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Climate Change and the Low-Carbon Economy

Consultation Paper 135

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Background

This consultation paper is presented as the first stage in the development of new Party policy in relation to climate change and the low-carbon economy. It does not represent agreed Party policy. It is designed to stimulate debate and discussion within the Party and outside; based on the response generated and on the deliberations of the working group a full policy paper will be drawn up and presented to Conference for debate.

The paper has been drawn up by a working group appointed by the Federal Policy Committee and chaired by Duncan Brack. Members of the group are prepared to speak on the paper to outside bodies and to discussion meetings organised within the Party.

Comments on the paper, and requests for speakers, should be addressed to: Christian Moon, Policy Unit, Liberal Democrats, 8 – 10 Great George Street, London, SW1P 3AE. Email: policy.consultations@libdems.org.uk

Comments should reach us as soon as possible and no later than Friday 26th October 2018.

Further copies of this paper can be found online at www.libdems.org.uk/policy_papers

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1. Introduction

1.1.1 This consultation paper summarises current Liberal Democrat policy on climate change and the low-carbon economy, and invites party members and others to respond with their ideas on how party policy should change (see page 1 for details of how to submit comments). Taking into account your views, the Federal Policy Committee plans to submit a full policy paper for debate to the autumn conference in 2019.

1.1.2 Climate change poses a serious threat to current and future human well-being, and to many features of the natural environment. Yet measures to combat it and reduce emissions of the greenhouse gases that cause it will also bring many benefits, to health, well-being and economic prosperity. Replacing petrol and diesel cars with electric vehicles, for example, will cut air pollution and improve standards of health. Improving home energy efficiency will reduce energy bills and end the scourge of fuel poverty. Improving the efficiency of electricity generation and industrial processes will reduce dependence on natural resource imports and improve the competitiveness of the UK economy.

1.1.3 Action to achieve these goals is urgent. The evidence that changes in the climate are caused by human activity is now overwhelming. Global temperatures have been steadily rising over the past 20 years, and in each of the last three years the average has been more than 1°C above pre-industrial levels. In Paris in December 2015, world leaders agreed to hold 'the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognising that this would significantly reduce the risks and impacts of climate change'. In January 2018, the UK Met Office forecast that the average global temperature could reach 1.5°C above pre-industrial levels before 2022. This clearly puts the Paris goal in serious jeopardy.

1.1.4 Climate change poses the greatest global threat to the future well-being of humanity and the natural world. The impacts of rising global temperatures include an increase in the frequency and

magnitude of extreme weather events such as storms and hurricanes, flooding from both higher rainfall and rising sea levels from the thermal expansion of the oceans and melting of the polar ice caps, more frequent and more dangerous heat waves and droughts, longer and more damaging wildfires, the spread of insect-borne diseases, the destruction of habitats and the extinction of vulnerable species, and disruption to agriculture. Most of these impacts are already evident. They carry with them the likelihood of increasingly costly damage to social and economic well-being, the possible collapse of countries with weaker governance and most exposed to the impacts, and a rapid growth in the numbers of climate refugees.

1.1.5 Although these impacts are increasingly well understood, global action to tackle them still lags behind what is necessary. UN Environment's most recent assessment of the gap between the reductions in greenhouse gas emissions necessary to achieve the Paris Agreement targets at lowest cost and the sum of the national plans for reducing emissions submitted so far 'is alarmingly high'. This assessment concluded that the pledges 'cover only approximately one third of the emissions reductions needed to be on a least-cost pathway for the goal of staying well below 2°C'.

1.1.6 The UK's own national target, set by the 2008 Climate Change Act, is for a reduction in greenhouse gas emissions of 80 per cent by 2050, from 1990 levels. The government sets interim targets for carbon emission reduction, or 'carbon budgets' covering five-year periods, about twelve years in advance, on the advice of the independent and expert Committee on Climate Change (CCC).

1.1.7 The first carbon budget, for 2008–12, was met and the UK is on track to outperform both the second budget, for 2013–17, and the third carbon budget, for 2018–22. It is not on track, however, to meet the fourth or fifth budgets, covering the 2023–27 and 2028–32 periods. The Conservative government's unjustified opposition to onshore wind and solar photovoltaic (PV), its obsession with fracking and its failure to make progress in tackling emissions from heating, road transport and aviation, in particular, mean that this situation is highly unlikely to improve without significant changes in policy.

1.1.8 In October this year the UN's Intergovernmental Panel on Climate Change (IPCC) will publish a special report on the impacts of global warming of 1.5 °C above pre-industrial levels; it is expected to confirm that the world will need to reach net zero greenhouse gas emissions by mid-century in order to deliver the goals of the Paris Agreement. As the slow rate of global action so far makes clear, the UK's current target of an 80 per cent reduction is insufficient. As Liberal Democrats have argued since the adoption of our policy paper *Zero-Carbon Britain* in 2007, the UK should aim for the target of net zero greenhouse gas emissions by 2050. A growing number of countries, including Bhutan, Costa Rica, France, Iceland, New Zealand, Norway and Sweden, have now committed to net zero emissions targets.

1.1.9 Although the party has repeatedly endorsed the aspiration of reaching net zero UK greenhouse gas emissions by 2050, it has not set out in detail how this could be achieved. In order to inform the debate, two years ago Baroness Featherstone, the party's spokesperson on energy and climate change, commissioned a consultancy report into the topic; the result, *A Vision for Britain: Clean, Green and Carbon Free*, was published in September 2017 and is available on the party's website (www.libdems.org.uk/climatereport).

