

An independent assessment of the Clean Growth Strategy

Technical annex – Buildings

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 Buildings sector underpinning that report, in three sections:

- i) Emissions from the Buildings 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 Buildings sector today

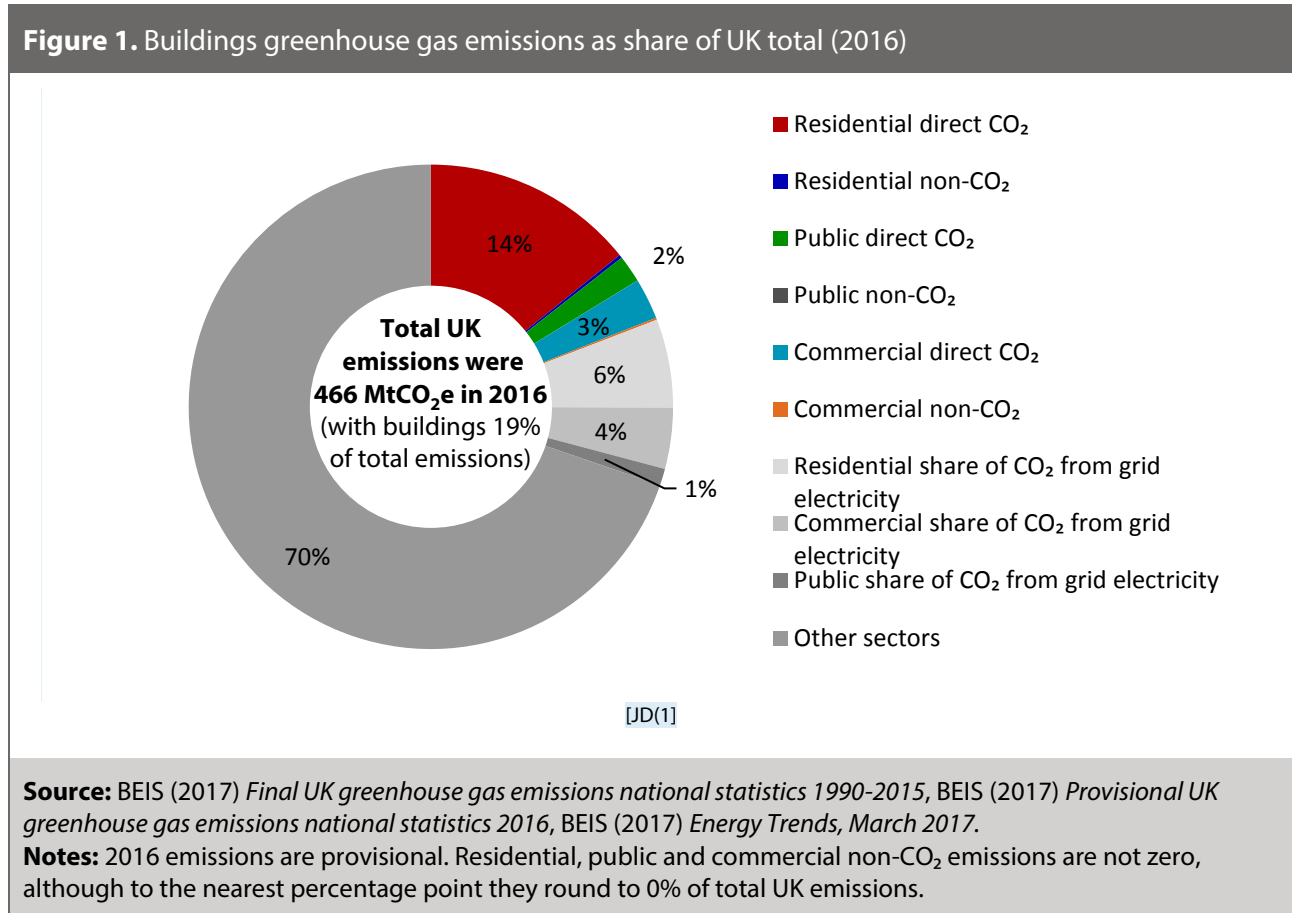
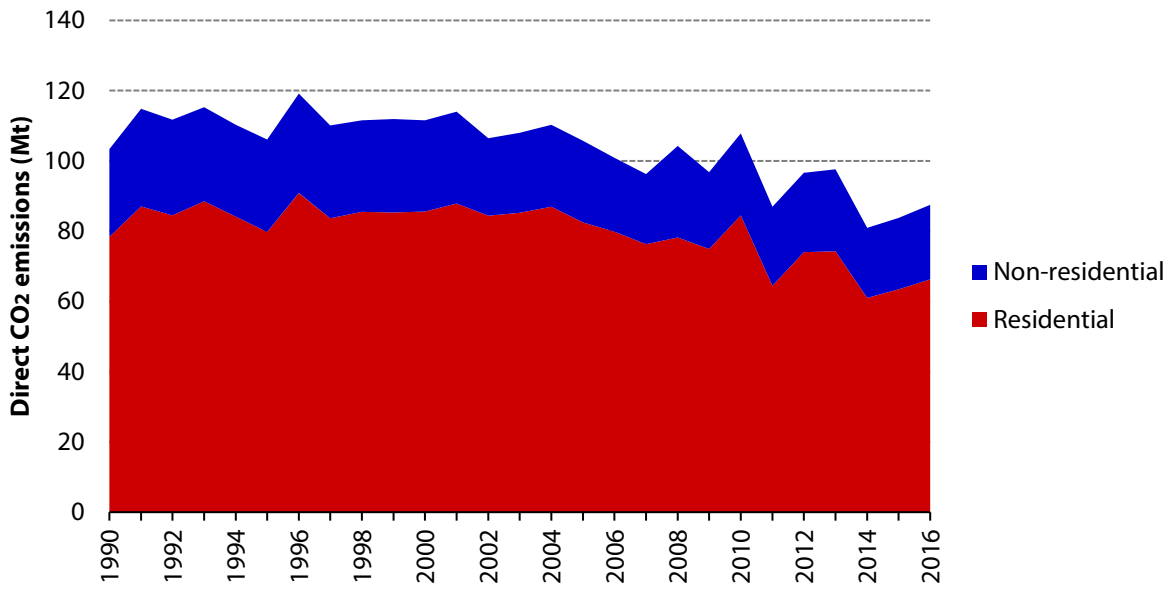


