

## THE UNITED KINGDOM'S CLEAN GROWTH STRATEGY

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*Case Studies contain preliminary research, analysis, findings, and recommendations on previous long-term planning exercises. They are circulated to stimulate timely discussion and critical feedback and to influence ongoing debate on emerging issues.*

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Suggested Citation: Gault, Adrian. 2018. "The United Kingdom's Clean Growth Strategy." Case Study. Washington, DC: Long Term Strategies Project. Available online at [www.longtermstrategies.org/uk-clean-growth-strategy](http://www.longtermstrategies.org/uk-clean-growth-strategy).

### OVERVIEW

The UK government's Clean Growth Strategy (CGS) was submitted to the UNFCCC in April 2018, as the UK response, under Article 4, paragraph 19 of the Paris Agreement, to "formulate and communicate long-term low greenhouse gas emission development strategies."

The strategy itself was developed under separate legislation, the United Kingdom's 2008 Climate Change Act. It sets out the proposals and policies to meet legislated limits on UK emissions in five-year periods to 2028–32 (the "fifth carbon budget"). It must do this, however, with a view to also meeting the long-term target, in the Act, for at least an 80 percent reduction in 2050 emissions relative to 1990 levels. So there is a clear linkage between actions required now to deliver emissions reductions over the next decade, and actions to ensure long-term targets can be delivered.

The UK government has said that it believes the United Kingdom will need to legislate for a net-zero emissions target at an appropriate point in the future. The government will ask its independent adviser, the Committee on Climate Change (CCC), for guidance on the implications of Paris for long-term targets following the Intergovernmental Panel on Climate Change (IPCC) 1.5°C report.

In the meantime the CCC has advised that strong actions are needed to deliver the aspirations and proposals contained in the strategy, to include the measures to achieve the fourth and fifth carbon budgets (covering emissions in 2023–27 and 2028–32, respectively), and to develop options for the future, including a strategy for greenhouse gas removal (GGR) technologies.

### CONTEXT

A key part of the context for the long-term strategy is provided by the UK Climate Change Act (Box 1).

Currently, carbon budgets have been legislated—at levels recommended by the CCC—out to the fifth carbon budget period (covering emissions in 2028–32). The fifth carbon budget was legislated in July 2016 and requires around an average 57 percent reduction in emissions during 2028–32 as against 1990.

## CONTENTS

Overview .....	1
Context.....	1
Development of the strategy.....	2
Overall ambition.....	3
Sector-specific pathways.....	5
Implementing the strategy.....	6
Using the strategy to inform short-term planning.....	6
Capacity, funding, and the enabling environment.....	7
Reviewing and revising the long-term strategy.....	8
Lessons learned .....	8

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Under the Climate Change Act, having legislated a budget, the government is required to produce a plan setting out its proposals and policies to meet that budget. The Clean Growth Strategy, published in October 2017, was produced to meet that requirement. It is focused on what is needed to meet the fourth (2023–27) and fifth (2028–32) carbon budgets.

The Clean Growth Strategy is not, therefore, the first such UK plan. Like previous plans,<sup>1</sup> it makes proposals at both sector and economy-wide levels and includes material relevant to how the 2050 target will be met (the budgets must be on a track to meeting the 2050 target). It is, however, the first to be required subsequent to the Paris Agreement and, while uncertainties remain, the Clean Growth Strategy is probably more detailed—partly in recognition of the needs of Paris—in regard to the long-term requirements than the previous plans. It also is much more explicit in its ambition to maximize the benefits—social and economic—from the transition to a low-carbon economy.

## DEVELOPMENT OF THE STRATEGY

UK emissions in 2017 were 43 percent<sup>2</sup> below levels in 1990. The United Kingdom is on track to meet the limits on emissions in the second (2013–17) and third (2018–22) budget periods. The Committee on Climate Change had been warning for some time, however, that the United Kingdom was not on track to meet the fourth (2023–27) carbon budget.

The Clean Growth Strategy was published in October 2017, a rather longer delay (15 months after setting the fifth carbon budget) than experienced in the production of plans following the setting of carbon budgets 1–3 and 4 (around six months in each case). To an extent, a longer delay was understandable. The government had other priorities, with preparations for Brexit, and there was an election in the intervening period. The strategy, therefore, was probably stronger in October 2017 than it would have been if published at the end of 2016. The time between the confirmation of the budget level and publication of the strategy also meant that there were two opportunities for the CCC to set out in some detail, in its annual progress reports to Parliament in June 2016 and June 2017, its view of what was required of the government’s strategy, when it did appear, to put the United Kingdom on course to meet carbon budgets 4 (2023–27) and 5 (2028–32).

