

# An independent assessment of the Clean Growth Strategy

## Technical Annex - Power

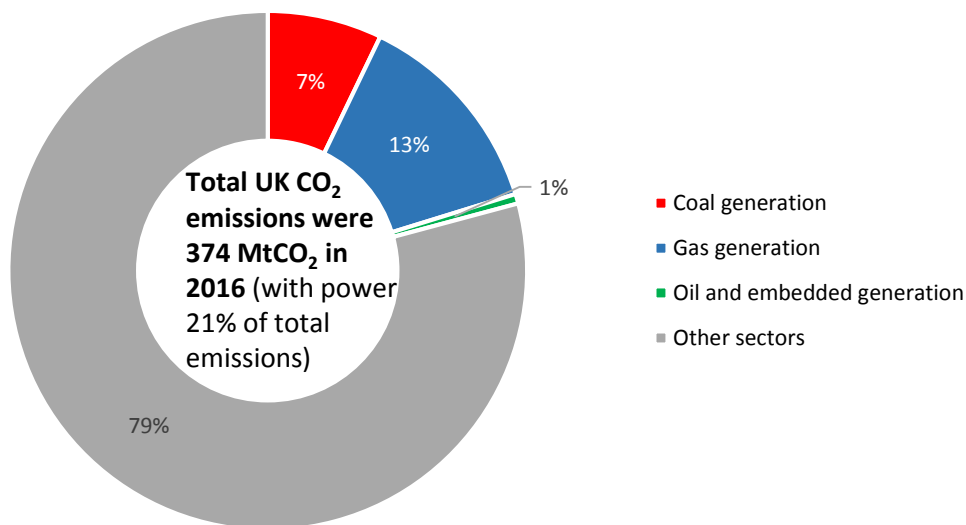
Under the Climate Change Act, the government is required to publish a set of policies and proposals that will enable the legally-binding carbon budgets, on track to the 2050 target, to be met. The Clean Growth Strategy, published in October 2017, presents the Government's plans.

Our report, *An independent assessment of the Clean Growth Strategy: From ambition to action*, sets out our overall assessment of the Strategy. This technical annex sets out the analysis for the power sector underpinning that report, in three sections:

- i) Emissions from the power sector today
- ii) Ambition in the Clean Growth Strategy
- iii) Policy development required to deliver ambition in the Clean Growth Strategy

### i) Emissions from the power sector today

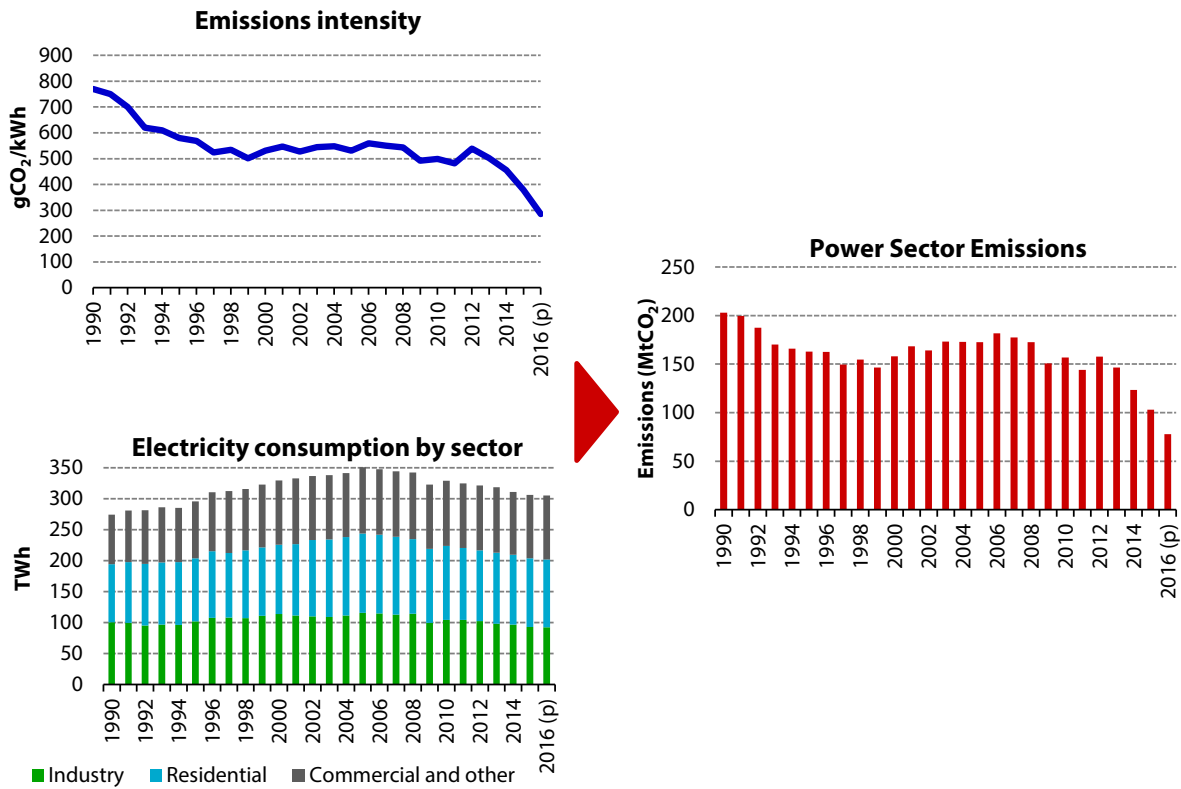
**Figure 1.** Power sector CO<sub>2</sub> emissions as a share of UK total, 2016



**Source:** CCC analysis based on: BEIS (2017) *UK Greenhouse Gas Emissions 1990-2016 (provisional)* and BEIS (2017) *Energy Trends*.