1.1.10 This consultation paper summarises the conclusions of that report and contrasts them with existing party policy, drawn mainly from the 2017 election manifesto and in some cases the more detailed 2015 manifesto (further detail is also available in the party's last climate policy paper, *Green Growth and Green Jobs* (2013) (https://www.libdems.org.uk/policy_papers)). We invite party members and others to respond with their ideas on how party policy needs to change to ensure the zero emissions goal can be achieved. Each chapter offers a series of questions; your response to these, and any other comments you wish to make, will be warmly welcomed. We particularly welcome any comments on how best we can promote our policies in order to win votes – because as we know, it is not enough to possess the right policy; we must also persuade people to vote for us.

2. Achieving net zero emissions

2.1.1 By 2016 total UK greenhouse gas emissions had been reduced by 37 per cent compared to the baseline year of 1990, mainly due to the replacement of coal in electricity generation by, first, gas and then renewable energy, as well as some improvements in the efficiency of energy use. Many of the 'easy' options are now close to being exhausted, however, and reducing the remaining 63 per cent of emissions to zero is likely to prove considerably more difficult. In particular, very little progress has been made to date in reducing emissions from heating, surface transport, agriculture and the UK's share of international aviation and shipping.

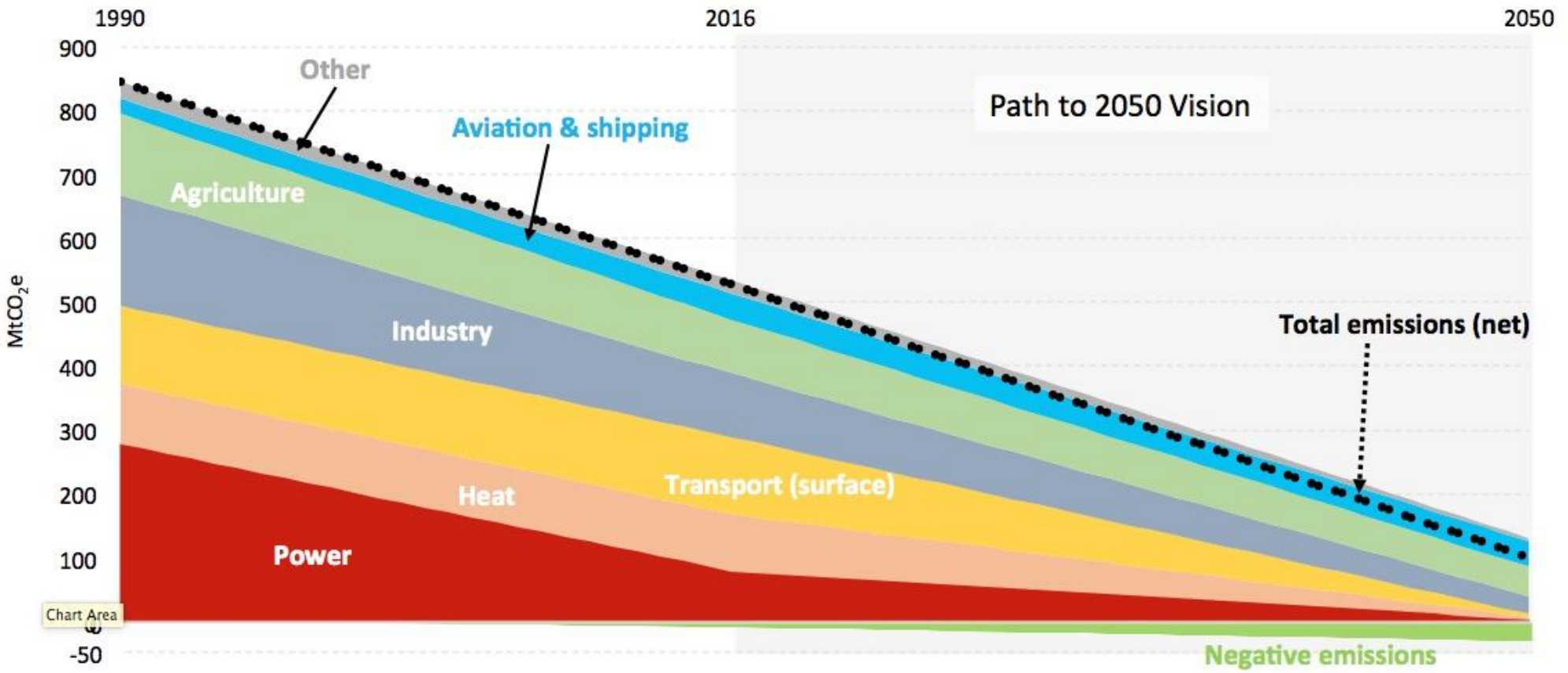
2.1.2 The figure on the next page shows the trajectory of UK greenhouse gas emissions from 1990 to 2016, together with the projected path the UK needs to follow to reduce emissions to net zero by 2050. The detailed calculations behind this, drawn from the *Vision for Britain* report, are included in the Annex, and the individual sectors are discussed in more detail in the chapters that follow.

2.1.3 On the projections in the *Vision for Britain* report, it should be possible – though not easy – to reduce UK emissions by 85 per cent by 2050, on known technologies. The report also assumes further reductions from 'negative emissions' – increasing the update of carbon mainly through planting more trees, increasing carbon storage in soils and using carbon capture and storage (CCS) technology. This can reduce emissions further, to a projected 88 per cent reduction by 2050.