The UK government did not directly consult on development of its new strategy. There was, however, a good deal of stakeholder engagement, including discussions led by ministers. The government also recognized, prior to publication of the strategy (for example, in its published response to the CCC’s 2016 progress report), that further policy would be needed in order to meet the fourth and fifth budgets. It recognized not only that progress in reducing emissions from power would need to continue but also that new measures would be required in other sectors. As part of the usual run of business, consultations were undertaken on specific new proposals, but new initiatives in this period were few, and stakeholders mostly were left to wait for the comprehensive plan that was promised.

When the strategy appeared, in October 2017, the government presentation shifted substantially away from an emphasis on the costs of emissions reduction, as a burden to be minimized, and toward the opportunities presented by UK leadership—through innovation and new markets. While the Department for Business, Energy and Industrial Strategy was the lead government department in pulling together the strategy,

## Box 1: The UK Climate Change Act 2008

The Climate Change Act was passed in 2008 with a high degree of political consensus.<sup>a</sup> Indeed, there was what has been described as “competitive consensus,” as the main parties positioned themselves to promote a high degree of ambition. This followed on from the highly influential Stern review, *The Economics of Climate Change*, which presented an economic case for action, and the NGO-led Big Ask campaign, which had responded to a perceived failure by previous governments to put in place measures to meet commitments to reduce emissions.

The 2008 Act included the following key features:

- ◆ It established in legislation a target to reduce UK greenhouse gas emissions in 2050 by at least 80 percent relative to their 1990 levels.
- ◆ It established a system of carbon budgets—legally binding limits on the amount of emissions in successive five-year periods starting in 2008—that must be met to remain on track toward the 2050 target.
- ◆ It established an independent body—the Committee on Climate Change (CCC)—to advise the government on the level of the carbon budgets, and the 2050 target, and to report to Parliament annually on progress.

The targets were put in legislation to provide a clear medium- and long-term signal of intent, to investors and other stakeholders, that actions would be taken. The 2050 target was set to reflect the science, and a UK contribution to keeping global emissions to a level broadly consistent with holding global temperature rise to 2°C above preindustrial levels. The carbon budgets, set 11.5 years before the start of the budget period, provide a clearer picture of what will be required over a period better aligned to policy and investment decisions.

The CCC was established as an independent body,<sup>b</sup> comprising expert advisers to the government and Parliament, to provide a cross-economy view—reducing the special pleading of specific sectors or government departments—of how and on what trajectory emissions could be reduced. Its establishment took some inspiration from independence in other areas of public policy, such as the operational independence of the Bank of England to set interest rates,<sup>c</sup> which had been set in 1997.

The CCC has been influential to date. Its advice has not necessarily been followed on every issue, but carbon budgets have in each case been legislated at levels in line with its recommendations.

### Notes:

- Only three members of Parliament voted against the Climate Change Bill at second and third reading.
- In formal terms, a Non-departmental Public Body (NDPB).
- With the difference that the CCC is advisory—it does not have powers to set policy.

there was also clear reflection of the need for economy-wide reductions in emissions. Other government departments, such as the Department for Environment, Food and Rural Affairs, with responsibilities across agriculture, land use, and waste, were more clearly bought in to the overall ambition. In some areas, such as transport, there was less substance, but commitments were made to future documents that would bring forward additional proposals.<sup>3</sup>

## OVERALL AMBITION

The Clean Growth Strategy reflects the United Kingdom’s overall ambition, set in the Climate Change Act 2008, to reduce emissions in 2050 by at least 80 percent relative to 1990 levels.

At the time that target was set there was no quantitative goal agreed by the United Nations Framework Convention on Climate Change (UNFCCC) for limiting climate change. The 80 percent target was based on a UK contribution to halving global emissions by 2050, consistent with keeping global temperature rise close to 2°C above preindustrial levels.<sup>4</sup>

The Paris Agreement sets a temperature goal to limit warming to well below 2°C and to pursue efforts to limit it to 1.5°C. To achieve this aim it also sets a new long-term target for net-zero global emissions in the second half of the century. This temperature goal is more ambitious than the basis of the United Kingdom’s 2050 emission reduction target when it was set.