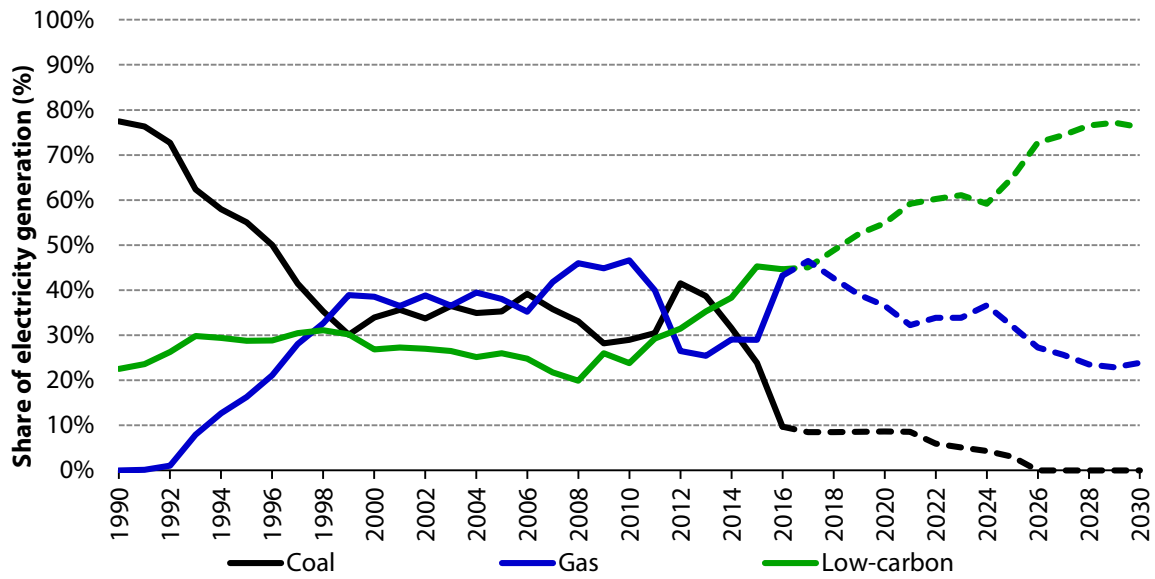
**Notes:** Estimates of emissions from coal and gas generation are based on generation from Major Power Producers in BEIS (2017) *Energy Trends*: Table 5.1.

**Figure 2. Emissions intensity, electricity demand and CO<sub>2</sub> emissions from the power sector (1990-2016)**



**Source:** BEIS (2017) *Energy Trends*, BEIS (2017) *UK Greenhouse Gas Emissions 1990-2016 (provisional)*, CCC analysis.  
**Notes:** Emissions intensity is UK based useable generation, i.e. excluding losses. Electricity consumption includes imported power. 2016 data are provisional.

**Figure 3. Share of generation by source (1990-2030)**



**Source:** CCC analysis based on BEIS (2017) *Energy Trends*; CCC *Fifth Carbon Budget scenarios*; BEIS (2017) *Updated Energy and Emission Projections 2016*.