Figure 2. Direct CO₂ emissions from buildings (1990-2016)



Source: BEIS (2017) *Final UK greenhouse gas emissions national statistics 1990-2015*, BEIS (2017) *Provisional UK greenhouse gas emissions national statistics 2016*.

Notes: 2016 emissions are provisional. Emissions data are not temperature-adjusted.

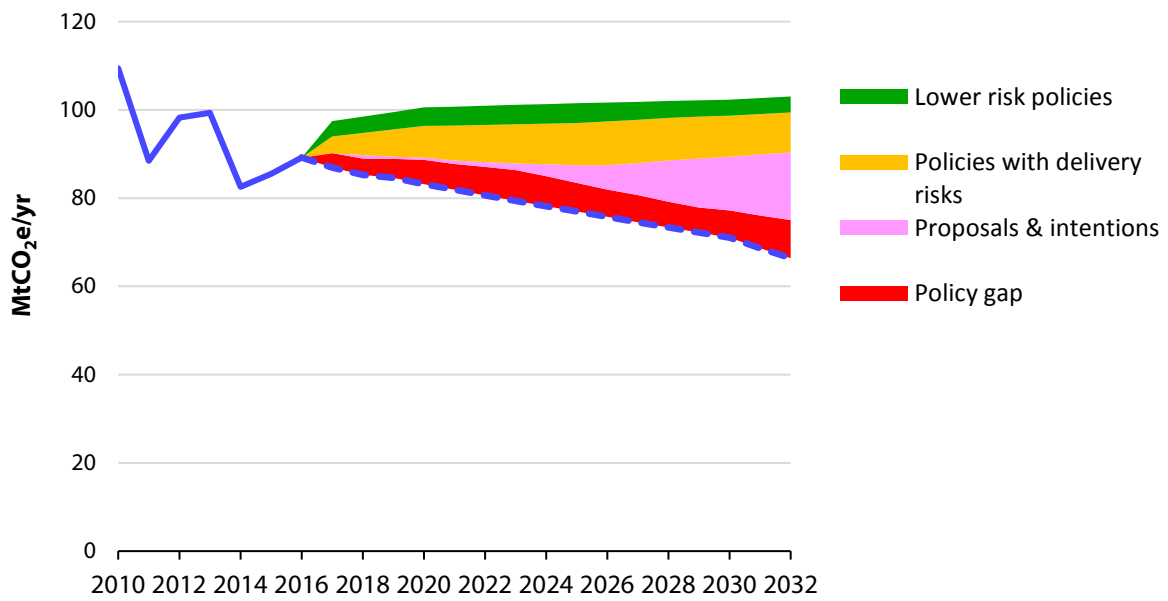
ii) Ambition in the Clean Growth Strategy