The CCC considered the implications of the Paris Agreement for UK targets in an October 2016 report to the government.<sup>5</sup>

The report included the following observations and recommendations:

- ◆ The existing UK 2050 target was potentially consistent with a wide range of global temperature goals.
- ◆ It was not necessary to revise UK long-term targets now.
- ◆ Priority should be given to vigorous pursuit of measures to deliver existing UK targets. Measures to achieve the legislated carbon budgets would maintain flexibility to go further in the future should that be required.

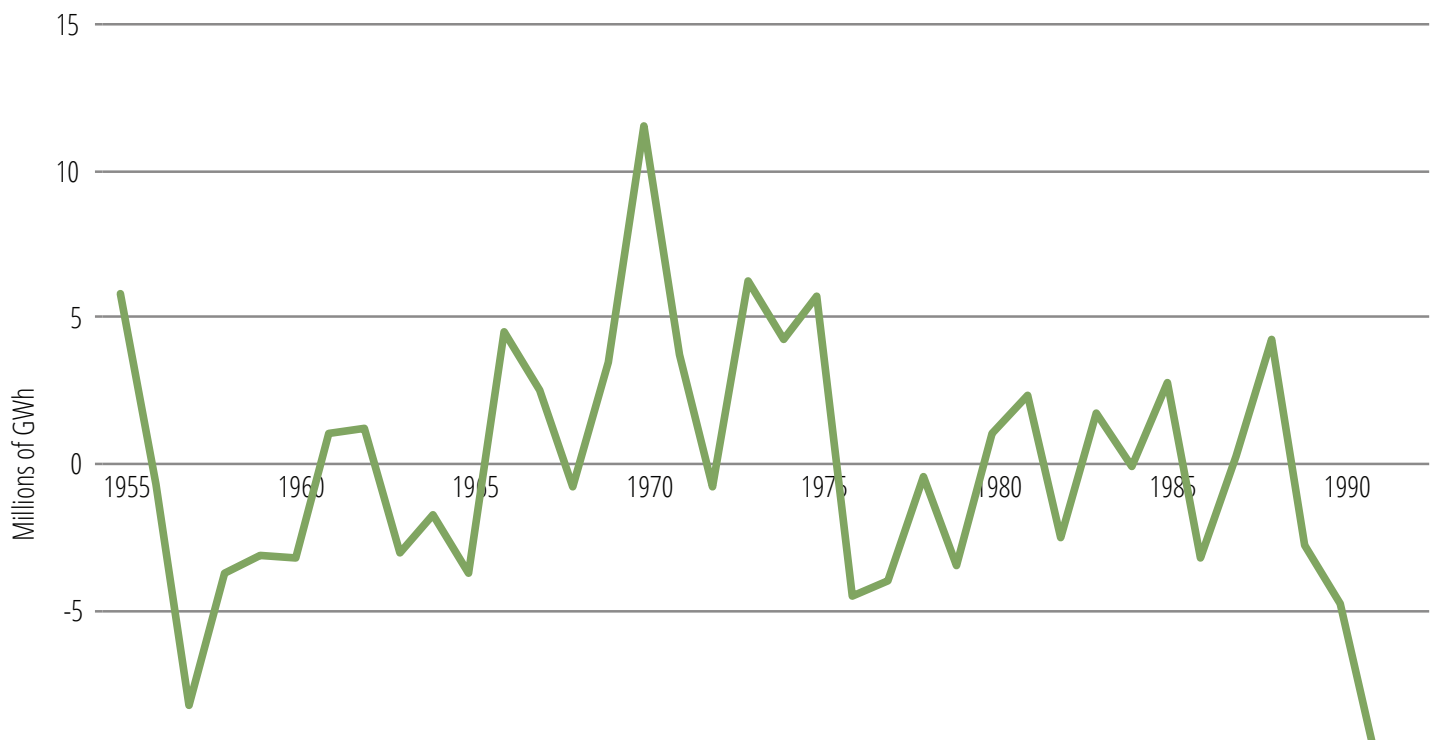
- ◆ There would be regular opportunities to consider amendments to UK long-term targets in the future, as low-carbon technologies and options for GGRs are developed and as more is learned about ambition in other countries and potential global paths to well below 2°C and 1.5°C.