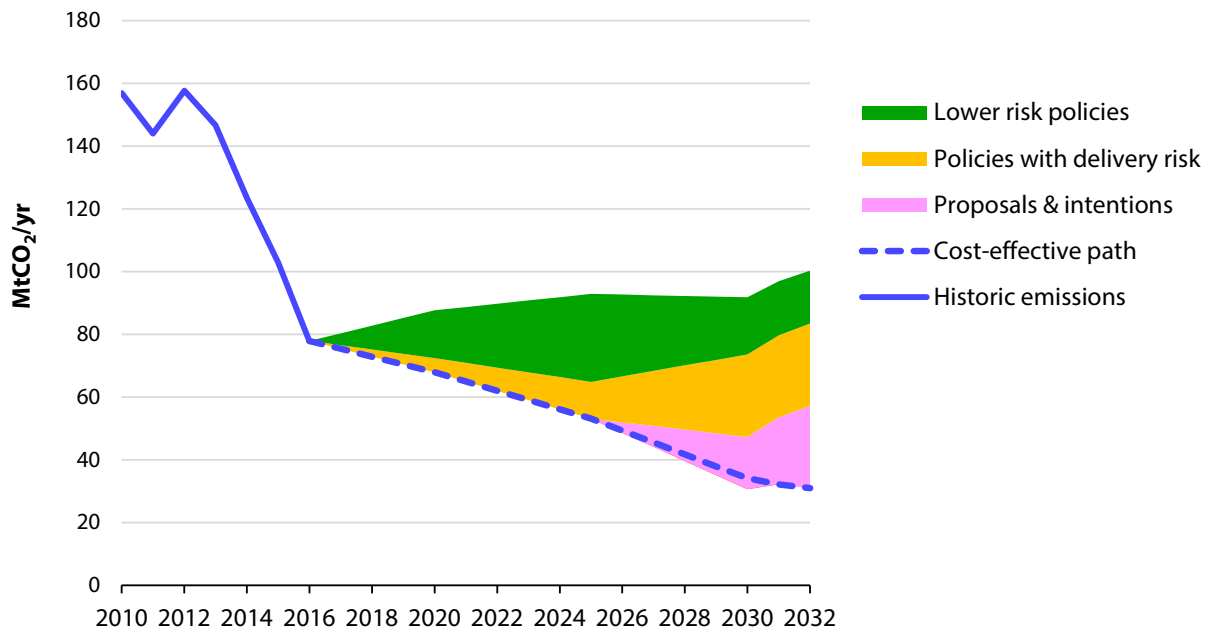
**Notes:** The rate of increase in share of low-carbon generation in the CCC's scenarios is comparable to the rate of increase in low-carbon generation since 2008. Variability in projected generation in the CCC's scenarios reflects uncertainty over retirement dates of existing coal and nuclear generation in BEIS's *Energy and Emissions Projections*.

## ii) Ambition in the Clean Growth Strategy

<b>Table 1. Ambition in key low-carbon technologies in the Power sector</b>			
<b>Key technology / behaviour</b>	<b>CCC scenarios</b>	<b>Clean Growth Strategy ambition</b>	<b>What we have assumed for quantification</b>
Low-Carbon Generation (TWh)	80% of low carbon generation in 2032, based on a portfolio of deployment of cost-effective low-carbon generation options.	85% low carbon generation in 2032, based on the policies and proposals in the Clean Growth Strategy:  £557 million funding for contracts for difference auctions.  Progressing talks with nuclear developers to secure competitive prices for future projects.	We have based our analysis of the ambitions in the Clean Growth Strategy on the 2016 Energy and Emissions Projections. This has 265 TWh of low carbon generation in 2032, which makes up 78% of 2032 generation.  We estimate that:  43 TWh of generation can be secured from £557 million funding for further contracts for difference auctions. <sup>1</sup>  75 TWh of additional generation from new nuclear plants beyond Hinkley Point C.

**Source:** BEIS (2017) *Clean Growth Strategy*, BEIS (2017) *Updated Energy and Emission Projections 2016*.  
**Notes:** 1) Assuming the same level of funding per unit of generation as the 2017 contracts for difference auction. CCC analysis of the Clean Growth Strategy is based on BEIS (2017) *Energy Emissions Projections (2016)*.

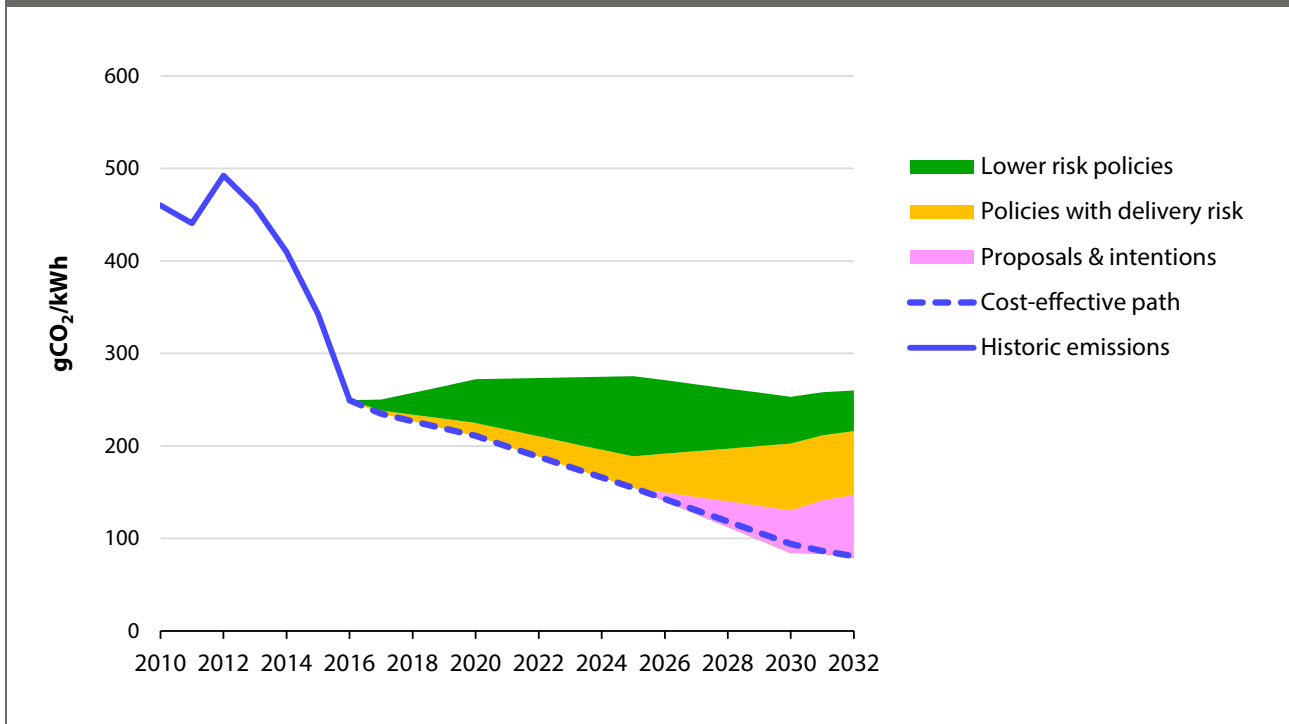
**Figure 4.** Power sector emissions and the policy gap (2010-2032)