Table 1. Ambition in key low-carbon technologies and behaviours in buildings			
Key technology / behaviour	CCC scenarios	Clean Growth Strategy ambition	What we have assumed for quantification
Low-carbon heat	At least a quarter of buildings heat from low-carbon sources by 2030	Reform the Renewable Heat Incentive, spending £4.5 billion to support innovative low carbon heat and refocus towards greater uptake of heat pumps and biomethane.	Cost-effective uptake of heat pumps and biomass boilers in off-gas fossil-heated buildings is included through the 2020s, but not where displacing electric heating.
Heat pumps	At least 2.5 million heat pumps in homes by 2030, and 300k by 2020 (critical path)	Phase out installation of high carbon fossil fuel heating in new and existing homes currently off the gas grid during the 2020s.	For residential buildings, this is broadly equivalent to around 60% of installations in oil-heated homes in 2024, reaching 100% of suitable oil-heated homes by 2028. For non-residential buildings, we assume 100% phase out from 2022 in line with our central scenario.
Biomethane	Around 20 TWh of biomethane injected into the gas grid by 2030	Build and extend heat networks across the country, underpinned with public funding out to 2021.	The total uptake of low-carbon heat is lower than in our scenarios as it does not include heat pumps in new homes or displacing conventional electric heating. We assume that CGS proposals do not currently cover biomethane from 2022.
Low-carbon heat networks	Around 40 TWh of heat supplied through low-carbon heat networks by 2030, and 10 TWh by 2020		Cost-effective low-carbon heat networks uptake included from 2025, but assuming that CGS proposals mainly support gas CHP in the interim. This is equivalent to around 20 TWh from low-carbon sources by 2030.
Loft insulation in homes	All practicable lofts insulated by 2022	All fuel-poor homes to be upgraded to Energy Performance Certificate Band (EPC) C by 2030.	Abatement delivered by Clean Growth Strategy policy catches up with the cost-effective path by 2032.
Cavity wall insulation in homes	All practicable cavity walls insulated by 2030	As many privately rented homes and as much social housing as	

Table 1. Ambition in key low-carbon technologies and behaviours in buildings

Key technology / behaviour	CCC scenarios	Clean Growth Strategy ambition	What we have assumed for quantification
Solid wall insulation in homes	2 million solid walls insulated by 2030	possible upgraded to EPC band C by 2030 where practical, cost-effective and affordable. As many homes as possible to be EPC band C by 2035 where practical, cost-effective and affordable.	
Commercial energy efficiency	Demand reduction from energy efficiency measures of 23% by 2030 against a 2015 base, or 42% including the impact of widespread switching to heat pumps	Business energy efficiency improvement of at least 20% by 2030.	Assuming 20% reduction in commercial energy and emissions by 2030, against 2016 baseline. We include the additional savings relative to the Reference scenario energy efficiency policy savings.
Innovation	Not quantified	£184m innovation spend	Not quantified.

Figure 3. Buildings emissions and impact of Clean Growth Strategy (2010-32)



Source: BEIS (2017) *Updated Energy and Emission Projections 2016*, BEIS (2017) *2016 UK Greenhouse Gas Emissions, provisional figures, CCC analysis*.

Notes: Chart is for actual (i.e. 'gross') emissions and is on the basis of Government emission projections used in the Clean Growth Strategy. Emission reductions from existing policies that we judge to have significant delivery risks (e.g. insufficient funding) are coloured amber. We have assessed emission reductions from proposals and intentions that were included in the Clean Growth Strategy. These are coloured pink. The remaining gap to the cost-effective path is coloured red.

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

Table 2. Progress against the Committee's recommendations on buildings in the 2017 Progress Report			
Recommendation in 2017 Progress Report	Clean Growth Strategy proposal	Assessment	Commentary
<p>New-build. Standards to ensure new-build properties are highly energy efficient and designed to accommodate low-carbon heating from the start.</p>	<p>Subject to the conclusions of the independent review of Building Regulations and fire safety, consult on strengthening energy performance standards for new homes under Building Regulations, including futureproofing for low-carbon heating systems.</p>	<p>Partially met</p>	<p>Further clarity needed on the intention to consult and scope of consultation, which should be set out in 2018.</p> <p>New-build standards had been planned for 2021 under the Energy Performance in Buildings directive (from 2019 for public buildings). These standards will need to remain in place or be replaced with equivalent standards following UK exit from the EU.</p> <p>Standards must deliver high levels of fabric efficiency and be designed so as to encourage low-carbon heat installation (rather than solely solar PV as a substitute for low-carbon heating).</p>

