



The Climate Change Act

Briefing note

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The Climate Change Act received Royal Assent on 26 November 2008 and set an overarching target to reduce UK greenhouse gas emissions by at least 80 per cent by 2050 compared to 1990 levels. The Act had strong political support: it was passed nearly unanimously by Parliament, as were the first four carbon budgets establishing intermediate targets. This briefing note summarises research by the Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science on key features of the Climate Change Act. These include the background, the economics, the UK low-carbon transition, the international context and the scientific evidence.

1. The Climate Change Act: background

- The Climate Change Act was passed near-unanimously by Parliament in 2008. It set the world's first legally-binding climate change target, requiring the UK to reduce its greenhouse gas emissions by at least 80 per cent by 2050 compared with 1990. It also included a medium-term target of a reduction of at least 26 per cent by 2020 (subsequently amended to a reduction of at least 34 per cent by 2020). The Act also established the requirements for a National Climate Change Risk Assessment and the National Adaptation Programme, and set up an independent body, the Committee on Climate Change, to advise the Government on emissions targets and progress on other aspects of the Act.
- The UK 2050 emissions target was set on the basis of interim advice from members of the Committee on Climate Change (Turner, 2008) who indicated that it would be consistent with the task of reducing global annual emissions of greenhouse gases covered by the Kyoto Protocol, to about 20 billion tonnes of carbon-dioxide-equivalent by 2050, in line with the goal of limiting global warming to no more than 2°C by 2100 and creating a low probability of warming of 4°C.
- A series of five-year carbon budgets, proposed by the Committee on Climate Change and subsequently legislated by the Parliament, define the path to 2050. The first three carbon budgets were set in 2009 and cover the periods 2008-2012, 2013-2017 and 2018-2022. The fourth budget was set in 2011, for the period 2023-2027, committing the UK to reduce emissions to 50 per cent below 1990 levels.
- To comply with these budgets, a number of climate change policies are being implemented. A proportion of the UK's carbon emission reductions are being achieved through the European Union Emissions Trading System (EU ETS). Domestic measures have also been introduced to reduce energy consumption in those sectors outside the EU ETS and in households, as well as to stimulate the uptake of low-carbon

technologies across the whole economy. These include: the Climate Change Levy, Climate Change Agreements and Carbon Reduction Commitments, which effectively apply a carbon price for electricity and fossil fuels used by firms; the Feed-in Tariffs and Renewables Obligation, supporting the deployment of small- and large-scale renewable energy technologies; and other instruments targeting energy efficiency, such as the Green Deal, the Energy Companies Obligation (ECO) and smart meters.

- Provisional figures published by the Department of Energy and Climate Change in July 2013 indicate that the UK's emissions (including those covered by the EU ETS) for the period 2008-2012 were 2,943 million tonnes of carbon-dioxide-equivalent, compared with the first carbon budget of 3,018 million tonnes of carbon-dioxide-equivalent.
- In its fifth statutory report to Parliament on progress towards meeting the UK's carbon budgets, the Committee on Climate Change (2013) concluded that, while the first carbon budget (2008-2012) has been met and it is likely that the second one (2013-2017) will also be achieved, the UK is not currently on track to meet the third (2018-2022) and fourth (2023-2027) budgets. The Committee warned: "Without a significant increase in the pace of emissions reduction, starting very soon, the costs and risks of moving to a low-carbon economy in the 2020s and beyond will be increased. To meet its statutory commitments, it will be necessary for the Government to develop and implement further policy measures over the next two years".
- The Committee on Climate Change recommended in December 2010 that the fourth carbon budget should be set at 1950 million tonnes of carbon-dioxide-equivalent for the period 2023-27. The Committee stated that the fourth carbon budget "should be regarded as an absolute minimum" because "a less ambitious budget, requiring further acceleration towards the end of the 2020s would ... put the 2050 target at risk". This was accepted by the Government and legislated by Parliament in June 2011. The Committee also recommended that the fourth budget be reviewed in light of progress towards the European Union's emissions reduction target for 2030, which could have implications for UK emissions covered by the EU ETS. The Government accepted this advice and indicated it will undertake the review in 2014.
- The Climate Change Act allows carbon budgets to be reviewed, but they may only be changed if there has been a clear and significant change in the specific circumstances upon which the budget was set. The Committee on Climate Change will be publishing in December 2013 its advice to the Government about the review of the fourth carbon budget. In July 2013, Lord Deben, the Chair of the Committee, wrote to Ed Davey, the Secretary of State for Energy and Climate Change, to point out that the original advice about the fourth carbon budget "was not premised on the EU increasing ambition in its 2020 emissions reduction target from 20% to 30% on 1990 levels" (Gummer, 2013). The letter states: "The fact that this has not happened does not constitute a change in the basis upon which the fourth carbon budget was set. It is therefore not relevant to the review and could not be the basis for changing the budget".
- If the fourth carbon budget is increased as a result of the review, such that the required emissions reduction is weakened, the delay and backloading of action may increase the