**Source:** BEIS (2017) *Updated Energy and Emission Projections 2016*, CCC analysis.

**Notes:** Chart is for actual (i.e. 'gross') emissions and is on the basis of the *Updated Energy and Emission Projections 2016*. Emission reductions from existing policies that we judge to have low delivery risks are coloured green. Emission reductions from existing policies that we judge to have significant delivery risks (e.g. insufficient funding) are coloured amber. These include the remaining funding for Contracts for Difference, and the Hinkley Point C project. We have assessed emission reductions from proposals and intentions that were included in the Clean Growth Strategy. These are coloured pink and includes generation from new nuclear plants beyond Hinkley Point C. We have adjusted BEIS's 'no policy' baseline to reflect actual generation in 2016. Emissions in the baseline increase beyond 2030 due to nuclear plant retiring from the electricity system.

**Figure 5. Power sector emissions and the policy gap (2010-2032)**



**Source:** BEIS (2017) *Updated Energy and Emission Projections 2016*, CCC analysis.

**Notes:** See Figure 4. The chart shows the emissions intensity of UK generation before accounting for losses. This is lower than the emissions intensity of UK based 'useable generation', which we also estimate and use as an indication of the carbon intensity of consumption.

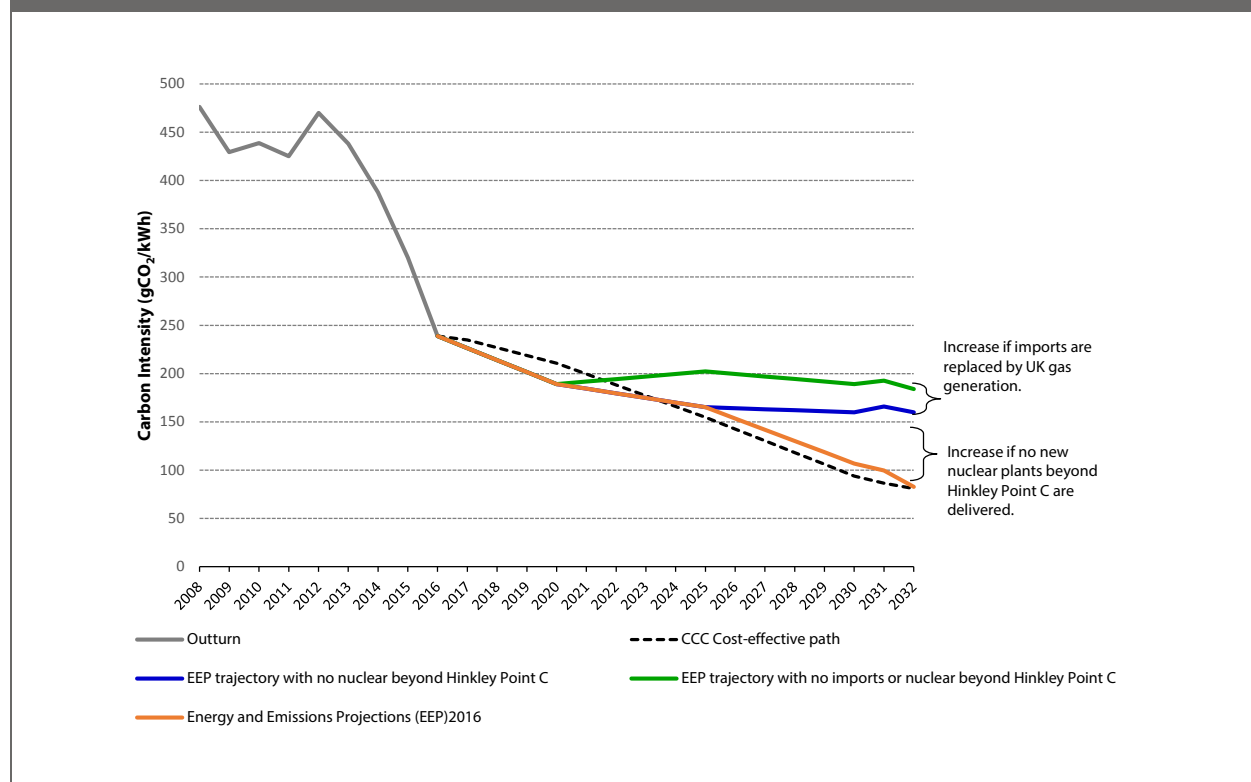
### Box 1. Forecast emissions intensity in the Clean Growth Strategy's power sector projections

