Commons Library, [New Nuclear Power](#), 25 September 2019

⁷⁹ Department for Business, Energy and Industrial Strategy, [Clean Growth Strategy](#), April 2018, p 106.

⁸⁰ [Explanatory Notes](#), p 8.