The UK government accepted that advice. It has, however, also accepted that it will need to legislate for a net-zero ambition at some point in the future.<sup>6</sup> It restated that position in the Clean Growth Strategy.

In its October 2016 advice, the CCC identified a number of points at which it might be opportune to revisit its advice on the UK long-term targets. These included the release of the IPCC Special Report on 1.5°C, due in 2018, or the stocktake of collective pledges in 2023.

Subsequently, the government has confirmed that it will ask the CCC to advise again on the implications for long-term targets following the IPCC 1.5°C report.

**Figure 1. Risks around the Delivery of Policies at the Economy-Wide Level**



Source: CCC, *Reducing UK Emissions: 2018 Progress Report to Parliament*, June 28, 2018.

Notes: The chart presents economy-wide emissions. Chart is on the basis of the latest UK government emissions projections published in January 2018. Baseline emissions for the power; waste; agriculture; and Land Use, Land-Use Change, and Forestry (LULUCF) sectors have been adjusted to reflect the latest available information on energy generation and inventory accounting methods. Emission reductions from existing policies that the CCC judges to have significant delivery risks (e.g., insufficient funding) are rated “medium risk.” The CCC assessed emission reductions from proposals and intentions that were included in the Clean Growth Strategy, which are included as “high risk.” There remains potential for cost-effective emissions reduction, which the CCC includes as the “policy gap” to the cost-effective path.

## SECTOR-SPECIFIC PATHWAYS

The CCC's recommendations to the government on the levels of future carbon budgets are underpinned by detailed sector-by-sector analysis of potential for emissions reduction, and related costs. This analysis recognizes that, depending on the cost-effective opportunities available, not all sectors will proceed at the same speed. In the CCC's analysis, for example, emissions from the power sector reduce relatively fast. Decarbonization of heat in buildings—currently largely provided by the burning of natural gas—proceeds more slowly, accelerating after 2030.

The government's proposals for meeting the legislated budgets are also set out by sector. Thus, the Clean Growth Strategy contains separate sectoral summaries of ambition relating to Business and Industry Efficiency; Improving Our Homes; Low-Carbon Transport; Clean, Smart, Flexible Power; Natural Resources; and the Public Sector.

While the broad picture of what is required to meet the legislated carbon budgets to 2032 can be set out, the route beyond that to the 80 percent reductions required for 2050 is less clear. There are low-regrets actions (including improvements to the energy efficiency of buildings and industry, increased uptake of ultralow emission vehicles, district heating, and continued decarbonization of power) common to all pathways, but the Clean Growth Strategy sets out three scenarios for the longer term:

- ◆ Electrification, without carbon capture and storage (CCS): extensive electrification, covering all cars and vans and around 80 percent of space heating by 2050. To meet extra demand, UK electricity generation would need to be double that of today's supply, with a very low carbon intensity.
- ◆ Hydrogen, with repurposing of the gas grid: low-carbon hydrogen is the dominant energy carrier by 2050, powering all cars and vans, over half of all space heating, and a third of industrial energy demand. Such a scenario would require extensive deployment of infrastructure, both in repurposing the UK gas grid to accept hydrogen and for transportation and storage of CO<sub>2</sub> captured in hydrogen production from fossil fuels.
- ◆ Emissions removals: negative emissions in electricity generation (from use of bioenergy with CCS) creates "headroom," allowing some continuing use of high-carbon fuels in transport and home heating. There are no negative emissions in the other two scenarios.

There are challenges to each of these scenarios, and in practice a combination of actions from all three will most likely be needed. According to the CCC,

The plan now should be to reach very low emissions from transport, buildings and power generation by 2050 (e.g. as in the Strategy's no CCS scenario), combined with industrial CCS and, if feasible, greenhouse gas removal (including BECCS) so that a reduction of significantly more than 80% can be achieved. . . .

The Government should not plan to meet the 2050 target without CCS. A "no CCS" pathway to even the existing 2050 target is highly challenging and likely to be much more costly to achieve. Furthermore, deeper reductions will be required to meet the aims of the Paris Agreement, whether by 2050 or subsequently.<sup>7</sup>

It is inevitable that the longer ahead we look, the less certain we can be of the pathway. This need not matter provided measures are taken now that develop the options likely to be required, and leave open the choice of pathway.