BEIS's Energy and Emissions Projections' reference scenario for electricity generation in 2032 includes 20% of generation from new nuclear power beyond Hinkley Point C (equivalent to two to three additional plants) and up to 15% of generation from imported electricity. In addition to existing low-carbon generation, projects with signed contracts, and expected generation from the remaining funding for low-carbon generation (45% of generation in 2032), this leads to an emissions intensity of around 85 gCO<sub>2</sub>/kWh by 2032. This is consistent with the CCC's cost-effective path, which considers emissions intensity below 100 gCO<sub>2</sub>/kWh by 2030, however there are risks associated with this:

- BEIS's generation scenarios imply up to three new nuclear plants commissioning beyond Hinkley Point C. Delay or cancellation of these plants could – in the absence of additional contracts for low-carbon generation - require increased domestic gas generation, in order to meet demand. Depending on how much capacity is delayed or cancelled this could increase emissions intensity by up to 80 gCO<sub>2</sub>/kWh in 2032.
- Although the UK is currently a net importer of electricity - and emissions associated with these imports do not count towards UK carbon budgets - structural changes to European energy markets or changing fuel prices could lead to imports below BEIS's projections in 2030. This would leave the UK needing to generate more energy domestically, which – in the absence of additional contracts for low-carbon generation - we assume would come from gas generation. This could increase emissions intensity by an additional 25 gCO<sub>2</sub>/kWh in 2032.

A combination of these two risks could increase emissions intensity from below 100 gCO<sub>2</sub>/kWh, which is consistent with the CCC cost-effective path, to around 200 gCO<sub>2</sub>/kWh.

Figure B1. Range of emissions intensities in the Clean Growth Strategy projections



**Notes:** Emissions intensity in BEIS's Energy and Emissions projections is below the CCC cost-effective path from 2017 to the mid 2020s due to lower coal generation in BEIS projections than in CCC scenarios during this period.

**Source:** BEIS (2017) *Updated Energy and Emission Projections 2016*, CCC *Fifth Carbon Budget Scenarios*.

### iii) Policy development required to meet the ambition in the Clean Growth Strategy

**Table 2.** Progress against the Committee’s recommendations on Power in the 2017 Progress Report to Parliament

Recommendation in 2017 Progress Report	Clean Growth Strategy proposal	Assessment	Commentary
Extension of existing approaches to contract an additional 80-100 TWh low-carbon generation in the 2020s	Up to £557 million for further Contract for Difference auctions, with the next one planned for spring 2019.	Partially met	We estimate that the £557m of committed funding, along with the recent contracts for difference auction results, will contract around 55 TWh of low carbon generation. We recommend that the Government holds further auctions to support the full range of cost-effective low-carbon technologies.
A new strategic approach to carbon capture and storage deployment in the UK should include power plants as anchor loads for strategic clusters	Publish a deployment pathway for CCUS in 2018, setting out the steps needed to meet our ambition of deploying CCUS at scale during the 2030s, subject to costs coming down sufficiently.	Not met	Plans are very high level and early stage, focused on industry rather than power.[Deploying CCS at scale in the UK is likely to involve power plants as anchor loads for strategic clusters.] The funding commitment is small. The statement of ‘costs coming down sufficiently’ that underpins the overall commitment, needs to be clearer given that significant cost reduction is already available through scale-up.
Implementation of plans for increasing flexibility (e.g. storage, interconnection, demand response, flexible generation)	The Government, Ofgem and industry will implement the 29 actions set out in the Smart Systems and Flexibility Plan by 2022.	Partially met	Progress implementing the actions from the Smart Systems and Flexibility plan will need to continue to be made by all parties.