long-term costs of achieving the 2050 target. The change may also undermine the confidence of investors about the pace of the UK low-carbon transition.

2. The Climate Change Act: the economics

- The interim advice from members of the Committee on Climate Change (Turner, 2008) estimated the likely cost of achieving a target of reducing the UK's annual emissions of greenhouse gases by at least 80 per cent by 2050 compared with 1990: "The costs to the UK from this level of emissions reduction can be made affordable – we estimate between 1-2% of GDP in 2050 - with appropriate policies and trajectories. Our estimates are the same order of magnitude as those provided by the Stern Review and other estimates for global emissions reductions." Subsequent analysis by the Committee has reaffirmed this estimate.
- The Impact Assessment for the Climate Change Act published by the Department of Energy and Climate Change in March 2009 indicated that the total benefits (present value) would be £457 billion to £1,020 billion, while the total costs (present value) would be £324 billion to £404 billion. It noted: "Long-term modelling suggests that the costs will be in the range estimated by the Stern Review of 1% +/- 3% of GDP".
- The Stern Review (2007), which was published before the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), assessed a wide range of evidence on the impacts of climate change and on economic costs, and used a number of different techniques to assess the costs and risks. Its main conclusion was that "The benefits of strong and early action far outweigh the economic costs of not acting". Among its other conclusions were: "Using the results from formal economic models, the Review estimates that if we don't act, the overall [global] costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of GDP or more." It added: "In contrast, the costs of action – reducing greenhouse gas emissions to avoid the worst impacts of climate change – can be limited to around 1% of global GDP each year." This estimate was based on the assumption that concentrations of greenhouse gases in the atmosphere would be stabilised between 450 and 500 parts per million of carbon-dioxide-equivalent.
- Stern (2008) took account of the findings of the IPCC Fourth Assessment Report and concluded that the scientific evidence indicated risks that justified stabilisation of atmospheric concentrations of greenhouse gases below 500 parts per million of carbon-dioxide-equivalent. It estimated that this would cost between -1 and +3 per cent of global GDP.
- Although there were some criticisms of some of the findings of Stern (2007), these have been comprehensively rebutted in the economics academic literature (e.g. see Dietz, Hope *et al.*, 2007; Hamid *et al.*, 2007; Dietz, Anderson *et al.*, 2007). Subsequent analyses (e.g. Garnaut, 2008) of the costs and benefits of reducing greenhouse gas emissions to avoid climate change risks have confirmed the overall conclusions of Stern (2007).

- Stern (2013) warned that current methods of assessing the potential impacts of unmitigated climate change using standard scientific and economic models, including those examined by Stern (2007), can substantially underestimate the potential costs and risks, and hence lead to inaccurate conclusions about the benefits of reducing greenhouse gas emissions.