2.1.4 On the top of this, we might expect new technologies to emerge over the next thirty years that will enable the UK to achieve net zero emissions – consider, for comparison's sake, the emissions-reducing technologies that have emerged over the last thirty years. A significant research effort into climate-mitigating technologies, including means of achieving negative emissions, will clearly be necessary. But is also seems likely that technological change by itself will not be sufficient. Personal lifestyle changes, for example over diets and patterns of working and learning, and changes by businesses and other organisations, will be necessary as well.

Climate Change and the Low-Carbon Economy

UK greenhouse gas emissions (MtCO2e), 1990 – 2016 (actual), 2017 – 2050 (projected)



For detailed figures and explanations of calculations, see the Annex

(This chart is reproduced in colour in the online version)

3. Power

Annual emissions from power generation				
1990	*2016*		*2050 projection*	
$MtCO_2e$	*$MtCO_2e$*	*% change from 1990*	*$MtCO_2e$*	*% change from 1990*
278	79	–72%	3	–99%

3.1 *Vision for Britain* summary

3.1.1 To meet its emissions targets, the UK needs to cut emissions from its power sector (i.e. from electricity generation) from their current (2016) levels of 79 $MtCO_2e$ per year to just 3 $MtCO_2e$ per year by 2050. This radical reduction requires:

- **The roll-out of 'smart power'** (technologies including but going well beyond smart meters, varying demand continuously to deliver services while minimising supply). Rapid technological innovation means that a combination of better interconnection, storage, and demand flexibility could combine to save consumers billions of pounds by 2030, help the UK meet its 2050 carbon targets, and secure the UK's energy supply for generations, given action now and through the 2020s.
- **Speeding up deployment of renewable power**. Despite the significant development of renewables in the UK, and the now considerable part they play in the UK energy mix, in order to meet a zero-carbon vision, deployment needs to be accelerated. The UK has great renewable energy potential, particularly with wind. But this depends on addressing the perception that intermittency is a limiting factor and, therefore, designing a system that does facilitate intermittency. There is an increased need to design financial instruments that better suit the needs of community-level, decentralised, renewable generation

- **Support for the rapid roll-out of storage technologies.** It is important to ensure that policies to 2030 and beyond avoid technological lock-in, especially at a time of rapid innovation. However, the importance of carbon capture and energy storage technologies suggests that these technologies should receive special support in the near term, particularly as they are expected to be cost-competitive relatively soon. There have been suggestions that the review of the UK capacity market rules for storage could make the UK a 'world leader in storage'. Action is essential now to improve the UK's capacity for effective clean energy storage. Additional support for rapid R&D and deployment of battery storage, as well as other kinds of pumped storage, will be necessary in the 2020s in order to support much greater grid flexibility and the integration of intermittent renewable energy sources.
- **Low-carbon centralised generation** will still exist in the energy mix. Despite a significant role for local generation and demand reduction, there will remain a role for low-carbon centralised generation, particularly for meeting peak demand, system balancing and other necessary grid services.
- **A reformed regulator**. There is now widespread consensus that OFGEM's role should shift from detailed investment evaluation to a focus on the need for appropriate market design and business models. The idea of moving towards an independent system operator and distribution system operators (DSOs) – which no longer own the assets – has been put forward. It is appealing both in terms of operations and planning, as well as in resolving conflicts of interest. In order to deliver this, there is a need for further UK electricity market reform in the 2020s.
- **A new governance structure for electricity**, with explicit provisions for decentralised energy services. Decentralised, community-scale electricity generation will play a big part in the generation mix of 2030 and 2050, in contrast to the highly centralised power sector of today. However, in its current form, it is hard to see Ofgem putting in place the necessary structures to support and incentivise decentralised energy structures and the

government's community energy strategy seems to have faded away. New governance arrangements, including DSOs acting as integrators of various distributed generation and demand-side services should receive early attention. Experience from Germany suggests that community ownership can be successful in promoting local renewable energy development and help in overcoming NIMBYism, especially over onshore wind.

3.2 Existing policy

3.2.1 The 2017 election manifesto included the following commitments:

- Expand renewable energy, aiming to generate 60% per cent of electricity from renewables by 2030, restoring government support for solar PV and onshore wind in appropriate locations (helping meet climate targets at least cost) and building more electricity interconnectors to underpin this higher reliance on renewables.
- Support investment in cutting-edge technologies including energy storage, smart grid technology, hydrogen technologies, offshore wind, and tidal power (including giving the go-ahead for the Swansea Bay tidal lagoon), and investing heavily in research and development.
- Oppose 'fracking' because of its adverse impact on climate change, the energy mix, and the local environment.
- Accept that new nuclear power stations can play a role in electricity supply provided concerns about safety, disposal of waste and cost are adequately addressed and new technology is incorporated, and without public subsidy for new build.
- Expand community energy schemes, encourage councils to develop community energy saving projects and local electricity generation and promote city-scale demonstration projects in electric vehicles and clean energy.

- Continue to back new entrants to the energy market, aiming for at least 30 per cent of the household market to be supplied by competitors to the 'Big 6' by 2022.

3.2.2 The 2015 manifesto contained the following commitment:

- Work with the independent regulator Ofgem to ensure the costs of electricity distribution and transmission infrastructure are allocated efficiently and fairly between consumers and generators across the country, and develop more European electricity interconnection capacity.