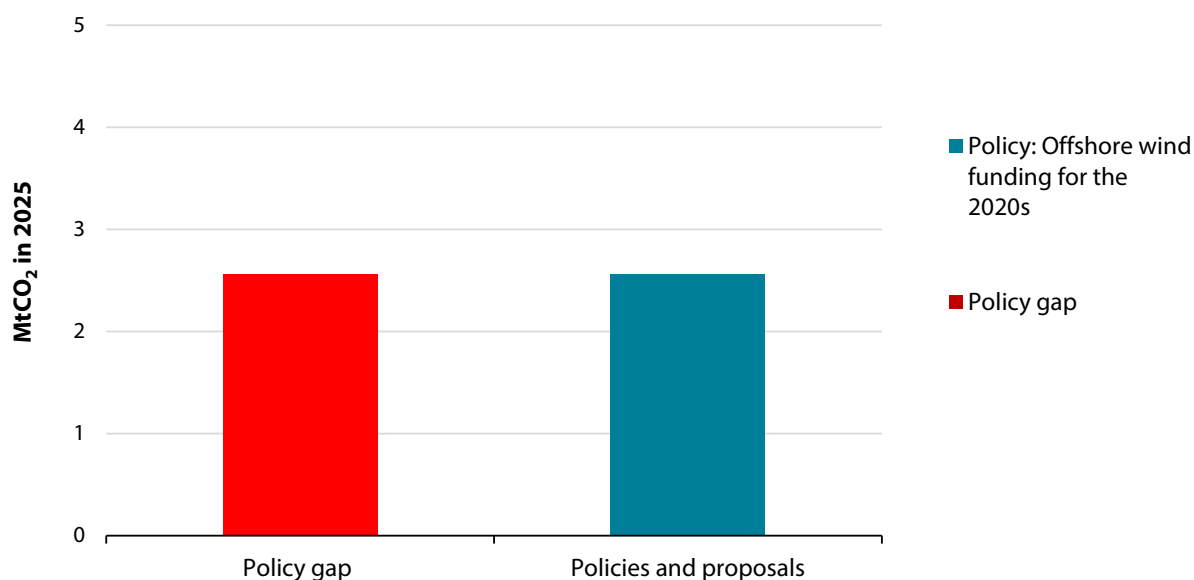
**Table 2.** Progress against the Committee’s recommendations on Power in the 2017 Progress Report to Parliament

<b>Recommendation in 2017 Progress Report</b>	<b>Clean Growth Strategy proposal</b>	<b>Assessment</b>	<b>Commentary</b>
Continued application of a carbon price after leaving the EU	The Government is confident that the Total Carbon Price, currently created by the combination of the EU Emissions Trading System and the Carbon Price Support, is set at the right level, and will continue to target a similar total carbon price until unabated coal is no longer used.	Met	The Government should keep the level of the total carbon price under review to ensure that unabated coal is phased out by 2025, alongside the extension of the Emissions Performance Standard to existing coal generation plant.
Contingency plans for delay or cancellation of planned projects, for example of new nuclear power plants	For new nuclear the Government has a monitoring and governance regime in place which ensures good visibility of any potential delays to commissioning dates.	No Progress	The Government should implement a monitoring and review process that will allow for contracting of additional low-carbon generation if there is delay or cancellation of planned projects.

**Source:** BEIS (2017) *Clean Growth Strategy*, HMT (2017) *Autumn Budget 2017*, HM Government (2017) *Meeting Carbon Budgets*, CCC (2017) *Progress Report to Parliament*.

**Notes:** The Clean Growth Strategy proposal on carbon pricing comes from Autumn Budget 2017. The Government committed to implementing the actions in the Smart Systems Plan in full by 2022 in the Industrial Strategy.

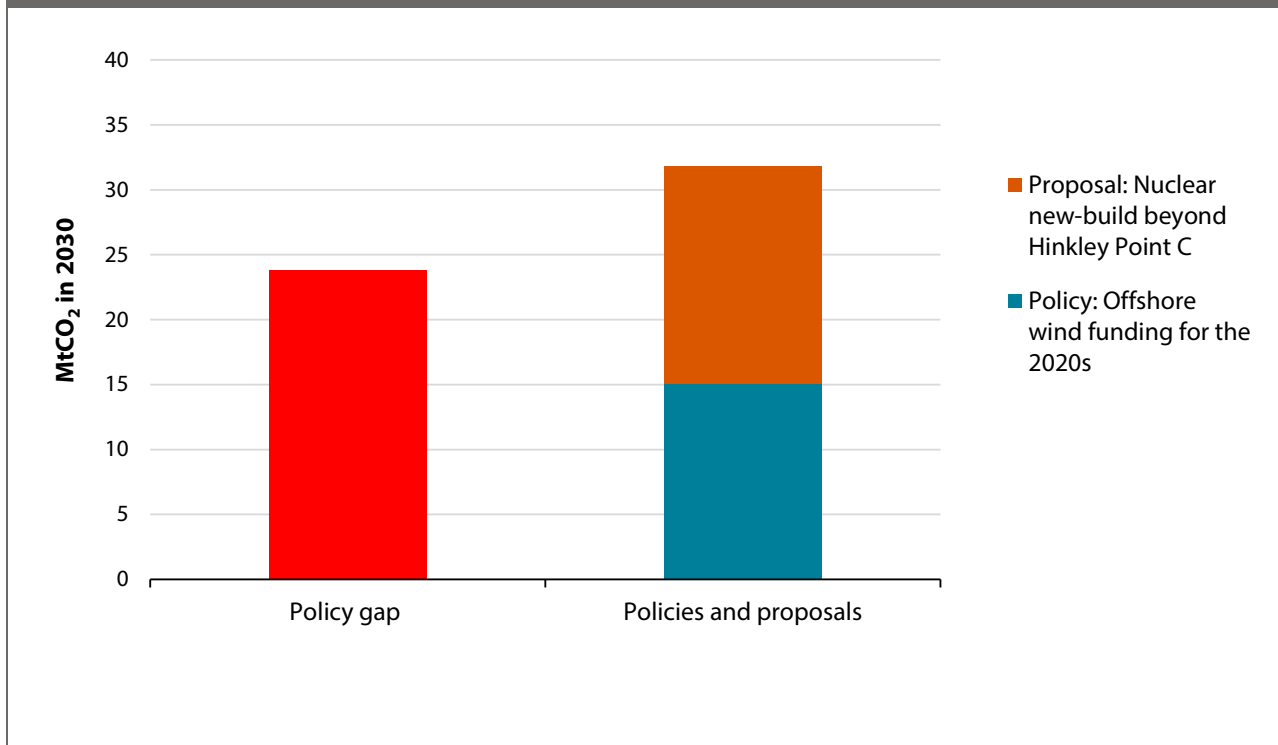
**Figure 6.** How policies and proposals in the Clean Growth Strategy could close the 2025 power policy gap