<p>Existing buildings. A stable framework and direction of travel backed by a schedule of future standards, existing and planned EC standards retained, targeted and well-timed access to low-cost finance and incentives, and improvements to the efficiency of existing heating systems.</p>	<p>As many homes as possible to be EPC band C by 2035 where practical, cost-effective and affordable.</p> <p>All fuel-poor homes to be upgraded to Energy Performance Certificate (EPC) band C by 2030.</p> <p>Develop a long-term trajectory to improve the energy performance standards of privately rented homes, with the aim of upgrading as many as possible to EPC band C by 2030 where practical, cost-effective and affordable. Consult on how social housing can meet similar standards over this period.</p> <p>Subject to the conclusions of the independent review of Building Regulations and fire safety, consult on strengthening energy performance standards for existing homes under Building Regulations.</p> <p>Extend support for home energy efficiency improvements until 2028 at the current level of ECO funding.</p> <p>Improve standards on the 1.2 million new boilers installed every year in England and require installations of control devices to help people save energy.</p>	<p>Partially met</p>	<p>Clarity is needed on the level of ambition and funding across policies, such as setting out the number of homes or measures considered practical, cost-effective and affordable.</p> <p>A robust policy framework will be needed to deliver energy efficiency improvements in the able-to-pay owner-occupier segment of the housing stock. In our 2016 report, <i>Next steps for UK heat policy</i>, we set out an example timeline. For the near term this includes energy efficiency incentives (stamp duty or council tax rebalancing, subsidy), green mortgages, mortgage extensions for renovation and a potential role for additional soft loans. It also includes the introduction of minimum standards by 2030 at the point of sale. The policy framework should be backed up by regulations where necessary to make it effective. Beyond the progress needed to deliver the fifth carbon budget, we set out an option for moving faster in upgrading these homes in order to meet the fourth carbon budget.</p> <p>Regulations will need to be amended to make the private-rented sector standards fully effective (in the absence of the Green Deal). Early decisions on the long-term policy framework for delivering against the 2030 EPC band C ambitions for fuel-poor, the private rented sector and social housing will help drive investment, enable supply chains to develop and support early adopters.</p> <p>The new boiler standards are a good first step in improving heating system efficiency and preparing for lower-temperature systems (such as heat pumps). Future standards in the first half of the 2020s should look at further potential for improving system efficiency, through cost-effective interventions such as hydraulic balancing.</p>
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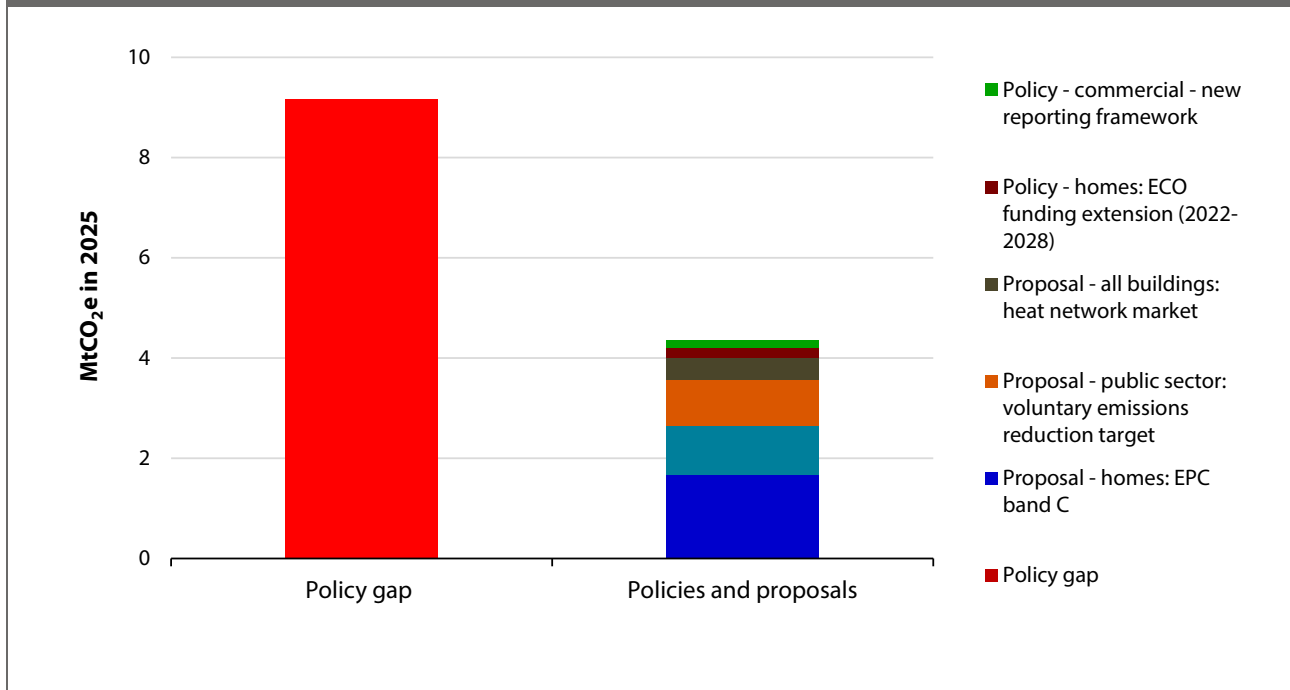
Table 2. Progress against the Committee's recommendations on buildings in the 2017 Progress Report