3.3 Questions for consultation

Question 1: *How can existing policy be developed and enhanced to meet the target of the almost complete decarbonisation of the electricity sector by 2050?*

Question 2: *How can policy best encourage the reduction in demand for electricity in the context of increasing use of electricity for transport and heat?*

Question 3: *What policies are needed to radically improve the experience (whether in terms of cost, service or reliability) of electricity customers?*

Question 4: *How can we best promote decentralised household and community-scale renewables?*

Question 5: *What changes are needed to accommodate increasing supplies of intermittent solar and wind energy?*

Question 6: *What future role, if any, do we envisage for nuclear power?*

Question 7: *How can we best secure the maximum benefits for consumers, in terms of creating jobs, boosting economic competitiveness, tackling social inequality and improving standards of health?*

4. Heating and cooling in buildings

Annual emissions from heating and cooling				
1990	*2016*		*2050 projection*	
$MtCO_2e$	*$MtCO_2e$*	*% change from 1990*	*$MtCO_2e$*	*% change from 1990*
294	89	–5%	4	–96%

4.1 *Vision for Britain* summary

4.1.1 To meet its emissions targets, the UK needs to cut emissions associated with the heating and cooling of its buildings from their current (2016) level of 89 $MtCO_2e$ per year to just 4 $MtCO_2e$ per year by 2050. This is a very significant cut, especially for a country which often suffers cold winters, has poor building insulation and an ageing housing stock and which currently relies heavily on fossil fuels (mainly natural gas) for residential and commercial heating. This radical reduction requires the following steps:

- **Energy efficiency measures become a clear priority for the UK over the next decade**. Numerous studies have shown that large-scale programmes, such as those involving retrofitting, have additional co-benefits, including reducing fuel poverty, giving a boost to several industries and creating jobs. The UK Green Building Council suggests that 260,000 jobs could come from a comprehensive retrofitting programme. There is a need for action now and throughout the 2020s.
- **Short-term financing becomes much more readily available**. The current government lacks a coherent strategy on energy efficiency. It may see the issue as involving large-scale public spending, but most evidence shows that investment in energy efficiency offers substantial social and economic returns. The political case needs restating now, with an associated speeding up of action over the next decade.

- **Electric heat pumps are installed in homes off the gas grid**. There are huge opportunities for heat pumps to be installed in heat-dense areas (e.g. cities) and for increased volumes of biomethane to be injected into the gas grid. The funding for these opportunities has already been agreed but we must learn the lessons from previous UK and international experience. Deployment of low-carbon heat cannot wait until the 2030s.
- **The National Infrastructure Pipeline offers much more on energy efficiency**. Energy Efficiency should be a priority of the National Infrastructure Commission's. Many experts have told us that there was no coherent strategy at the inception of the NIC and that it did not sufficiently include carbon and environmental considerations within its initial objectives. The political case needs making as soon as possible.
- Hydrogen pilots (replacing gas in the national or regional networks) are of sufficient scale and diversity to enable a real understanding of large-scale roll-out. As large-scale hydrogen deployment would require the use of carbon capture and storage (CCS), a strategy for CCS deployment remains an urgent priority and the same timeline for action (no later than the early 2020s) is recommended.
- **The UK develops a workforce with appropriate low-carbon skills**. The importance of developing a workforce with low carbon skills is being promoted by the TUC and many others. But the existing sector-based approach needs updating to cope with requirements which cut across sectors.

4.2 Existing policy

4.2.1 The 2017 election manifesto included the following commitments:

- Pass a new Green Buildings Act to set new energy efficiency targets, including a long-term ambition for every home in England to reach at least an energy rating of Band C by 2035.

- Ensure that at least four million homes are made highly energy efficient (Band C) by 2022, with priority given to fuel-poor households.
- Restore the Zero Carbon Standard for new homes which was set by the Coalition and abandoned by the Conservative government, increasing the standard steadily and extending it to non-domestic buildings by 2022.
- Expand community energy schemes, encourage councils to develop community energy saving projects and local electricity generation and promote city-scale demonstration projects in electric vehicles and clean energy.

4.3 Questions for consultation

Question 8: *Is existing policy adequate to meet the target of the almost complete decarbonisation of the heat sector by 2050? If not, how does it need to change?*

Question 9: *How can we encourage and fund household energy efficiency improvements? Though national infrastructure spending (i.e. from taxpayers)? Through encouraging householders' own investments, perhaps with appropriate tax incentives? Through local programmes?*

Question 10: *How can we ensure that new buildings are constructed to the highest possible standard?*

Question 11: *How can we raise the standards to which renovations of existing buildings are carried out?*

Question 12: *How do we ensure the private rented sector contributes to these targets?*

Question 13: *How can we best secure the maximum benefits for consumers, in terms of creating jobs, boosting economic competitiveness, tackling social inequality and improving standards of health?*

5. Transport

Annual emissions from surface transport				
1990	*2016*		*2050 projection*	
$MtCO_2e$	*$MtCO_2e$*	*% change from 1990*	*$MtCO_2e$*	*% change from 1990*
122	121	–1%	5	–69%
Annual emissions from international aviation and shipping (UK share)				
24	41	+71%	40	–67%

5.1 *Vision for Britain* summary

5.1.1 Surface transport was the largest emitting sector in the UK in 2016, with 26 per cent of total UK greenhouse gas emissions (121 $MtCO_2e$); this volume has hardly fallen since 1990. Demand for mobility, irrespective of mode of transport, continues to climb rapidly, meaning that to keep pace with demand, innovation must also move quickly. Electrification associated with a decarbonised grid, whilst not the 'silver bullet', is the major solution. Abatement is primarily due to conventional vehicle efficiency improvements and the uptake of ultra low emissions vehicles (ULEVs), with smaller reductions from biofuels, behaviour change in passenger transport, improvements to freight operations and further rail electrification. Specific solutions include:

- **Providing the motor industry with greater certainty to 2030**, with clear, stretching targets for new car and van CO_2, including heavy goods vehicles.
- **Tackling barriers to electric vehicle (EV) uptake**, including support for the upfront costs of EVs, the roll-out of a national network of charging points and the provision of local incentives such as access to parking.
- **Ensuring the tax regime keeps pace with technological change**. Vehicle taxation should be aligned to ongoing improvements in new

vehicle CO_2 emissions to incentivise uptake of the lowest emitting vehicles.