**Source:** BEIS (2017) *Updated Energy and Emission Projections 2016*, CCC analysis.

**Notes:** Policy gap assessment in our 2017 Progress Report to Parliament; represents the gap to the cost-effective path, rather than to carbon budgets. Estimated generation from the remaining £557m funding for Contracts for Difference and Hinkley Point C is expected to be sufficient to close the policy gap by 2025. This assumes that Hinkley comes fully online in 2025.

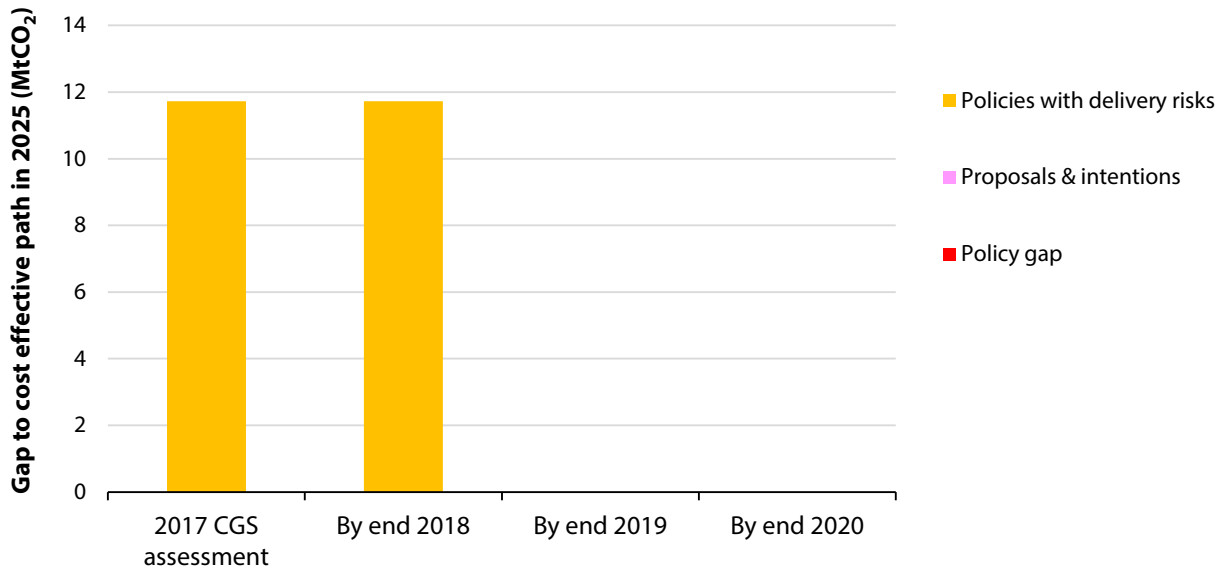
**Figure 7.** How policies and proposals in the Clean Growth Strategy could close the 2030 power policy gap



**Source:** BEIS (2017) *Updated Energy and Emission Projections 2016*, CCC analysis.

**Notes:** Policy gap assessment in our 2017 Progress Report to Parliament; represents the gap to the cost-effective path, rather than to carbon budgets. Estimated generation from the remaining £557m funding for Contracts for Difference, Hinkley Point C and the additional new nuclear generation in BEIS's Energy and Emissions Projections is expected to be sufficient to exceed the policy gap by 2030.