Recommendation in 2017 Progress Report	Clean Growth Strategy proposal	Assessment	Commentary
<p>Simple, highly visible information and certification including enhanced business reporting alongside installer training and public sector leadership.</p>	<p>Call for evidence by Spring 2018 seeking views on extending EPCs to other trigger points as well as wider views on how EPCs could be improved, in light of new sources of data and capabilities. BEIS are also undertaking work to explore innovative alternatives to EPCs, potentially based around use of smart meters.</p> <p>Replacement of the existing, telephone only Energy Saving Advice Service with a digitally-led service by spring 2018.</p> <p>Work with industry to implement the Each Home Counts review to improve quality and standards for retrofit energy efficiency and renewable energy installations.</p> <p>Simplify the requirements for businesses to measure and report on energy use.</p> <p>Subject to the conclusions of the Hackitt review, look at the potential for any further action on compliance and enforcement related to energy performance.</p> <p>Introduction of a voluntary public and higher education sector target of 30% reduction in greenhouse gases by 2020/21 against a 2009/10 baseline.</p>	<p>Partially met</p>	<p>The strategy commits to implementing the Each Home Counts review to improve quality and standards, and to consider further action on compliance and enforcement following the Hackitt review. These are vitally important across both retrofits and new build, to close the performance gap and drive up standards. As far as practical, standards and compliance procedures should be based on actual rather than modelled performance.</p> <p>Reforms around energy saving advice and information provision should be informed by international best practice, including well designed energy efficiency certificates and labels, feedback programmes, and energy audits.</p> <p>There is potential to go further than a voluntary target for the public sector, which may not be effective in driving emissions reductions, particularly low-carbon heat. Evidence of best practice in our 2016 report, <i>Next Steps for UK Heat Policy</i>, highlights the role which public sector procurement can play, for example in linking to a buildings reporting scheme such as the Australian NABERS scheme.</p>

Table 2. Progress against the Committee's recommendations on buildings in the 2017 Progress Report

Recommendation in 2017 Progress Report	Clean Growth Strategy proposal	Assessment	Commentary
<p>Reformed support for low-carbon heat through the 2020s, including a process for making decisions on heat infrastructure through the 2020s, a regulatory and financial framework for heat networks, active preparations for a decision on hydrogen and the future of the gas grid, and pilots and demonstrations to better understand the challenges of a wide scale hydrogen switch over.</p>	<p>Invest in low-carbon heating by reforming the Renewable Heat Incentive, spending £4.5 billion to support innovative low-carbon heat technologies in homes and businesses between 2016 and 2021.</p> <p>Decision to be made on RHI successor policy in 2018.</p> <p>Phase out the installation of high-carbon fossil fuel heating in new and existing homes currently off the gas grid during the 2020s, starting with new homes (and equivalent commitment for non-residential buildings).</p> <p>Build and extend heat networks across the country, underpinned with public funding (allocated in the Spending Review 2015) out to 2021. Industry taskforce to recommend measures necessary to create an effective long term market framework.</p> <p>Plan to publish initial findings from studies on the future of heat decarbonisation in 2017, with a full review of evidence by summer 2018.</p> <p>Invest around £184 million of public funds, including two new £10 million innovation programmes to develop new energy efficiency and heating technologies to enable lower cost low-carbon homes.</p>	<p>Partially met</p>	<p>The proposals set out a framework for working towards a decision on the future of the gas grid in the mid-2020s following an ongoing R&D programme, together with continued deployment of low-regrets options such as heat pumps in off-gas buildings and heat networks.</p> <p>Plans need to be developed now on the phase-out of the installation of high-carbon fossil fuel heating.</p> <p>Gaps include the support for low-carbon heat networks through the 2020s (beyond just gas CHP) and the continued support for biomethane after RHI funding comes to an end in 2021.</p> <p>There are no proposals for a governance framework to drive decisions on heat infrastructure through the 2020s. This is therefore a key requirement for the planned 2018 government publication on heat strategic options.</p>

