**Building a zero-carbon economy – Call for Evidence**

**Background**

On 15 October 2018 the governments of the UK, Scotland and Wales asked the Committee on Climate Change (CCC) to provide advice on the UK and Devolved Administrations' long-term targets for greenhouse gas emissions and the UK's transition to a net zero-carbon economy. Specifically: when the UK should reach net zero emissions of carbon dioxide and/or greenhouse gases as a contribution to global ambition under the Paris Agreement; if that target should be set now; the implications for emissions in 2050; how such reductions can be achieved; and the costs and benefits involved in comparison to existing targets.

The advice has been requested by the end of March 2019.

The UK's long-term emissions target is currently for at least an 80% reduction in greenhouse gas emissions from 1990 to 2050. It covers all sectors, including international aviation and shipping and is measured on a 'territorial' basis (i.e. based on emissions arising in the UK). On a comparable basis, emissions in 2017 were estimated to be 38% below 1990 levels.

The current target was set in 2008 based on advice from the Committee. That advice considered that to avoid the worst impacts of climate change, the central expectation of global temperature rise should be limited "to, or close to, 2°C", while the probability of crossing "the extreme danger threshold of 4°C" should be reduced to an extremely low level. That meant global emissions would roughly have to halve by 2050. The 2008 advice made the assumption that the UK should not plan to have a higher level of per capita emissions in 2050 than the global average.

The long-term target guides the setting of carbon budgets (sequential five-year caps on emissions that currently extend to 2032 and require a reduction in emissions of 57% from 1990 to 2030). Both the 2050 target and the carbon budgets guide the setting of policies to cut emissions across the economy (for example as set out most recently in the 2017 Clean Growth Strategy).

Any change to the long-term targets would therefore be expected to have significant implications, not just in the long-term but on current policies to drive the transition.

The CCC will advise based on a thorough consideration of the relevant evidence. We expect that to cover:

- The latest climate science, including as contained in the IPCC Special Report on 1.5°C.
- The terms of the Paris Agreement.
- Global pathways (including those reported by the IPCC) consistent with limiting global average temperature rise in line with the goals of the Paris Agreement.
- International circumstances, including existing plans and commitments to cut emissions in other countries, actions to deliver on those plans and opportunities for going further.
- An updated assessment of the current and potential options for deep emissions reductions in the UK and emissions removals from the atmosphere, including options for going beyond the current 80% target towards net zero.
- An appraisal of the costs, risks and opportunities from setting a tighter long-term target.
- The actions needed in the near term that would be consistent with achieving the long-term targets.

This Call for Evidence will contribute to that advice.

**Responding to the Call for Evidence**

We encourage responses that are brief and to the point (i.e. a maximum of 400 words per question, plus links to supporting evidence, answering only those questions where you have particular expertise), and may follow up for more detail where appropriate.

You do not need to answer all the questions, please answer only those questions where you have specific expertise and evidence to share. It would be useful if you could use the question and response form below and then e-mail your response to: communications@theccc.gsi.gov.uk using the subject line: 'Zero carbon economy – Call for evidence'. Alternatively, you can complete the question and answer form on the CCC website, available here.

If you would prefer to post your response, please send it to:

The Committee on Climate Change – Call for Evidence
7 Holbein Place
London
SW1W 8NR

**The deadline for responses is 12 noon on Friday 7 December 2018.**

**Confidentiality and data protection**
Responses will be published on our website after the response deadline, along with a list of names or organisations that responded to the Call for Evidence.

If you want information that you provide to be treated as confidential (and not automatically published) please say so clearly in writing when you send your response to the consultation. It would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded by us as a confidentiality request.

All information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the access to information legislation (primarily the Freedom of Information Act 2000, the Data Protection Act 1998 and the Environmental Information Regulations 2004).

### Question and response form

When responding, please provide answers that are as specific and evidence-based as possible, providing data and references to the extent possible. Please limit your response to a maximum of 400 words per question.

**Part 1: Climate Science**

**Question 1 (Climate Science):** The IPCC's Fifth Assessment Report and the Special Report on 1.5°C will form an important part of the Committee's assessment of climate risks and global emissions pathways consistent with climate objectives. What further evidence should the Committee consider in this area?