Indeed, the Clean Growth Strategy emphasizes the importance of innovation in helping to meet future targets and positioning the United Kingdom to take advantage of new market and employment opportunities. The strategy includes over £2.5 billion in government spending on clean technology innovation from 2015 to 2021. This links to the wider Industrial Strategy,<sup>8</sup> which recognizes that the United Kingdom needs to spend more on research and development (R&D).<sup>9</sup>

The CGS does not include specific estimates of what emissions reductions such innovation investment will deliver for the fourth and fifth carbon budgets, but the strategy is based on a belief that it can contribute to meeting the policy gap in these budgets. The CGS is, however, very oriented toward a "supply push," through research, development, and demonstration. In some areas, "market pull" for the deployment of new innovations is absent or weak. The CCC has emphasized the role of support for innovation in creating a wider range of ways to reduce emissions in the longer term, but it also has underscored the importance of deploying currently known technologies in meeting the closer-term fourth and fifth budgets.

## IMPLEMENTING THE STRATEGY

The government has presented the policies and proposals in the CGS as making it possible to meet the fourth and fifth carbon budgets.<sup>10</sup>

With respect to support for innovation, further announcements have been made since the strategy was published. For example, it was announced in May 2018 that the United Kingdom would lead a Mission Innovation challenge, with international partners, to support the development of carbon capture, use, and storage (CCUS) technologies; a Clean Growth mission to at least halve the energy use of new buildings by 2030 has also been launched.

In its most recent assessment,<sup>11</sup> the CCC has identified the risks attached to policy delivery (illustrated in Figure 1), emphasizing the following:

- ◆ Almost half<sup>12</sup> the emissions reductions from existing policies and intentions are at risk of underdelivery in 2030 (the middle year of carbon budget 5). This includes savings from the delivery of low-carbon electricity generation and a wide range of policies potentially affected by leaving the European Union (e.g., energy efficiency standards for new products, new vehicle efficiency standards).
- ◆ Around another 30 percent of those savings depend on turning aspirations in the Clean Growth Strategy into firm measures. This includes phasing out of sales of conventional cars and vans by 2040, upgrading the residential building stock, and improving business energy efficiency by at least 20 percent by 2030.
- ◆ The CCC also identifies potential to go further through low-cost measures currently not supported by the government.<sup>13</sup> These could include support for onshore wind and deployment of heat pumps in homes being built. Such measures could provide contingency for nondelivery of other measures or, if they take emissions below the level of the fifth carbon budget, contribute to the greater reductions that will be required in the longer term under the Paris Agreement.

While the Clean Growth Strategy contains a welcome level of ambition, there is a continuing urgent need to turn that ambition into action.

To take that forward, the government has established a Clean Growth Inter-ministerial Group to monitor implementation and drive policies. The government has committed to updating key elements of the strategy in line with its annual statutory responses to the CCC's progress reports. It remains to be seen how this delivers. The next year will be critical. In its June 2018 progress report, the CCC set out its—independent—expectations of policy issues to be taken forward in the next year if future budgets are to be met.

The Climate Change Act also includes flexibilities that might be used to meet future carbon budgets, should policy measures fail to deliver required emissions reductions. This includes the potential to use “banking,” the carrying forward of the outperformance of one carbon budget to enable a future budget to be met. The CCC has been clear that the government should plan on these flexibilities not being used—that their use would risk failing to develop options and low-carbon industries for the future, storing up larger costs for future generations, and undermining the United Kingdom's position of leadership. The government has stated its intention to meet the budgets through domestic actions, without using credits or outperformance of earlier budgets. Nevertheless it retains the option.<sup>14</sup>

## USING THE STRATEGY TO INFORM SHORT-TERM PLANNING

Under the Climate Change Act there is a strong alignment between longer-term targets for emissions reduction (at least 80% emission reduction by 2050), the legislated carbon budgets, and the actions that should be taken now.

The Clean Growth Strategy sets out the actions and milestones that the government has committed to under its plan, also identifying the lead department. These mainly relate to actions over the next year or so, with a commitment to update linked to the government's annual response to the CCC's progress report.