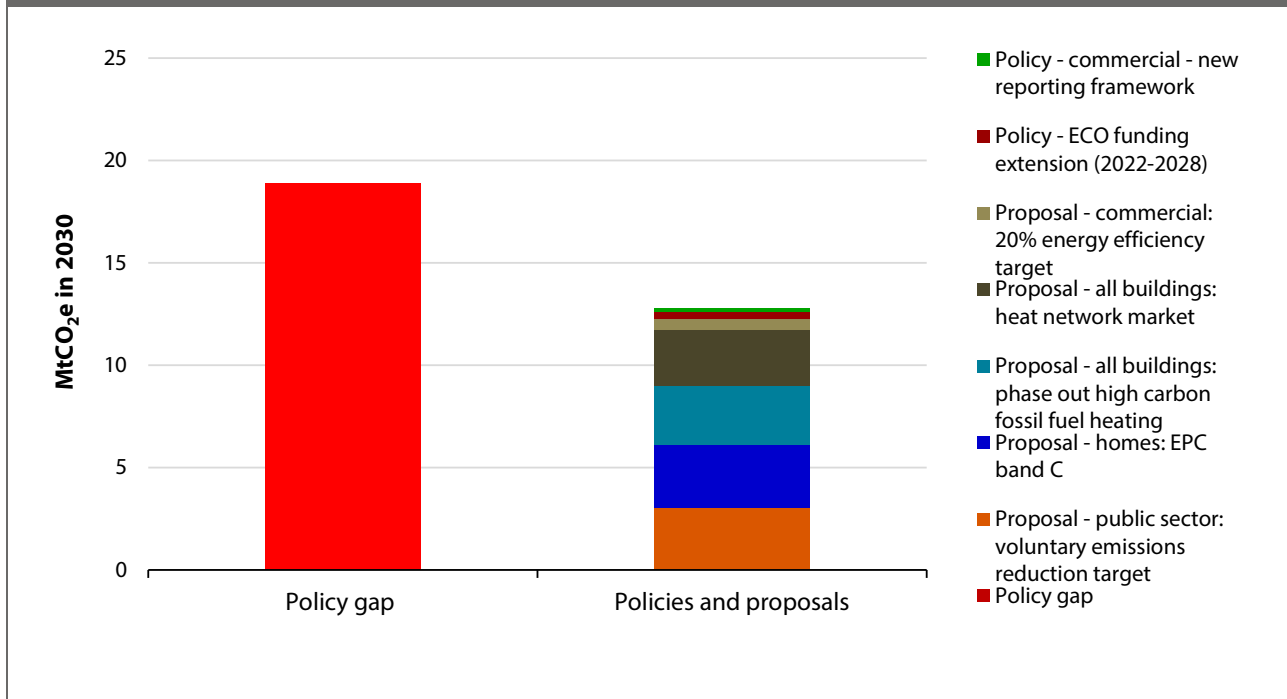
Figure 4. How policies and proposals in the Clean Growth Strategy could close the 2025 buildings policy gap



Source: CCC analysis.

Note: Policy gap assessment in our 2017 Progress Report to Parliament; represents the gap to the cost-effective path, rather than to carbon budgets.

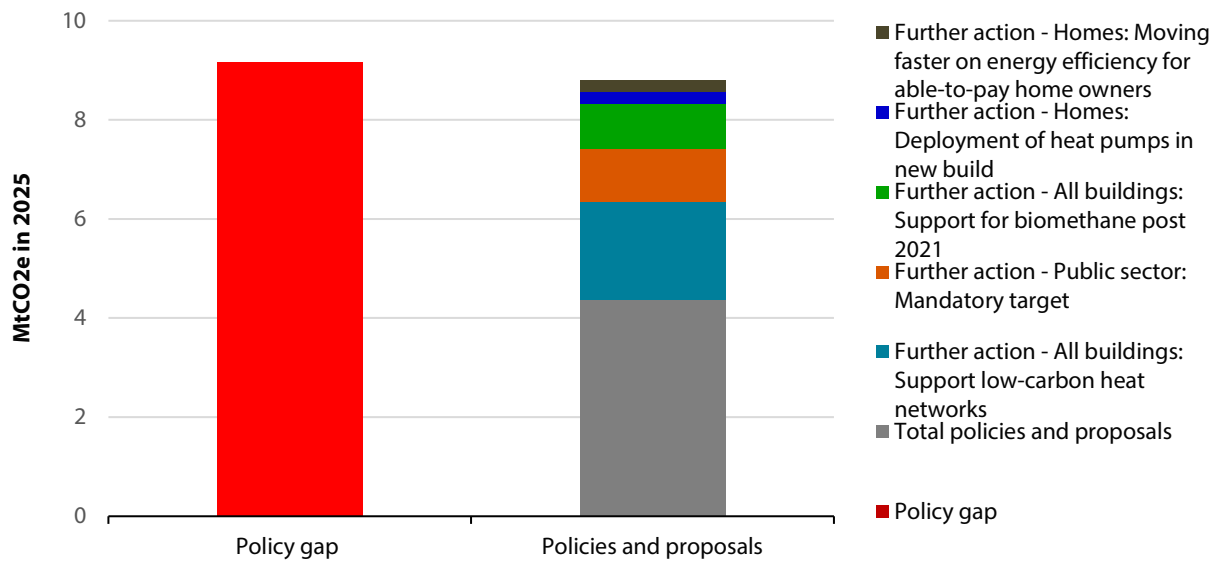
Figure 5. How policies and proposals in the Clean Growth Strategy could close the 2030 buildings policy gap



Source: 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. Policy savings are calculated as additional to abatement in the Government's Reference policies scenario. This impacts on the level of savings in cases such as the proposed 20% energy efficiency target - calculated in absolute terms - where the Reference policy scenario includes a number of policies delivering commercial energy efficiency savings.