ANSWER: In the IPCC 1.5C report it is worth noting how the figures for the carbon budget have changed - from 70 GT a few years ago (which would be eaten up by 2022) to 200 GT CO2 a couple of years ago, and now 420 GT for a 66% chance of staying at 1.5C, and 580 GT for a 50% chance. This seems to relate to their using 1850-1900 as a baseline, and assumptions on negative emissions. See:

https://www.carbonbrief.org/analysis-why-the-ipcc-1-5c-report-expanded-the-carbon-budget

We also recommend you consider;

https://kevinanderson.info/blog/callous-or-calamitous-the-uk-climate-minister-pulls-the-rug-from-under-1-5c/

**To avoid future needs to re-calibrate the UK Climate Act budgets to match the evidence from the most recent science and the need for climate equity, CAT recommends UK Government adopt a net-zero goal by 2040. Our Zero Carbon Britain (ZCB) research has identified existing technologies that can deliver this, and the timescale is similar to that of Bristol and Manchester City Regions.**

**Question 2 ($CO_2$ and GHGs):** Carbon dioxide and other greenhouse gas gases have different effects and lifetimes in the atmosphere, which may become more important as emissions approach net-zero. In setting a net-zero target, how should the different gases be treated?

ANSWER: It is worth noting some Global Warming Potential conversion figures (such as those for methane to CO2e) have tended to increase over time – so it may well be worth taking a cautionary stance against possible future increases.

**Part 2: International Action**

**Question 3 (Effort share):** What evidence should be considered in assessing the UK's appropriate contribution to global temperature goals? Within this, how should this contribution reflect the UK's broader carbon footprint (i.e. 'consumption' emissions accounting, including emissions embodied in imports to the UK) alongside 'territorial' emissions arising in the UK?

ANSWER: A useful evidence-based analysis can be found from the work of Dr. Jaise Kuriakose of the Tyndall Centre for Climate Change Research. It describes how to calculate the 'science-based carbon budget' for Manchester. If we want to stay below 2C of warming, this limits the amount of carbon emissions that we as a planet can emit. The key message is: we will exceed Manchester's carbon budget before 2028 if we continue to emit at the rate we do today. The carbon budget must last until 2100. In order that we have enough emissions left to last that long, we must achieve a 13% year on year reduction from 2018, before being almost fully decarbonised (with the exception of a few sources of emissions) by 2038. This research also stressed the importance of using our existing green infrastructure and creating new areas as "natural and easy ways to sequester carbon from the atmosphere. There are so many more health and wellbeing benefits to improved green spaces than just carbon emissions reduction."

We note that this analysis does not address the still more challenging commitment to "pursue 1.5°C."

http://www.manchesterclimate.com/sites/default/files/Appendix%202%20-%20Quantifying%20the%20Implications%20of%20the%20Paris%20Agreement%20to%20Manc....pdf

It is also worth noting that in November, Bristol declared a "climate emergency", with all parties on the Bristol Council unanimously agreeing to bring forward their commitment to be carbon neutral from 2050 to 2030

Also see Sweden's commitment to net-zero by 2045:
https://www.government.se/opinion-pieces/2018/04/to-lead-on-climate-countries-must-commit-to-zero-emissions/

**The UK's contribution should, of course, represent emission by consumption rather than just territorial emissions. The UK must follow the IPCC's clear recommendation that ambitious action must be taken in the next 12 years, so all UK climate act 5 year targets and budgets must be re-calibrated to a zero goal now, rather than the Governments suggested approach of continuing to use existing 80% format to 2032, then trying to adjust the targets and budgets to reach zero by 2050.**

**Question 4 (International collaboration):** Beyond setting and meeting its own targets, how can the UK best support efforts to cut emissions elsewhere in the world through international collaboration (e.g. emissions trading schemes and other initiatives with partner countries, technology transfer, capacity building, climate finance)? What efforts are effective currently?

ANSWER: There are still too many countries that have not yet been able to prepare scenarios that align their short-term actions and long-term plans with the levels of ambition required by the Paris Agreement. Our 2018 report *Raising Ambition* is a tool to help build international communications.

http://www.zerocarbonbritain.org/images/pdfs/raisingambition-zerocarbonscenarios.pdf

One of our key conclusion showed that (excluding the global and regional scenarios), of a total 199 countries in the world we found only 32 had national-scale deep decarbonisation, 100% renewable energy or net zero scenarios. That's a mere 16%. Also, too few scenarios have been able to undertake full net-zero analysis. This requires integration of work across disciplines, linking energy, transport, buildings, diets, land-use and sustainable, natural carbon sinks.