3. The Climate Change Act: the UK low-carbon transition

- Investing in a low-carbon, resource-efficient economy has a price. But it is important to differentiate an 'investment' cost from a 'resource' cost. The cost of installing alternative energy infrastructure is mostly higher than conventional fossil-fuel-based infrastructure, but the margin is beginning to narrow for some renewable technologies, and such energy systems are likely to be cheaper to run in the future, so well-planned investment should pay off.
- In addition, the likelihood is that the costs of new energy systems will fall further relative to conventional supply, especially as energy storage and energy distribution technology improves. The extent to which they do so depends on the purchasing, installing and running costs of the capital equipment, which is in part a function of learning and experience, and also the evolution of the costs of fossil fuels. Although breakthroughs for conventional energy sources, such as fracking, may alleviate pressures in some regions, the likelihood remains that fossil fuel prices will generally rise under pressure from growing demand from industrialising countries in Asia and elsewhere.
- Focusing solely on upfront costs is therefore not a good gauge of value for money. It has been suggested that the current economic environment in the UK does not present a good time to raise energy costs for businesses and households. However, from a macroeconomic perspective, now is the best time to pay for the changes we need to make in order to create jobs and growth. There is no lack of private saving; annual private sector surpluses – the difference between private saving and investment – have swollen to record levels over the past few years, amounting to more than 5 per cent of UK GDP (Zenghelis, 2012). There is, however, a perceived lack of opportunity holding back capital investment. The net economic returns to leveraging this saving now, by creating private investment opportunities, are uniquely high. Capital costs are historically low and the potential to crowd out alternative investment and employment is much smaller than when the economy is operating close to full capacity.
- There is also a strategic reason to support low-carbon investment. The green economy covers several sectors, including transport, energy, buildings, industry and land use. The Confederation of British Industry estimates an investment of £150 billion is required in energy over the next 20 years in the UK. The Department for Business, Innovation and Skills (2013) values the green market at £3.4 trillion annually worldwide. Policies to encourage low-carbon investment would provide new business opportunities and generate income for investors in the UK precisely because they address growing global resource challenges.

- The world's economy will inevitably shift to low-carbon resource-efficient production, either as a result of policy or because of market pressures on resource prices. This process has already begun. Two of the world's fastest-growing economies, South Korea and China, have moved decisively to champion high-technology low-carbon growth in stimulus packages in 2008 and 2009. China's 12th Five-Year Plan also sets strong targets¹. These countries recognise that investment flows to the pioneers of revolutions (Perez, 2002).
- The green sector is one of the few vibrant parts of the global economy at the moment. The Department for Business, Innovation and Skills (2013) valued sales in the UK low-carbon and environmental goods and services sector at £128.1 billion in 2011–12, growing 4.8 per cent from the previous year. Overall, the UK is a substantial net exporter of green businesses, including to the likes of Germany and China (Green Alliance, 2013). But the UK private sector is not investing as heavily as it could in green innovation and infrastructure because of a lack of confidence in future returns in this policy-driven sector.
- The evidence suggests that the UK's success in nurturing the innovative, high-technology low-carbon sector has been based on strong domestic policies, global leadership and clear political commitments that have boosted investor confidence. However, more and more countries are now acting strongly to draw investment into this high growth sector. 138 countries now have renewable energy targets and 71 countries apply feed-in-tariffs for renewable generation (Green Alliance, 2013).
- A growing lack of political leadership, together with open conflict within the Government about energy and climate policies, weakens business confidence in this successful sector and threatens to erode the UK's ability to compete internationally. The impact of the 2008 Climate Change Act in setting world-leading emissions reduction targets is being undermined by political threats to weaken the carbon budgets. The Confederation of British Industry (2012) warned: "If the government continues with its current approach, there is a real risk that UK green business growth will not reach the government's expectations, which could mean the UK losing almost £400 million in net exports in 2014-15."
- In economic terms, resolving key market failures and preventing the lock-in of wasteful, resource-hungry infrastructure, as well as driving innovation, requires early action (Romani *et al.*, 2011). Minimising the investment cost of such action, in turn, requires clear strategic policy direction by demonstrating its commitment to a sector.
- Network externalities associated with energy, communications and transport systems mean the value of joining a network depends on how many others are on it. The private sector is highly unlikely to risk changing existing networks, even if the returns are viable for specific technologies, unless the long-term path of policy is credible and policy risk is minimised such that the hurdle of up-front costs can be overcome.