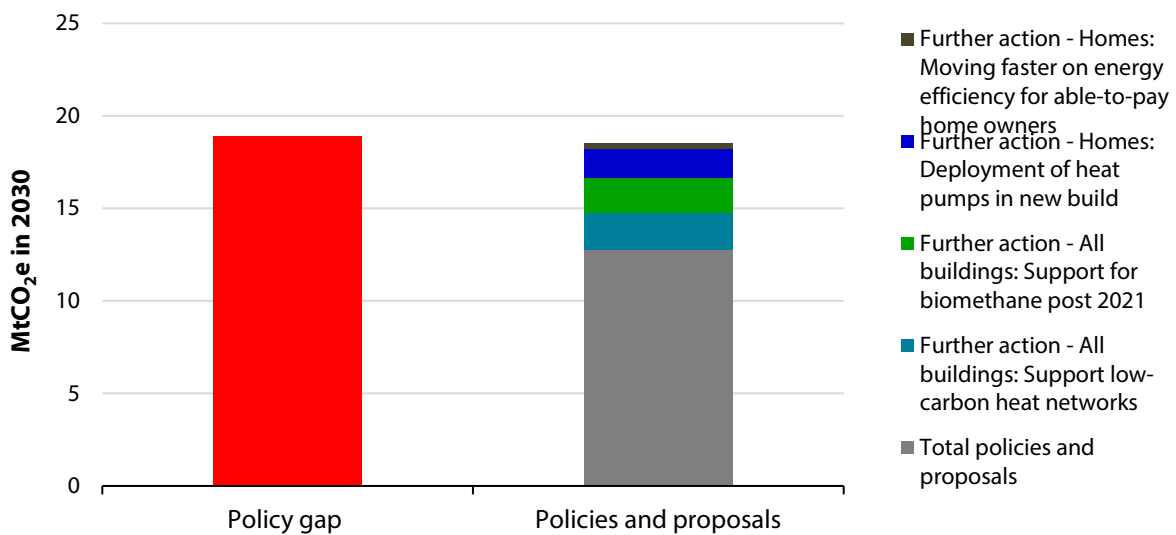
Figure 6. Additional actions required to close the 2025 policy gap in buildings



Source: CCC analysis.

Note: Policy gap assessment in our 2017 Progress Report to Parliament; represents the gap to the cost-effective path, rather than to carbon budgets. Policy savings for additional actions have been calculated on a case-by-case basis, so do not sum precisely to the remaining gap.

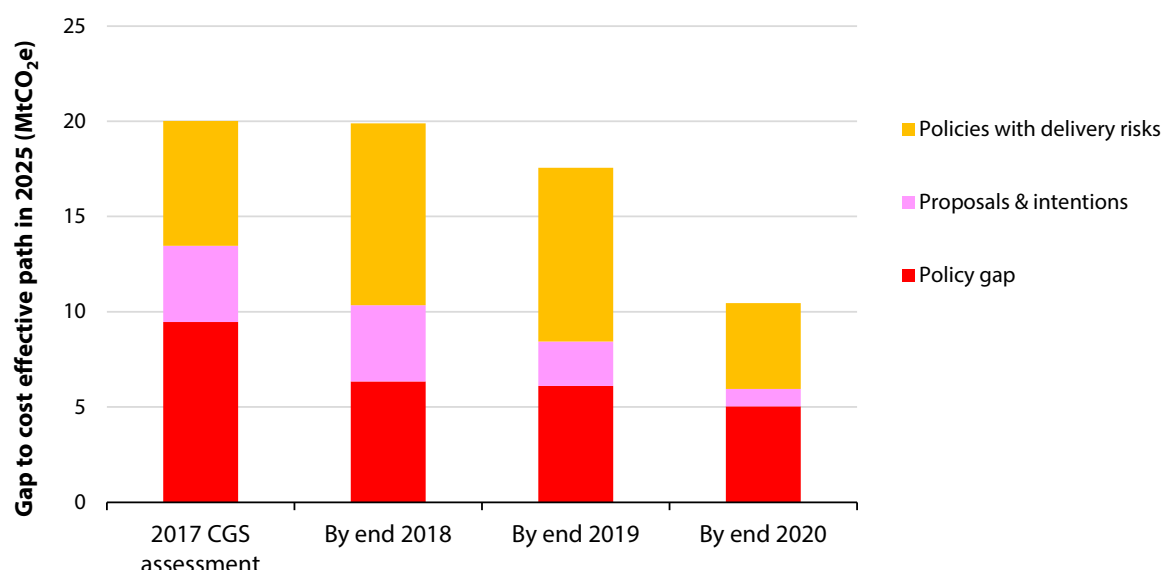
Figure 7. Additional actions required to close the 2030 policy gap in buildings



Source: CCC analysis.

Note: Policy gap assessment in our 2017 Progress Report to Parliament; represents the gap to the cost-effective path, rather than to carbon budgets. Policy savings for additional actions have been calculated on a case-by-case basis, so do not sum precisely to the remaining gap.