If we are to take the Paris Agreement's target of 1.5°C / well below 2°C seriously, all countries – developed and developing, large and small – must be supported to produce evidence based, fully integrated net-zero scenarios to inform their UNFCCC Nationally Determined Contributions, associated policy and industrial strategies. Robust scenarios help ensure each country's development pathway aligns with the mitigating actions required, whilst creating trust-worthy investment frameworks and helping develop social licence.

There is also a need for a common language, framework and assumptions, to make the comparison and integration of modelling and transboundary emissions analysis easier across international borders.

One case-study in Raising Ambition was Lappeenranta University of Technology (LUT), who delivered very useful scenario development collaborations to support majority world countries such as Asia and Central / South America. Cost optimal, 100% renewable energy based systems by the year 2030 or 2050, were developed by LUT using hourly resolution for each region. It shows systems with a lower levelised cost of electricity (LCOE) than today. Across all regions they concluded that a 100% renewable energy based system could be a reality economically and technically and more cost competitive than nuclear and fossil carbon capture and storage. The overarching message of the LUT research is that the intermittency of renewable technologies can be effectively stabilized to satisfy hourly demand at a cost lower than today.

**UK universities should follow their example, and work with the British Council to support majority world countries in developing scenarios, focusing on areas of the commonwealth countries and regions that currently are unable to develop ambitious scenarios.**

Land use – whether in energy system modelling, government goal-setting or financial investment – is consistently underestimated or even ignored.

**Question 5 (Carbon credits):** Is an effective global market in carbon credits likely to develop that can support action in developing countries? Subject to these developments, should credit purchase be required/expected/allowed in the UK's long-term targets?

ANSWER: This is not CAT's expert area

**Part 3: Reducing emissions**

**Question 6 (Hard-to-reduce sectors):** Previous CCC analysis has identified aviation, agriculture and industry as sectors where it will be particularly hard to reduce emissions to close to zero, potentially alongside some hard-to-treat buildings. Through both low-carbon technologies and behaviour change, how can emissions be reduced to close to zero in these sectors? What risks are there that broader technological developments or social trends act to increase emissions that are hard to eliminate?

ANSWER: Hard-to-reduce sectors are covered in Zero Carbon Britain: Rethinking the Future. See http://www.zerocarbonbritain.org/images/pdfs/ZCBrtflo-res.pdf

Section 3.6.1 shows that we can significantly reduce agricultural emissions whilst improving the healthiness of the average UK diet. In this scenario, emissions from food production ('on the farm') are reduced to 17 MtCO2e per year – about 27% of what they were in 2010. Imports are reduced from 42% to 17%. Land used for food production is reduced from about 78% of total UK land to about a third, freeing up space for other uses.

In terms of flights, expanding airports does not send the right signals to business or to society. In 'ZCB Rethinking the Future', sections 3.3 Power Down and 3.4 Power Up show solutions to the high density

energy demands that cannot be met by electricity. In total, some 234 TWh per year of this type of energy is delivered in our scenario. These include:
Transport: (3.3.2) 98 TWh per year of synthetic liquid fuel. (39 TWh for aviation, 59 TWh for heavy commercial vehicles and ships)
Balancing supply and demand: (3.4.2) about 27 TWh per year of biogas or synthetic gas as back-up for our energy supply. 3.4.2 also shows biomass can be combined with hydrogen to produce synthetic gas and liquid fuels, which increases the amount of fuel produced per unit of land.

**Hard-to-treat buildings:** ZCB Rethinking the Future, section 3.3.1 describes how retrofitting existing buildings can include: cavity wall or solid wall insulation; floor and loft insulation; improved glazing (all of which reduce the 'fabric heat loss' of a building); and draught-proofing (which reduces the 'ventilation heat loss' of a building). A programme to retrofit all dwellings with the above measures, as required, could reduce the average heat loss of the UK's housing stock by 50% (DECC, 2010). In combination with improved heating controls, the above measures can reduce average space heating demand by around 50-60% per building.

**Social trends related to building energy use:** Average indoor temperatures in the UK have risen consistently from around 12 degrees in 1970 to 18 degrees by the mid-2000s (Utley & Shorrock, 2008). ZCB Rethinking the Future, section 3.3.1 introduces the importance of heating controls and thermal comfort on building energy use. Shifting expectations of occupant heating practices and user responses to both low-energy retrofit and new-build highlight social trends in thermal comfort that could increase emissions and be hard to tackle.