¹ Of the seven 'Magic Growth sectors' identified in the Twelfth Five Year Plan, three are low-carbon industries: clean energy, energy efficiency, clean energy vehicles; the others are high-end manufacturing.

- In addition, innovation requires understanding of the unintended consequences which result from knowledge spills-overs from one sector to another². Market failures relating to information and ownership mean investors fear that they will fail to capture the full returns to risky long-term innovation where the knowledge spill-over is free, and so underinvest in its development. In all these cases, private and public costs and benefits diverge, and coordination and information problems limit the degree of investment in energy efficiency and waste reduction. A strong public steer is necessary in order to induce the efficient level of private innovation. By contrast, mixed or muddled policy signals will put off investors and raise project costs.
- The House of Commons Select Committee on Science and Technology (2013) recently reported: “What is consistent across business is the need for a clear vision from the government to provide confidence into the future. Without a definite commitment from government, business is more reticent about making its own financial commitment to the levels of risk that innovation requires. The evidence that we have seen shows that there is no coherent innovation policy.”
- A clear green strategy is likely to be at the heart of the global innovation race over the coming century. But the potential to deter nervous investors is particularly acute in an uncertain economic environment such as that which exists at present. There is mounting evidence to suggest that the UK private sector is not investing as heavily as it could in green innovation and infrastructure because of a lack of confidence in future returns in this policy-driven sector. This threatens to undermine one of the most successful and innovative UK business sectors. The lack of confidence appears in large measure to be due to growing uncertainties surrounding current energy and environment policy. These uncertainties are likely to cost jobs and growth.

4. The Climate Change Act: the international context

- At the 15th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change in Copenhagen, Denmark, in December 2009, 114 Parties, including the UK agreed the Copenhagen Accord, which states: “To achieve the ultimate objective of the Convention to stabilize greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, we shall, recognizing the scientific view that the increase in global temperature should be below 2 degrees Celsius, on the basis of equity and in the context of sustainable development, enhance our long-term cooperative action to combat climate change.” A further 27 Parties subsequently indicated that they also agreed with the Accord. In addition, 42 industrialised countries, including the UK, provided quantified economy-wide emissions targets for 2020, while 45 developing countries provided details of nationally appropriate mitigation actions.

² Mariana Mazzucatto in ‘The Entrepreneurial State’, 2013, tells a compelling story of how almost all the radical technologies behind the iPhone were funded by government, mostly through defence research funds: this includes the internet, GPS, touchscreen display, and even the new voice-activated Siri personal assistant.

- The commitments in the Copenhagen Accord were re-affirmed at the 16th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change in Cancún, Mexico, in December 2010. The Parties, including the UK, agreed that “deep cuts in global greenhouse gas emissions are required according to science, and as documented in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, with a view to reducing global greenhouse gas emissions so as to hold the increase in global average temperature below 2°C above preindustrial levels, and that Parties should take urgent action to meet this long-term goal, consistent with science and on the basis of equity”. The Parties also agreed to carry out a review between 2013 and 2015 to consider “strengthening the long-term global goal on the basis of the best available scientific knowledge, including in relation to a global average temperature rise of 1.5°C”.
- The 17th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change in Durban, South Africa, in December 2011 noted “*with grave concern* the significant gap between the aggregate effect of Parties’ mitigation pledges in terms of global annual emissions of greenhouse gases by 2020 and aggregate emission pathways consistent with having a likely chance of holding the increase in global average temperature below 2 °C or 1.5 °C above pre-industrial levels”. It agreed to set up the Ad Hoc Working Group on the Durban Platform for Enhanced Action, which would “complete its work as early as possible but no later than 2015 in order to adopt this protocol, another legal instrument or an agreed outcome with legal force at the twenty-first session of the Conference of the Parties and for it to come into effect and be implemented from 2020”. It also agreed that that “the process shall raise the level of ambition and shall be informed, inter alia, by the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, the outcomes of the 2013–2015 review and the work of the subsidiary bodies”.
- A number of countries have followed the example set by the UK and have reinforced their international commitments about action on climate change through national legislation. A study by the Global Legislators Organisation (GLOBE International) and the Grantham Research Institute (Townshend *et al.*, 2013) found that 32 of 33 major economies have progressed or are progressing significant climate and/or energy-related legislation. It concluded that much of the substantive progress on legislative activity on climate change in 2012 took place in emerging economies, including China, which will provide the motor of global economic growth in coming decades.