- **Extending successful emissions-reduction schemes for freight operations**. Existing schemes to help freight operators reduce their fuel costs and emissions should be rolled out to include small operators.
- **Ensuring lessons from schemes to reduce travel demand are applied**. Sustainable travel scheme schemes should be properly evaluated and extended.

5.1.2 Greater international collaboration and regulation is likely to be the only realistic solution for cutting emissions from international aviation and shipping from 41 $MtCO_2e$ to 40 $MtCO_2e$. The modest reduction mainly reflects expectations of future demand growth. However, significant growth in aviation activity, in particular, could be offset by technological advances in fuels, design and smarter logistics. Specific solutions include"

- **A role for UK leadership** in pressing for strongest possible model and implementation of the International Civil Aviation Organisation (ICAO) market-based mechanism.
- **Incremental reductions in carbon intensity** through improved aircraft efficiency and operational practices, such as international collaboration on aircraft design.
- **Biofuels offer a potential solution for aviation**, but by 2050 demand for sustainable bioenergy may be highly intensive.
- Backing a global approach for emissions reduction from shipping led by the International Maritime Organisation.
- **Reducing the carbon intensity of ships** by up to 65 per cent through the use of alternative fuels, use of larger ships, technology and operational innovation.

5.2 Existing policy

5.2.1 The 2017 election manifesto included the following commitments:

- A diesel scrappage scheme, and a ban on the sale of diesel cars and small vans in the UK by 2025.
- Extending Ultra-Low Emission Zones to ten more towns and cities.
- All private hire vehicles and diesel buses licensed to operate in urban areas to run on ultra-low emission or zero emission fuels within five years.
- Reform of vehicle taxation to encourage sales of electric and low-emission vehicles and development of electric vehicle infrastructure, including charging points.
- Pursue the electrification of the rail network, improve stations, reopen smaller stations, restore twin-track lines to major routes and proceed with HS2, HS3, and Crossrail 2, including development of a high-speed network stretching to Scotland.
- Invest capital in major transport improvements and infrastructure, including shifting more freight from road to rail.
- Develop a strategic airports policy for the whole of the UK, taking full account of the impacts on climate change and local pollution. We remain opposed to any expansion of Heathrow, Stansted or Gatwick and any new airport in the Thames Estuary and will focus instead on improving existing airports outside south-east England such as Birmingham and Manchester. We will ensure no net increase in runways across the UK.

5.3 Questions for consultation

Question 14: *Is existing policy adequate to meet the target of the almost complete decarbonisation of surface transport by 2050? If not, how does it need to change?*

Question 15: *Is there more we can do to reduce the demand for transport, including options for encouraging public rather than private*

transport, car sharing, cycling and walking? Or is it enough to focus solely on reducing emissions?

Question 16: *Recognising that the UK's ability to affect international aviation and shipping is limited, nevertheless, what can be done to reduce emissions from these sources?*

Question 17: *How can we best secure the maximum benefits for consumers, in terms of creating jobs, boosting economic competitiveness, tackling social inequality and improving standards of health?*

6. Industry

Annual emissions from industry				
1990	*2016*		*2050 projection*	
$MtCO_2e$	*$MtCO_2e$*	*% change from 1990*	*$MtCO_2e$*	*% change from 1990*
174	100	–43%	27	–84%

6.1 *Vision for Britain* summary

6.1.1 The industry sector comprises manufacturing, construction, water and waste management, refining and energy extraction. To meet its 2050 ambitions, the UK needs to cut emissions from 100 $MtCO_2e$ to around 27 $MtCO_2e$ in 2050, primarily through the use of energy efficiency, supply chain optimisation and the application of circular economy principles. Potential solutions include:

- **Development and deployment of industrial carbon capture and storage** (CCS) on a large scale. The application of CCS to large industrial sites is particularly important for energy-intensive sectors where there are few existing abatement options, including iron and steel, refining, cement and chemicals.
- **Fuel switching to bioenergy, hydrogen and electricity** as the power sector decarbonises. Hydrogen from decarbonised electricity could be used to supply low-temperature heat and significant quantities of high-temperature heat particularly in the iron and steel sector.
- **Energy efficiency investments**, through instruments such as product policies, Climate Change Agreements (CCAs), the Carbon Reduction Commitment (CRC), the Energy Savings Opportunity Scheme (ESOS), which makes it mandatory for large businesses to undertake assessments of energy use and energy efficiency opportunities, and the rationalisation of business energy taxes and policies to promote energy efficiency.

- **Public procurement and public-sector supply chains** need to pull in the same direction of the sector strategies and ensure that they are fully incentivising low carbon innovation in industry. Emissions disclosure should become a core part of public sector procurement, properly embedded in public sector procurement activities for both local and central and devolved government.
- **Business action to raise resource productivity**: what is known as the Circular Economy. An important recent study from CIEMAP has indicated that pursuing resource productivity could provide significant opportunities to plug shortfalls in climate polices, saving an additional 62–100 $MtCO_2e$ over the period 2013–32. Resource productivity should be placed at the heart of the UK's decarbonisation strategy.
- **A focus on low-carbon skills**. The TUC sees a key role for revitalised sector skills bodies and also indicates the Institute for Apprenticeships could plan for apprenticeship provision to meet the needs of a sustainable industrial policy.
- **A renewed focus on export opportunities**. There is considerable potential for low-carbon business opportunities for the UK. The Carbon Trust, for example, forecasted (in 2014) that '[by 2020], the UK has a credible opportunity to triple its [low carbon] exports from £12 billion to around £30 billion and double its share of the global low carbon export market from around 5% to around 10%'.