**Question 7 (Greenhouse gas removals):** Not all sources of emissions can be reduced to zero. How far can greenhouse gas removal from the atmosphere, in the UK or internationally, be used to offset any remaining emissions, both prior to 2050 and beyond?

ANSWER: Even with a 100% renewable energy system, reduced agricultural emissions, and more efficient, circular industrial processes – to achieve net zero, there will still be significant residual emissions that must be addressed with net negative processes. Whilst all research can help inform decisions, we must avoid the temptation to 'balance out' the continued burning of fossil fuels with speculative future technologies. These unproven methods are likely to burden future generations with the need to re-capture massive amounts of carbon. For example, mass deployment of mechanical Negative Emission Technologies (NETs) is widely cited by IPCC authors and journalists alike as the carbon capture solution the world needs. However, such scenarios rely on the mass deployment of systems, for which the feasibility at the scale required and the full life-cycle costs of delivery are highly uncertain at this time, and there is also little understanding of how they will be integrated into society and ecosystems.

Scientists and policy-makers are also considering geoengineering technologies which aim to directly alter the balance of the Earth's atmosphere to cool the planet. These emerging technical-options present a complex mix of risks, costs and benefits, and may have differing effects on different parts of the world. Much more research is needed so we achieve a greater understanding of the scalability, costs and implications of geoengineering options. They also need to be delivered in a way that minimises risk, maximises benefit, and is done so ethically for all people, ensuring long-term effective governance.

**The key criterion is that such approaches must be considered <u>in addition</u> to the rapid elimination of fossil fuel emissions, not as an excuse to continue burning them.**

Again, land use is vital, we can become stewards of land not only for sustainable agriculture, healthy diets and recreational uses, but also for carbon management. The first step down this path is including land use, diets and Natural Climate Solutions (NCS) in our local, national and regional zero carbon modelling work. NCS are carbon mitigating and sequestering measures originating in our natural systems across the globe. Many have existed for centuries, but more careful stewardship, monitoring and accounting techniques enable us to regenerate and develop a carbon capturing capacity that is place-based and native to both peoples and natural systems. NCS can both mitigate and sequester carbon, whilst also providing a multitude of benefits such as jobs, flood prevention and biodiverse habitats.

**Question 8 (Technology and Innovation):** How will global deployment of low-carbon technologies drive innovation and cost reduction? Could a tighter long-term emissions target for the UK, supported by targeted innovation policies, drive significantly increased innovation in technologies to reduce or remove emissions?

ANSWER: Continuity around the 'delivery plan' for a tighter long-term zero emissions target is essential for the UK to drive both cost reduction and innovation. Between now and 2040, there will be several elections, and it has become crystal clear that changes of Government can cause massive shifts in our approach to rising to this challenge. From the non-fossil fuel obligation to the current 'contracts for difference' mechanism, the continual shifting of the policies used to deliver innovation and cost reduction have created challenges. It is worth noting the failure of latest round of contracts for difference to be ambitious enough to deliver the scale needed.

Cross-party consensus around a such a delivery plan and policy-framework for the UK is vital to drive increased innovation. Driven by an inclusive process, such agreement on action would offer a long-term stable framework giving confidence to municipal or business investment, training and skills, technology research and development, and job creation. It would also, of course, increase confidence from both international collaborators and wider UK society that no one will use this urgent challenge as a political football. We need to ensure a consistent, coherent approach regardless of who is in or out of government over the next 20 years.

Our Zero Carbon Britain research shows 100% renewable energy sources can deliver 24/7 across the seasons, we can grow the vast majority of the food needed for a healthy, low carbon diet, and to manage the land to capture carbon, nurture biodiversity and increase the health and resilience of the UK ecosystems. Rather than an unresolved technical challenge, to reach net-zero, we actually face a mix of economic, cultural & psychological barriers. This requires integration of targeted intervention policies to increase innovation in a much wider range of disciplines, as reflected in our 2017 report Zero Carbon Britain: Making it Happen see http://www.zerocarbonbritain.org/images/pdfs/ZeroCarbonBritain-MakingItHappen.pdf

**Question 9 (Behaviour change):** How far can people's behaviours and decisions change over time in a way that will reduce emissions, within a supportive policy environment and sustained global effort to tackle climate change?