The CCC, in its January assessment of the CGS and in its June progress report, has added to the government's set of milestones, setting out its view of the necessary steps to ensure that carbon budgets are met.



## CAPACITY, FUNDING, AND THE ENABLING ENVIRONMENT

In addition to the actions to meet carbon budgets, the Climate Change Act requires that the government's plans make preparations for meeting the 2050 target. These are actions that might be easy to put off, or dropped in the face of other immediate pressures (such as pressures on government spending). But failing to develop options is likely to increase decarbonization costs in the longer term. The Clean Growth Strategy identifies priorities in this regard:

- ◆ Decisions on the future of the gas grid. The strategy acknowledges the need to make decisions in the first half of the 2020s about how UK homes are heated. This includes the future of the gas grid (currently around 85% of homes are heated with natural gas) and the respective roles for heat pumps and hydrogen. The government is supporting innovation to bring down the cost of low-carbon heating technologies.
- ◆ Greenhouse gas removal (GGR). GGR is not a substitute for action to reduce emissions, but the CCC has advised that it is likely to be required to some extent globally if the ambitions of the Paris Agreement are to be achieved. Options include relatively proven options (such as afforestation), options for which there is some understanding (such as bioenergy with carbon capture and storage, or BECCS), and others that are less well understood. The strategy commits to the development of a strategic approach to GGR technologies, building on the government's R&D program and addressing barriers to long-term deployment. For example, the government has been working with the Research Councils in the United Kingdom, which launched an £8.6m GGR research program in April 2017.

Also critical will be deployment of CCS. The strategy includes an ambition to deploy CCUS in the 2030s. Given the importance of CCS for meeting the necessary level of emissions in the long term (decarbonization of heavy industry relies heavily on CCS, as do the GGR and hydrogen options), the CGS commitment is not strong enough. The CCC has emphasized the urgent need to set out plans that kick-start a UK CCS industry in the 2020s. Some progress is being made. A Cost Challenge Taskforce, established by the CGS to advise on requirements to support development of CCUS in the United Kingdom, has recently reported.<sup>15</sup> The government is committed to set out its view of a deployment pathway for CCUS by the end of 2018. It has also committed to convene and lead a new international working group to drive down the cost and accelerate deployment of CCUS. Beyond this, it is clear that policies to drive deployment will be needed.

Over the couple of years running up to publication of the Clean Growth Strategy, the UK government narrative around achievement of carbon budgets shifted gears. The government published an Industrial Strategy in 2017, aimed at improving productivity and the attractiveness of the United Kingdom as a place to invest. The low-carbon economy was placed at the heart of this industrial strategy—"Clean Growth," through low-carbon technologies and the efficient use of resources, is identified as one of four "Grand Challenges" set to transform industries and societies around the world. The Clean Growth Strategy was presented as a core part of delivering on the opportunities this transition will present.

The June 2016 vote to leave the European Union also is an important part of the backdrop. In due course we might expect the United Kingdom's long-term target for 2050, as in the Climate Change Act, and carbon budgets to form the basis of a UK nationally determined contribution. But reductions in emissions that would have been provided by EU mechanisms will now have to be delivered by UK measures. The Clean Growth Strategy recognizes this, while leaving precise mechanisms to be determined once the terms on which the European Union is left are known. In some areas—replacement policies to the Common Agricultural Policy, for example—there may also be opportunities to go further than the European Union would have done in redesigning policies to provide cost-effective abatement.

Public spending in the United Kingdom remains tightly constrained. To the extent that exchequer funding is used to support abatement measures and development of options, this is likely to be carefully targeted. But, of course, direct public funding is not the only route to delivery. One of the lessons of the last couple of years is the value of well-designed policy.

A particular success has been the move toward support of low-carbon generation technologies through the use of long-term contracts. These have created a market without direct public funding, with costs passed on through bills to consumers. The most recent auctions for generation technologies procured contracts for offshore wind at around £62 per megawatt hour for delivery in the early 2020s. This is well below projected costs for this technology just a few years ago. The CCC's latest analysis suggests that continued power sector decarbonization is likely to be no more expensive than alternative pathways for the sector,

such as increased use of gas generation paying a market price for carbon. Indeed, steady deployment of low-carbon technologies has significant cost-reduction potential.

The need to learn lessons from successful policy and apply this beyond the power sector is a key to low-cost decarbonization.