6.2 Existing policy

6.2.1 The 2017 election manifesto included the following commitments:

- Support an ambitious carbon capture and storage programme, which is essential for delivering clean industrial growth.
- Pass a Zero Waste Act, including legally-binding targets for reducing net consumption of key natural resources, and introducing incentives for businesses to improve resource efficiency.

- Benefit consumers by promoting better product design to improve repairability, reuse and recycling.
- Build on the Coalition's industrial strategy, working with sectors which are critical to Britain's ability to trade internationally, creating more 'Catapult' innovation and technology centres and backing private investment in particular in green innovation.
- Develop the skilled workforce needed to support this growth with a major expansion of high-quality apprenticeships including Advanced Apprenticeships, backed up with new sector-led National Colleges. We will develop a national skills strategy for key sectors, including in particular low-carbon technologies, to help match skills and people.

6.2.2 The 2015 manifesto included these commitments:

- Grow the market for green products and services with steadily higher green criteria in public procurement policy, extending procurement requirements more widely through the public sector including to the NHS and Academy schools. In particular we will deliver ambitious reductions in energy use.
- Ensure UK Trade and Investment and UK Export Finance can prioritise support for key sectors identified in our Industrial Strategy, including exports of green products and technologies, and press for higher environmental standards for export credit agencies throughout the OECD.

6.3 Questions for consultation

Question 18: *Is existing policy adequate to meet the target of reducing emissions from industry by 75 per cent 2050? If not, how does it need to change?*

Question 19: *How can we best decarbonise energy use in energy-intensive industrial sectors?*

Question 20: *What prospects are there for resource-efficiency and circular-economy solutions?*

Question 21: How can we best secure the maximum benefits for consumers, in terms of creating jobs, boosting economic competitiveness, tackling social inequality and improving standards of health?

7. Agriculture, land use, forestry and bioenergy

Annual emissions from agriculture and other non-CO_2 gases				
1990	*2016*		*2050 projection*	
$MtCO_2e$	*$MtCO_2e$*	*% change from 1990*	*$MtCO_2e$*	*% change from 1990*
126	84	–33%	47	–63%
Annual emissions from peatland				
21	21	0%	5	–76%
Annual emissions from land use, land use change and forestry, bioenergy with carbon capture and storage, wood in construction				
5	–7	n/a	–31	n/a

7.1 *Vision for Britain* summary

7.1.1 This chapter covers the agriculture, land use and forestry sectors, and the negative emission opportunities listed in the table in Chapter 2. (The totals included in the table also include some other non-carbon dioxide greenhouse gas emissions, such as methane from waste and fluorinated gases used for industrial purposes; these are not considered here.)

7.1.2 In order to meet its emissions reduction targets for the land-use and agriculture sector, the UK needs to find significant reductions in a range of different (and complex) sources of greenhouse gases and preserve its currently existing carbon sinks and rapidly augment them in order to deliver the very significant carbon removal options ('negative emissions') set out in the table in Chapter 2. The main measures include a comprehensive bio-economy strategy covering agriculture, land use and forestry, enabling an informed conversation about the many inter-related aspects which must be considered together in order to derive the greatest benefits and understand the trade-offs. This includes:

- **An ambitious programme of afforestation** in order to deliver the carbon removal/negative emissions associated with the CCC's max scenario (and our scenario) – which the CCC estimates to require up to 30,000ha of additional woodland coverage in the UK per year by 2050 (for context, this is around half the total area of the New Forest).
- Delivering **carbon removal/negative emissions** of between 11 and 55MTCO_2e through afforestation or alternatives such as algae cultivation – potentially in conjunction with Bioenergy with Carbon Capture and Storage (BECCS). (The upper figure in this range corresponds to the CCC's figure, but the development of BECCS technology is highly speculative. A UK government report published in 2017 included sharply reduced estimates for the amount of biomass feedstock likely to be available to the UK in the future given international competition.)
- Developing **alternatives to woody biomass**, such as organic waste, agricultural residues, algae and domestic energy crops (also contributing to landfill reduction strategies).
- **The increased use of wood in construction**, working with industry and forestry sectors to ensure this occurs effectively and sustainably, delivering carbon removal/negative emissions in the place of carbon-intensive materials such as concrete.
- For agriculture, reducing fossil fuel use in the sector and improving **land management practices for natural carbon sequestration**, including following France's lead in promoting a '4 per 1000' soil initiative to increase the amount of CO_2 captured by soil by four grams per kg.
- Developing **innovation clusters for sustainable biofuels and bioenergy**. More research into sustainable biofuels should be undertaken, including into woody/grassy crops with higher yields on marginal land; advanced biofuels demonstration; and demonstration of integrated gasification systems at scale. This could align with a policy for the development of innovation clusters supported by regional higher education providers.

- **Peatland** to be included in national carbon accounting, and emissions from peatland to be reduced from 21 $MTCO_2e$ to 5 $MTCO_2e$ through the restoration of the UK's extensively degraded peatland, particularly in upland areas.

7.2 Existing policy

7.2.1 The 2017 election manifesto included the following commitments:

- Continue our long campaign to reform agricultural subsidies – making sure British farming remains competitive and doesn't lose out in the event of Britain leaving the EU, rebalancing away from direct subsidy and refocusing support towards the public goods that come from effective land management, including countryside protection, flood prevention, food production, and climate change mitigation.
- Introduce a National Food Strategy to promote the production and consumption of healthy, sustainable and affordable food.
- Reverse the current sharp decline in the rate of woodland creation by aiming to plant a tree for every UK citizen over the next ten years, and protect Britain's remaining ancient woodlands.