ANSWER: We are currently experiencing a period where our behaviours in work, leisure, shopping, travel are changing faster than at any time in human history. Also, over 2018, as more and more of us understand this alarming threat to our planetary life-support system - rising to the challenge is becoming one of the deepest and most powerful heart-felt motivators of our time – building bridges, and uniting us across economic, political and cultural lines. Our report Zero Carbon Britain: Making it Happen references the following: http://www.zerocarbonbritain.org/images/pdfs/ZeroCarbonBritain-MakingItHappen.pdf

**6.1 and 7.1 Worldviews and values**: Climate change is not the root problem but a symptom of our materialistic culture and growing disconnection from nature and from each other. By fostering intrinsic values such as empathy, co-operation, social justice and ecological concern, and by encouraging reconnection with nature, we can start to shift towards being a society that cares about 'bigger-than-self' problems, and works together to solve them.

**6.2 and 7.2 Communications**: The prevailing silence on climate across the media and in public dialogues undermines levels of public awareness and action. There is significant media bias, also undue stress on the uncertainty of climate science, driven through well-funded campaigns by industry. Corporate or political affiliations can lead to media bias, often because of dependence on advertising revenue. Highly concentrated media ownership gives a few individuals a disproportionate influence on public opinion. Commercial advertising promotes values that are counter to action on climate.

**6.3 and 7.3 Psychology and behaviour change:** Positive stories of what can be practically achieved can help counter feelings of helplessness, demonstrate that other people care, and show that the actions of both individuals and communities do make a difference. The influence of social norms related to how others behave and what people believe others expect of them can be harnessed to encourage more sustainable behaviour. High profile individuals can also help normalise new behaviours.

**6.4 and 7.4 Carbon lock-in**: Industrialised economies have evolved dependent on fossil fuel systems over many years, developing significant system inertia that is hugely resistant to change. However, thousands of community groups are developing practical, positive examples of the zero carbon transition, ranging from waste food cafés to community energy. These empower and connect people, offer a sense of agency and help normalise sustainable behaviours. **But to achieve the scale and speed required, individual and community changes must be supported by ambitious Government policies.**

**Useful research also from: https://www.rapidtransition.org**

**Question 10 (Policy):** Including the role for government policy, how can the required changes be delivered to meet a net-zero target (or tightened 2050 targets) in the UK?

ANSWER: Our 2017 report Zero Carbon Britain: Making it Happen references the following key points: http://www.zerocarbonbritain.org/images/pdfs/ZeroCarbonBritain-MakingItHappen.pdf

See Chapters 6.6 and 7.6; Changing systems like energy or food is a political power struggle which confronts powerful vested interests. Just 90 private and state owned companies are responsible for nearly two-thirds of historical cumulative emissions of carbon dioxide. Fossil fuel and other high carbon industries successfully lobby governments to weaken climate legislation and policy, a phenomenon known as regulatory capture. Current lobbying laws fail to meet international principles on transparency and weaken checks on corporate influence. There is also a problem of 'revolving doors' where politicians and civil servants move to and from industry.

Powerful vested interests and their undue influence on the regulatory process can be challenged through shareholder action and divestment campaigns, as well as by increased transparency. The current law on transparency of lobbying can be amended to satisfy international principles of transparency. Rules to prevent the problem of 'revolving doors' must be tightened. Policy framework set to achieve a transition to zero carbon means regulation of those interests that subvert democratic control, and greater transparency and accountability in governance.

There are existing tools that can be used to hold those who govern us to account and to challenge the influence of vested interests. Ultimately, broad social movements must be built with a collective identity that challenges the status quo and the power of vested interests.

Political action requires programmes which increasing the visibility of climate solutions amongst voters - providing clear evidence that workable solutions already exist gives politicians no place to hide. Mass social movements based on coalitions of a broad range of groups will be needed to drive the necessary Government policy shift, as individual issue groups are not strong enough on their own. Forging a sense of collective identity and finding common values is vital.

Lack of collective political will for action is a fundamental obstacle, with cross-party unity on climate change diminished over recent years. Cross-party political support for both policy and action can be built by framing communications appropriately and by the use of trusted communicators.

Submissions to Parliamentary Select Committees or direct communication with MPs and local councillors help build support. Political risk can also be reduced by directly linking climate policies with complementary multi-solving policies, such as health, jobs etc. Chapter 7.6 offers an overview on practical case studies.

**Part 4: Costs, risks and opportunities**

**Question 11 (Costs, risks and opportunities):** How would the costs, risks and economic opportunities associated with cutting emissions change should tighter UK targets be set, especially where these are set at the limits of known technological achievability?