With the demands on government resources and capacity created by “Brexit,” one of the risks going forward—given the substantial need for low-carbon policy development that remains—is that capacity to deliver on these targets will be insufficient. One of the lessons from the last couple of years, however, is the importance of the Climate Change Act. The provisions of the Act—in terms of the need to set carbon budgets, and then to set out plans to meet them—have set requirements that the government could not ignore, or indefinitely delay. Government commitment to the Act and to meeting long-term targets has been maintained. Given the demands facing the government in other areas, it is at least possible that progress over this period would have been substantially less if the Act had not been in place.

## REVIEWING AND REVISING THE LONG-TERM STRATEGY

As set out above, the government has stated its view of the actions and milestones on which it needs to deliver. It has explicitly acknowledged that publication of the strategy is not the end of the process, and that key elements will be updated as required on a timetable linked to the need to provide an annual response to the CCC’s review of progress.

The CCC has set out its assessment of what is required and will be tracking progress against these indicators and actions.

The UK government has said that it believes the United Kingdom will need to legislate for a net-zero emissions target at an appropriate point in the future. It has announced that after the IPCC produces its special report on 1.5°C, expected in October 2018, it will ask the CCC to review the United Kingdom’s long-term targets. We can expect that to cover the UK contribution to the global net-zero ambition, as well as the level of the emissions reduction target in 2050 (currently at least an 80% reduction relative to 1990 levels). Further analysis is also likely to cover the potential to go further to reduce emissions in sectors that retain significant emissions in current scenarios to achieve the 2050 target (agriculture, parts of industry, aviation); and to consider the potential for GGR technologies, as well as how UK potential compares with wider global options.

When the government has received that advice, it will need to decide whether revisions to existing targets and/or new targets are necessary. In the meantime, urgent actions to take forward the high-level ambitions of the CGS are necessary, both to deliver on existing targets and to leave open the potential for meeting tighter targets later should they be required.

## LESSONS LEARNED

This year, 2018, marks the 10-year anniversary of the Climate Change Act in the United Kingdom. Cross-party political consensus was important in establishing the Act, and that consensus has held in the sometimes challenging years since then.

Experience to date shows the benefits of taking a long-term perspective—the framework provided by the Act for pursuing a long-term target, with the requirement to produce plans to reduce emissions on course to that target. In producing strategies for meeting a long-term target, the pathways on track to that target, and the actions this requires now, are important considerations for all.

Wider lessons include the following:

- ◆ It is not reasonable to think that the entire route map to a long-term target (for 2050 or beyond) can be laid out. That need not and must not be a barrier to action. The role of the strategy should include setting out the low-regret and low-cost actions that can be taken, consistent with the long-term vision.
- ◆ More work is needed, internationally, to understand global pathways to achieving net-zero emissions in the second half of the century, the potential role of different technologies, and the capacity of different countries or regions to contribute to the global pathway. Understanding the potential of GGR options is an important part of this requirement. These are likely to be necessary to reach net zero, but they must not be regarded as a substitute for urgent mitigation actions. National strategies also need to recognize the role and benefits of international collaboration.
- ◆ Publication of a “strategy” is not enough. Delivery needs to be monitored. It needs to be followed up with actions, regular updating, and “holding to account.”