7.2.2 The 2015 manifesto included these commitments:

- Grow the market for green products and services with steadily higher green criteria in public procurement policy, extending procurement requirements more widely through the public sector including to the NHS and Academy schools. In particular we will deliver ambitious reductions in energy use.
- Use biomass primarily for heating and small-scale power generation, act to encourage the wider use of biogas and argue for the reform of EU policies on biofuels and biomass which help drive deforestation, including ending all support for food-crop- based biofuels after 2020.

7.3 Questions for consultation

Question 22: *Is existing policy adequate to reduce emissions for agriculture to meet the targets included in A Vision for Britain? If not, how does it need to change?*

Question 23: *What measures can be adopted to increase soil carbon uptake?*

Question 24: *Should we be aiming to encourage changes in eating habits with the aim of reducing greenhouse gas emissions (e.g. eating less red meat)?*

Question 25: *Other than expanding forestry, party policy has not addressed the topic of negative emissions. Are the three options outline above (afforestation, wood in construction and BECCS) the right ones?*

Question 26: *Are there other negative emissions technologies we should explore?*

Question 27: *How can we best secure the maximum benefits for consumers, in terms of creating jobs, boosting economic competitiveness, tackling social inequality and improving standards of health?*

8. Delivering the transition

8.1 *Vision for Britain* summary

8.1.1 The UK has done well so far in developing low-carbon industries, such as renewable energy, but further progress is hampered by a lack of clear government commitment to supportive policy and institutional frameworks.

8.1.2 The Climate Change Act is now ten years old, but the Conservatives' sudden changes to low-carbon energy policies have led to a collapse in clean energy investment, jeopardising the UK's ability to meet its carbon budgets. The over-centralised machinery of government frustrates local energy and climate change initiatives, and the existing institutions – finance institutions, energy vehicles and banks – are not designed to support projects by small, community organisations. The Green Investment Bank was established under the Coalition government, to provide funding for low-carbon projects which have had difficulty raising finance in the past, and to boost private investment into such projects – but it was privatised by the Conservative government in 2017.

8.1.3 Liberal Democrats support an open and internationalist approach to tackling climate change, because the challenges are too massive for individual countries to be able to tackle them alone. By acting through the EU, the UK has been able to lead on climate change solutions and magnify and project its global influence. But Brexit threatens to destroy all of this. Brexit also means that the UK is highly likely to leave the EU Emissions Trading System, the centrepiece of this country's carbon pricing policy. Uncertainty over UK participation in the European Internal Energy Market, and UK compliance with the EU Clean Energy Package, are also undermining investor confidence.

8.1.4 *Vision for Britain* did not examine in detail issues of green finance and taxation, innovation support or the overall institutional framework for climate policy, though it did include two annexes, on 'financing the transition' and on 'Brexit and its possible impact'.

8.1.5 The first annex suggested that there were clear opportunities for the Liberal Democrats to develop a comprehensive green financial services strategy. The primary goal would be to energise parts of the economy that have been less able to raise finance and to grow the sustainable and carbon-neutral parts of their businesses, while ensuring that markets as a whole took climate risk and climate neutrality into account in their overall decision-making processes, including in their long-term investment and growth strategies. Such a strategy might include:

- Maximising the engagement of UK pension funds to provide long-term, patient capital.
- Exploring policy incentives in the use of green bonds and a green bond hub.
- Winding down the system of fossil fuel subsidies.
- Building sustainability into the remit of a new infrastructure bank – proceeds from the projected £2bn sale of the Green Investment Bank should be ring-fenced to support energy transition activities.
- Adopting the Financial Stability Board / Task Force on Climate-Related Financial Disclosures guidelines on risk disclosure for financial services as well as for public-sector bodies and pension funds. A keen eye should be kept on developments on mandatory reporting and disclosure in France, with a view to using similar measures in the UK.
- Consideration of UN Environment's recommendations for an overall UK Sustainable Financial Strategy.
- Local banks should be set up with a supportive network to share information (and risk).

8.1.6 The annex on Brexit outlined a series of questions that would need to be answered, including:

- The UK's continued participation in the EU Energy Union and the extent to which interconnection in energy systems will be continued and deepened, after Brexit.

- To what extent the UK will decide to remain in sync with the EU's post-2020 decarbonisation plans.
- Whether the UK remains part of the EU Emission Trading System or if it decides to set up its own parallel emissions trading system to cover UK-only emissions.
- Whether the UK will continue to be part of the EU Effort Sharing Regulation, which covers some areas not in the ETS, including high-emitting sectors such as transport (apart from aviation and shipping), buildings, waste and land use.
- Whether the UK will pursue 'equivalence' with EU standards on fuel quality and vehicle efficiency.
- The extent to which the UK will participate in the EU Circular Economy Package. Business has developed to a large extent without support from policy-makers on the circular economy, but many had thought that future EU policy in this area would help accelerate resource-efficiency gains.
- It is unclear exactly how Brexit will impact the UK's policy on forestry – both globally and domestically. As well as relinquishing its ability to determine the EU's sustainability criteria for biomass, the UK will also lose the ability to influence EU policy on climate accounting and LULUCF more broadly.
- What the UK's departure from the CAP will mean for environmental policy within agriculture. There are a number of possibilities on how UK policy could develop, some of which would be good for the environment and climate, others less so.
- The UK's continued participation in EU research and development is called into question by Brexit. There will be uncertainty around collaboration on R&D in energy.
- The extent to which the UK's overall influence on EU climate and decarbonisation issues will endure.