ANSWER: Our report Zero Carbon Britain; Rethinking the future, makes a clear case for the technological achievability of zero carbon targets. See http://www.zerocarbonbritain.org/images/pdfs/ZCBrtflo-res.pdf Our 2017 report Zero Carbon Britain: Making it Happen references economic risks and opportunities: http://www.zerocarbonbritain.org/images/pdfs/ZeroCarbonBritain-MakingItHappen.pdf

Chapter 7.5.1 There is an urgent need for a levelised cost analysis approach to allow fair assessment of low or zero carbon investments. Fossil fuels still receive billions of pounds in subsidies, far higher than those given to renewables, and the full external costs of fossil fuels are not included in the price, making them appear cheaper. Human activities, such as the build environment, energy generation, transport, industry and agriculture, cause substantial environmental and human health damages and the need for future adaptation spending, which vary widely depending on where the activity takes place and on the type of the activity. These costs are for the most part not integrated into the current pricing system.

This is illustrated by the following research which also helps us see what progress could look like: https://www.imf.org/external/pubs/ft/wp/2015/wp15105.pdf

https://newclimateeconomy.report/2018/

*Making it Happen Economic Conclusions Page 265:* Making all energy choices pay their full societal or environmental costs will help level the playing field for the necessary transition.
*Making it Happen Economics and finance executive summary page 7:* There is enormous scope for more community and public ownership, particularly in energy supply and distribution. This will increase 'social licence' and can be achieved by strengthening policies that encourage community energy projects and through new legislation. Taking assets like the railways or national grid back into public ownership could ensure that the necessary improvements take place and profits are reinvested for the public good rather than being distributed to shareholders.
**As stated above, a cross-party delivery plan is urgently needed this would also ensure a stable platform for: technology research and development, training and up-skilling, employment planning, social licence plus, of course, investment.**

**Question 12 (Avoided climate costs):** What evidence is there of differences in climate impacts in the UK from holding the increase in global average temperature to well below 2°C or to 1.5°C?

ANSWER: In terms of delivery on UK's obligations to the Paris Agreement, the definition *Primary prevention,* as used by Welsh Government, is helpful in clarifying the most effective and lowest cost options by avoiding climate costs.

*Primary prevention – Building resilience, creating the conditions in which problems do not arise in the future.*

*Secondary prevention – Targeting action towards areas where there is a high risk of a problem occurring.*

*Tertiary prevention – Intervening once there is a problem, to stop it getting worse and prevent it reoccurring in the future.*

*Acute spending –acts to manage the impact of a strongly negative situation but does little or nothing to prevent problems occurring in the future.*

Of the many and varied reports on avoiding the cost impacts of climate change, the Stern Review is without doubt one of the most influential. It's clear conclusion that the overall costs of inaction on climate change will far exceed the costs of action has helped shape the global response to climate risk – and provides a clear economic evidence base for *Primary prevention.*

http://www.lse.ac.uk/GranthamInstitute/publication/the-economics-of-climate-change-the-stern-review/

However rather than focusing on *Primary prevention* around 'energy related emissions' in isolation - modelling an integrated picture of **all potential climate costs** offers a multi-solving approach. Changing land-based systems may appear complex but farmers, foresters and river users have amassed extensive knowledge over the centuries. The UK has the capacity, the knowledge and skills to think and act with regenerative development in mind. UK Government can become a steward of its land, not only for sustainable agriculture, diets and recreation, but also for carbon management.

The Natural Climate Solutions coalition have conducted research identifying 20 conservation, restoration and/or improved land management actions that increase carbon storage and/or avoid GHG emissions, across global forests, wetlands, grasslands, and agricultural lands.

https://nature4climate.org/n4c-mapper/

There is however a clear need for a level playing field in which the societal or 'external' costs of the industry (for example, the future adaptation costs and health costs of air pollution) are not currently accounted for in their pricing. https://www.imf.org/external/pubs/ft/wp/2015/wp15105.pdf

New business and ownership models can also enhance the economic returns; these include energy co-operatives, social enterprises, new energy supply models, municipally owned companies, community and public ownership.

**Part 5: Devolved Administrations**

**Question 13 (Devolved Administrations):** What differences in circumstances between England, Wales, Scotland and Northern Ireland should be reflected in the Committee's advice on long-term targets for the Devolved Administrations?