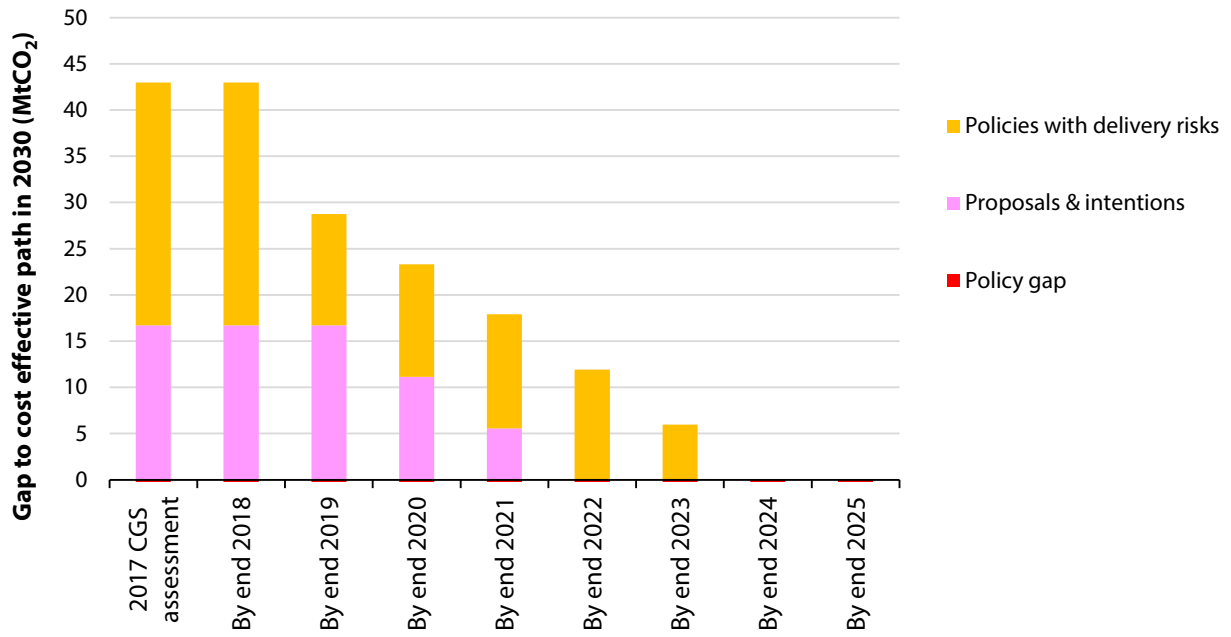
**Figure 8.** Fourth carbon budget: The power policy gap in 2025 and how Government policies should develop over time to close this gap



**Source:** BEIS (2017) *Updated Energy and Emission Projections 2016*, CCC analysis.

**Notes:** This chart reflects the Committee's detailed assessment of how the remaining gap to the cost-effective path can be closed and how current policies, proposals and intentions firmed up so that delivery risks are largely eliminated. This is based on an assessment of the current status of policies, proposals and intentions, and the potential to strengthen policy by 2020. The chart focuses on annual emissions in 2025, the middle year of the fourth carbon budget period, and the gap to meeting the cost-effective path. This assessment is based on the government emission projections used in the Clean Growth Strategy. New projections were published in January 2018. These reduced the level of projected future emissions in 2025, and therefore imply a smaller policy gap to be closed.

**Figure 9.** Fifth carbon budget: The power policy gap in 2030 and how Government policies should develop over time to close this gap



**Source:** BEIS (2017) *Updated Energy and Emission Projections 2016*, CCC analysis.

**Notes:** This chart reflects the Committee's detailed assessment of how the remaining gap to the cost-effective path can be closed and how current policies, proposals and intentions firmed up so that delivery risks are largely eliminated. This is based on an assessment of the current status of policies, proposals and intentions, and the potential to strengthen policy by 2025. The chart focuses on annual emissions in 2030, the middle year of the fifth carbon budget period, and the gap to meeting the cost-effective path. This assessment is based on the government emission projections used in the Clean Growth Strategy. New projections were published in January 2018. These reduced the level of projected future emissions in 2030, and therefore imply a smaller policy gap to be closed.

**Table 1. Timetable for closing the power sector policy gap**

Policy	2018 H1	2018 H2	2019 H1	2019 H2	2020	2021	2022	2023	2024	2025	2026-32
Carbon pricing	‘Total Carbon Price’ maintained at current levels.										
Contracts for difference for renewables		Consultation on future market design, including: technology neutrality, subsidy-free CfDs and repowering of existing sites									
			Next ‘Pot 2’ CFD round open for applications in Spring 2019	Additional low-carbon generation coming online.							
			Continued auctions for ‘Pot 1’ and ‘Pot 2’ low-carbon generation technologies (including ‘subsidy-free’ technologies) to meet the 5 <sup>th</sup> Carbon Budget								
New nuclear power	Progress discussions with developers to secure a competitive price for future projects. Award contracts for new nuclear power stations coming online in 5 <sup>th</sup> carbon budget period									EDF target commissioning date for Hinkley Point C	
	Regular Government progress reports on new-build nuclear progress										
	In case of delay or cancellation on new-build projects, consider contracting alternative low-carbon generation										
Unabated coal										Emissions Performance Standard to close unabated coal generation by end of 2025	
Smart systems and flexibility							Smart Systems Plan fully implemented	Continued improvements in electricity system flexibility			
Energy demand	Continued improvements in energy efficiency and demand management.										
Energy costs	Continued control over policy costs										

**Notes:** Commitments from the 2017 Budget, the Industrial Strategy and the Government’s response to the unabated coal closure consultation are also included.  
**Legend:** *Green* - Government commitment and timing in Clean Growth Strategy; *Blue* - Government commitment in Clean Growth Strategy with CCC timing; *Orange* - CCC recommendation.