8.2 Existing policy

8.2.1 The 2017 election manifesto included the following commitments on green finance and the institutional and governance arrangements for climate policy:

- Pass five green laws: a Green Transport Act, a Zero-Carbon Britain Act, a Nature Act, a Green Buildings Act, and a Zero Waste Act to incorporate existing EU environmental protections, maintain product standards, for example for energy efficiency, and establish a framework for continual improvement.
- Pass a Zero Carbon Britain Act to set new legally binding targets to reduce net greenhouse gas emissions by 80 per cent by 2040 and to zero by 2050.
- Set up a British Housing and Infrastructure Development Bank to mobilise investment into the low carbon and sustainable infrastructure the UK needs to remain competitive.
- Support the Paris agreement by ensuring the UK meets its own climate commitments and plays a leadership role in international efforts to combat climate change.
- Maintain membership of Euratom, ensuring continued nuclear co-operation, research funding, and access to nuclear fuels.
- To ensure the policies set out in this chapter are implemented, and to put the protection of the environment at the heart of policies across all areas of government, we will establish a Cabinet Committee on sustainability, chaired by a cabinet minister, establish an Office for Environmental Responsibility to scrutinise the government's efforts to meets its environmental targets and place a responsibility on every government agency to account for its contribution towards meeting climate targets in everything it does.

8.2.2 In addition, of course, the party has consistently opposed Brexit. Should it go ahead, we called for:

- Membership of the single market and customs union: We believe that any deal negotiated for the UK outside the EU must ensure

that trade can continue without customs controls at the border, and must maintain membership of the single market, which smooths trade between the UK and the continent by providing a common 'rule book' for businesses and a common mechanism to ensure that everyone abides by the rules.

- Maintaining environmental standards: The European Union has created the highest environmental standards in the world. We have a duty to future generations to protect our environment and tackle climate change. Liberal Democrats will ensure that everything is done to maintain those high standards in UK law, including the closest possible co-operation on climate and energy policy and continued membership of the Internal Energy Market.

8.3 Questions for consultation

Question 28: *What changes, if any, are needed to the Climate Change Act 2008?*

Question 29: *What policies on green finance does the party need to develop?*

Question 30: *Do we see a role for taxation, such as carbon or energy taxes?*

Question 31: *Where do we see a role for subsidies?*

Question 32: *How can we best deliver support for innovation?*

Question 33: *How do the structures of national government need to change to deliver the net zero goal?*

Question 34: *How much further can we get by unleashing local initiative and innovation? What powers can be decentralised to local government and communities?*

Question 35: *What strategies do we need for the development of appropriate skills?*

Question 36: *Should Brexit go ahead, how should we align UK policy and structures with the EU?*

Question 37: *How can the UK best play a leadership role in international efforts to combat climate change?*

Question 38: *How can we best secure the maximum benefits for consumers, in terms of creating jobs, boosting economic competitiveness, tackling social inequality and improving standards of health?*

Annex: UK greenhouse gas emissions

Greenhouse gases include carbon dioxide, emitted primarily from burning fossil fuels (coal, oil and gas); methane, emitted mainly from gas and oil wells, agricultural processes and waste degradation; nitrous oxide, mainly from agriculture; and a number of synthetic gases such as hydrofluorocarbons, used in industrial processes. All of these have different impacts on the climate, and for comparison's sake are measured in terms of carbon-dioxide-equivalent (CO_2e) emissions.

Total emissions of greenhouse gases in the UK in 1990 amounted to 823 million tonnes of CO_2e ($MtCO_2e$), including the UK's share of aviation and shipping (currently excluded from the national account until reliable accounting methods become available, but included in the 2050 target). The consultants who prepared the *Vision for Britain* report argued also for including peatland, currently a significant source of emissions, giving an additional 21 $MtCO_2e$ per year, for a total of 844 $MtCO_2e$.

The table below sets out actual UK emissions in 1990 and 2016 by sector, and estimates for emissions in 2050 under two scenarios: the CCC's 'max' scenario, which it describes as ambitious but feasible under current technology, and the scenario developed by the consultants, which varies from the CCC's in three respects:

- Additional savings of 5 $MtCO_2e$ from industry through resource-efficiency measures.
- Emissions from peatland are included, as above; the assumption is that these can be reduced from 21 $MtCO_2e$ to 5 $MtCO_2e$ per year.
- The scope of negative emissions from bioenergy with carbon capture and storage (BECCS) is sharply reduced, in line with a 2017 government estimate of limited future availability of feedstock.

Sector	**Annual emissions ($MtCO_2e$)**			
	1990	**2016**	**2050 (CCC)**	**2050 (*Vision*)**
Power	278	79	3	3
Heat for buildings	94	89	4	4
Surface transport	122	121	5	5
Industry	174	100	32	27
Agriculture and non-CO_2 GHG emissions	126	84	47	47
International aviation and shipping, UK share (not currently included in UK accounting)	24	41	40	40
Peatland (not currently included in UK accounting or CCC scenarios)	21	21	21	5
Total without negative emissions	*839*	*514*	*152*	*131*
Negative emissions: land use, land-use change and forestry	5	–7	–16	–16
Negative emissions: bioenergy with carbon capture and storage	N/A	N/A	–47	–11
Negative emissions: wood in construction	N/A	N/A	–4	–4
Total negative emissions	*5*	*–7*	*–67*	*–31*
Total including negative emissions	***844***	***507***	***85***	***100***