ANSWER: Key differences in circumstance in Wales include: the need for a delivery plan to focus on more agricultural economies, a recognition Wales is carrying a greater share of UK industries and engagement with Welsh Government's world-leading policy; the Wellbeing of Future Generations (Wales) Act 2015.

The Act is legislation requiring public bodies - such as local authorities, health boards and organisations like the Arts and Sports Councils of Wales - to put long-term sustainability at the forefront of their thinking, and work with each other along with other relevant organisations (such as third sector groups) and the public to prevent and tackle problems. The Act was decided upon following an extensive consultation period known as the National Conversation. It passed into law in April 2015. In order to create a more sustainable Wales, public bodies must work towards seven Well-being Goals and enact the five Ways of Working.
The Welsh Government has also published a set of 46 National Indicators to help measure progress towards achieving these Goals. The Indicators have been chosen so that we can all see if, for Wales as a whole, things are getting better. The Act enables Ministers to review and amend the national indicators so that they stay up to date and relevant. At the start of each financial year Ministers must publish an annual progress report setting out the progress made over the last year.

**Who does it affect?**
Public Bodies - The Act places a requirement on 44 devolved public bodies to set and publish well-being objectives that are designed to maximise their contribution to achieving each of the well-being goals, and they must take all reasonable steps to meet those objectives. They must publish an annual report showing the progress they have made in meeting their objectives.

Public Service Boards - The Act also forms Public Service Boards (PSBs) to improve the economic, social, environmental and cultural well-being in its local areas by strengthening joint working across all public services in Wales. PSBs must include the Local Authorities, Natural Resources Wales, Health Boards and Fire Services - and additional 'invited participants' including; Welsh Ministers, Chief Constables, and at least one body representing relevant voluntary organisations. PSBs have a duty to design and implement Local Well-being Plans, informed by detailed assessments, and set objectives for their local area to maximise their contribution to the well-being goals.

For more information visit https://www.wcva.org.uk/what-we-do/the-future-generations-(wales)-act-all-you-need-to-know

**Part 6: CCC Work Plan**

**Question 14 (Work plan):** The areas of evidence the Committee intend to cover are included in the 'Background' section. Are there any other important aspects that should be covered in the Committee's work plan?

ANSWER: We suggest that multi-solving should become a vital part of the committee's recommendations to Government. Such an approach can act as a tool to optimise co-benefits, which then helps strengthen the economic case and can build coalition across a range of sectors. In fact, the transition to zero carbon holds the potential to be one of the most exciting opportunities in human history, offering potential to fundamentally transform current systems. Whilst there are challenges, there are also huge multi-solving opportunities.

Multi-solving examples are outlined in our 2018 report *Raising Ambition* http://www.zerocarbonbritain.org/images/pdfs/raisingambition-zerocarbonscenarios.pdf

These include:

- **Equitable and integrated economics**: Renewable energy systems, rooted in our air, land and seas, provide the opportunity for more control over energy supplies, and potential for its ownership and revenues to become more equally distributed.
- **Employment**: Rising to the climate challenge can create opportunities for increased and more meaningful employment, with a greater sense of purpose. Although some jobs will inevitably be lost in conventional energy systems, analysis indicates new ones should more than compensate.
- **Adaptation and resilience**: The transition to zero emissions will not only reduce the degree of adaptation required, it also offers many opportunities for increasing our resilience to the changes already underway.
- **Restoring natural ecosystems**: Mapping an integrated zero emissions pathway offers a powerful opportunity to promote cross-sectoral thinking, enabling us to respect vital planetary boundaries, revitalising the global systems that support all human life.
- **Health and wellbeing**: Scenarios show how cleaner air and water, better diets and more active lifestyles can improve health, and that cleaner urban environments are more pleasant to live in and better support mental wellbeing. The Lancet's 2015 Commission on Health and Climate Change, with over 100 authors from around the world, stated as its central finding that, *"tackling climate change could be the greatest global health opportunity of the 21st century."*

Although there are big challenges, rather than an unresolved technical challenge, it is increasingly accepted that we actually face a mix of economic, cultural & psychological barriers. We recommend the UK Government engage a wider range of disciplines and researchers to explore ways of overcoming the key barriers rapidly enough to meet the demands of the 1.5C evidence-base.

Our 2017 report Zero Carbon Britain; Making it Happen references examples: http://www.zerocarbonbritain.org/images/pdfs/ZeroCarbonBritain-MakingItHappen.pdf