5. The Climate Change Act: the scientific evidence

- Since the Climate Change Act received Royal Assent in November 2008, more scientific evidence has accumulated which reinforces the logic of the 2050 target for reducing greenhouse gas emissions in line with the task of limiting global warming to no more than 2°C.
- The Summary for Policymakers of the contribution of Working Group I on the physical science basis of climate change to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change is due to be published in Stockholm on 27

September 2013. The report, prepared by 255 experts from 38 countries, will provide the most comprehensive and authoritative assessment of the science of climate change that has ever been published, based on a review of all of the available evidence and research. It is likely to confirm previous assessments that the Earth is warming, and that human activities, such as emissions of carbon dioxide from the burning of fossil fuels and deforestation, are primarily responsible. It will document a range of impacts of global warming in many regions around the world, such as an increase in the frequency and intensity of very hot days, changes in the patterns of precipitation, a reduction in glaciers and polar ice, rises in sea level, and acidification of the oceans. It is also expected to outline a budget of greenhouse gas emissions that cannot be exceeded during this century if a rise in global average temperature of more than 2°C is likely to be avoided.

- The Met Office published a series of three papers in July 2013 on the slowdown in the rise of global average surface temperature. The first paper (Met Office, 2013b) pointed out: "Although the rate of surface warming appears to have slowed considerably over the most recent decade, such slowing for a decade or so has been seen in the past in observations and is simulated in climate models, where they are temporary events." The second paper (Met Office, 2013c) stated: "Observations of ocean heat content and of sea-level rise suggest that the additional heat from the continued rise in atmospheric carbon dioxide concentrations has been absorbed in the ocean and has not been manifest as a rise in surface temperature. Changes in the exchange of heat between the upper and deep ocean appear to have caused at least part of the pause in surface warming, and observations suggest that the Pacific Ocean may play a key role." The third paper (Met Office, 2013d) concluded: "The recent pause in global surface temperature rise does not materially alter the risks of substantial warming of the Earth by the end of this century. Nor does it invalidate the fundamental physics of global warming, the scientific basis of climate models and their estimates of climate sensitivity."
- There is clear scientific evidence that the UK is already experiencing global warming. The Met Office's records for the UK, which began in 1910, show that average annual temperature has increased by about 1°C since 1970, and the seven warmest years on record have all occurred since 2000. The latest evidence also indicates that climate change is already affecting flood risk in the UK. Global sea level is currently rising due to global warming at more than 3 millimetres per year (University of Colorado Sea Level Research Group, 2013), increasing the risk of coastal flooding in the UK and around the world. Patterns of rainfall in the UK are shifting and increasing the risk of inland river and surface water flooding. The Met Office (2013a) pointed out that four of the five wettest years since records began in 1910 have all occurred since 2000, and long-term averages of 30-year periods show an increase in annual rainfall of about 5 per cent between 1961-1990 and 1981-2010. In addition, a preliminary analysis by the Met Office (2013a) also indicates that 1 in 100 day extreme rainfall events may have become more frequent since 1960. Jones et al. (2013) found evidence of increases in extreme rainfall in many UK regions between 1961 and 2010. In 2012, the second wettest year in the UK since records began in 1910, insurance companies paid out £1.19 billion in claims for losses from flooding, according to the Association of British

Insurers (2013). In 2007, insurers paid out a record £3 billion after severe flood damage across parts of England.

6. Further reading

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