## ENDNOTES

1. See HM Government, The UK Low Carbon Transition Plan: National Strategy for Climate and Energy, July 2009, <https://www.gov.uk/government/publications/the-uk-low-carbon-transition-plan-national-strategy-for-climate-and-energy>; HM Government, The Carbon Plan: Delivering Our Low Carbon Future, December 2011, <https://hub.globalccsinstitute.com/publications/carbon-plan-delivering-our-low-carbon-future>.
2. Provisional estimates.
3. A Department for Transport strategy document, The Road to Zero, was published in July 2018.
4. Global pathways meeting that temperature goal showed global emissions around 20–24 GtCO<sub>2</sub>e in 2050. Assuming UK emissions per person at the global average at that date implied a level of emissions in the United Kingdom 80% below 1990 levels.
5. Committee on Climate Change, UK Climate Action following the Paris Agreement, October 13, 2016, <https://www.theccc.org.uk/publication/uk-action-following-paris/>.
6. Stated in Parliament by Andrea Leadsom, then energy minister, March 2016.
7. CCC, An Independent Assessment of the UK's Clean Growth Strategy, January 17, 2018, <https://www.theccc.org.uk/publication/independent-assessment-uks-clean-growth-strategy-ambition-action/>.
8. HM Government, Industrial Strategy: Building a Britain Fit for the Future, white paper, November 27, 2017, <https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future>.
9. The UK Industrial Strategy commits to increasing UK R&D spend (public and private) from 1.7% of GDP in 2015 to 2.4% by 2027.
10. The quantified subset of policies would—in the government's assessment—meet 94% and 93% of the fourth and fifth carbon budget reductions, respectively, though this includes the impact of emissions reduction to date, irrespective of whether these reflect policies or market-induced reductions. In updated projections published in January 2018, the government revised that assessment to 97% and 95%.
11. CCC, Reducing UK Emissions: 2018 Progress Report to Parliament, June 28, 2018, <https://www.theccc.org.uk/publication/reducing-uk-emissions-2018-progress-report-to-parliament/>.
12. That is, the yellow shaded policies in Figure 1 as a proportion of the green, yellow, and red. The total of these three would broadly reach the legislated fifth carbon budget.
13. That is, the red-hashed area in Figure 1.
14. Before deciding on banking forward from one budget period to the next, the government will be required under the Climate Change Act to obtain and take account of the CCC's advice.
15. CCUS Taskforce, Delivering Clean Growth: CCUS Cost Challenge Taskforce Report, July 19, 2018, <https://www.gov.uk/government/publications/delivering-clean-growth-ccus-cost-challenge-taskforce-report>.

## ACKNOWLEDGMENTS

The author would like to thank Adam Harmon and Jim Watson for reviewing and Owen Bellamy, Cynthia Elliott and Kelly Levin for providing input on the draft case study.

The case study series was developed by Kelly Levin, Taryn Fransen, Cynthia Elliott and Katie Ross.

We would like to thank Carni Klirs, Romain Warnault, Julie Moretti and Billie Kanfer for their assistance with publication design, graphics and layout. Emily Matthews and Alex Martin provided editorial support. Beth Elliott helped with messaging and outreach, and Pauline Hill provided administrative support.

We are pleased to acknowledge our institutional strategic partners, who provide core funding to WRI: Netherlands Ministry of Foreign Affairs; Royal Danish Ministry of Foreign Affairs; and Swedish International Development Cooperation.

Funding from Germany's Federal Ministry of Economic Cooperation and Development (BMZ) made this project possible.



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Adrian joined the secretariat of the Committee on Climate Change in May 2009, where he is responsible for analytical work looking at UK greenhouse gas emission reduction potential and costs. He was Acting Chief Executive of the Committee from July 2017-April 2018. Recently, the Committee's June 2018 report to Parliament looked at UK progress in reducing emissions, the Government's Clean Growth Strategy and what is needed to meet the legislated the fourth and fifth carbon budgets. The Committee will shortly be taking forward work to provide advice to the UK Government on implications of the Paris Agreement for the UK's long-term emission reduction targets. Prior to joining the CCC secretariat, Adrian has substantial experience of energy and environment issues - as an economist in Department for Transport, the Energy Group of the Department of Trade and Industry and in the Treasury tax team. He is 2018 Chairman of the British Institute of Energy Economics.

## ABOUT THE LONG-TERM STRATEGIES PROJECT

World Resources Institute and the United Nations Development Programme, working closely with UN Climate Change, are developing a set of resources to help policymakers integrate long-term climate strategies into national policy making.



WORLD  
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This project contributes to the 2050 Pathways Platform and is undertaken in collaboration with the NDC Partnership.



This vision and direction of the project is guided by the project's advisory committee: Monica Araya, Richard Baron, Ron Benioff, Pankaj Bhatia (co-chair), Yamil Bonduki, Rob Bradley, Carter Brandon, Hakima El Haite, Claudio Forner, Stephen Gold (co-chair), Emmanuel Guerin, Ingrid-Gabriela Hoven, Dr. Martin Kipping, Carlos Nobre, Siddharth Pathak, Samantha Smith, Marta Torres Gunfaus, Laurence Tubiana, and Pablo Vieira.

For more information about the project, and to view the expanding set of resources, visit [www.longtermstrategies.org](http://www.longtermstrategies.org).