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

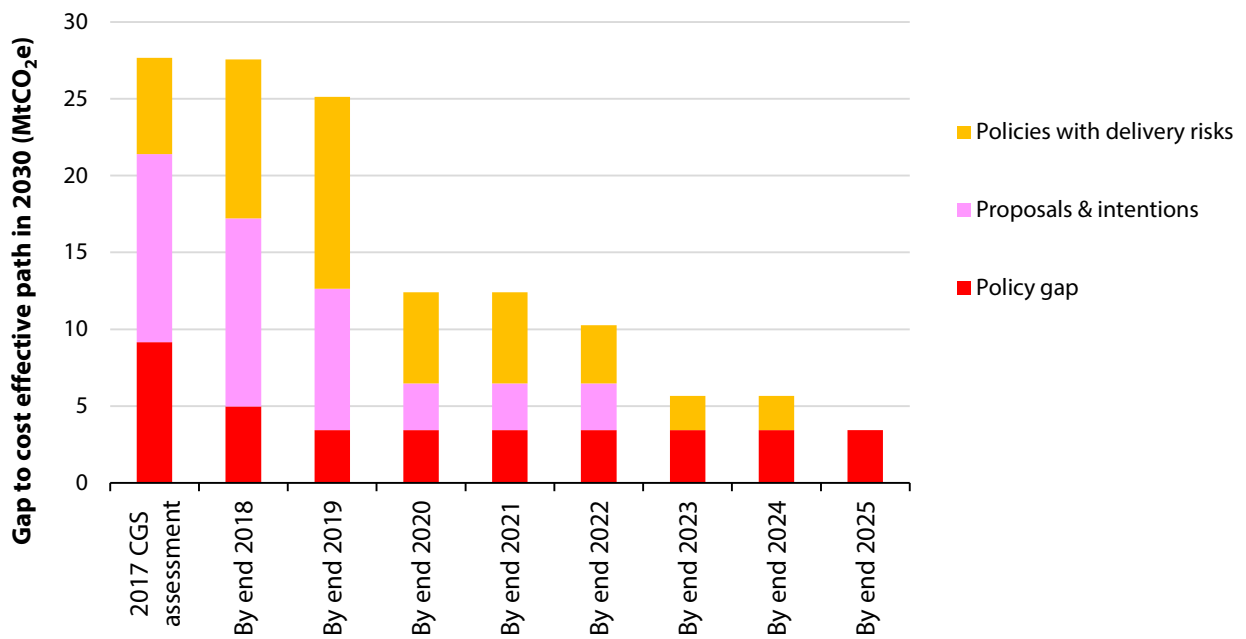


Source: BEIS (2017) *Updated Energy and Emission Projections 2016*, CCC analysis.

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 are 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.

There is a policy gap remaining in buildings, where we judge that there is a risk that Government estimates of policy savings from buildings regulations and smart meters will not be fully realised and we have therefore conservatively re-classified a portion of this abatement as policy gap (not reflected in figures 6 and 7). This is due to issues around the performance gap and questions around the potential savings from smart meters. Any under delivery will need to be made up for by further savings from other policies to realise the cost-effective energy efficiency potential through the 2020s. This could include further support for SMEs for instance. An accelerated approach to implementing the Each Home Counts recommendations and improving quality in the supply-chain would remove the remaining delivery risks in 2020.

Figure 9. Fifth carbon budget: The buildings 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 are 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.

There is a policy gap remaining in buildings where we judge that there is a risk that Government estimates of policy savings from buildings regulations and smart meters will not be fully realised and we have therefore conservatively re-classified a portion of this abatement as policy gap (not reflected in figures 6 and 7). This is due to issues around the performance gap and questions around the potential savings from smart meters. Any under delivery will need to be made up for by further savings from other policies to realise the cost-effective energy efficiency potential through the 2020s. This could include further support for SMEs for instance.

Table 3. Timetable for closing the policy gap on low-carbon heat (cross-cutting)

Policy	2018 H1	2018 H2	2019 H1	2019 H2	2020	2021	2022	2023	2024	2025	2026-32
Cross-cutting	Assess governance processes	Publish Heat Strategy, incl. high-level governance	Continued Heat Strategic Options work (to include development of governance proposals, evaluation of demonstrators...)					Government-led strategic decisions on the future of the gas grid			
	Heat research programme including hydrogen and demonstrators										
Building-scale low-carbon heat	Retarget RHI towards heat pumps and biomethane, decision on RHI successor, set out proposals for high-carbon fossil phase out				Framework of measures to phase out high-carbon fossil fuel heating						
Networked low-carbon heat		Examine plans for long-term heat networks policy framework	Transition to sustainable heat networks market								
						Targeted support for lower-carbon heat networks					
						Biomethane support (or equivalent policy)					
Heating system efficiency	Improve boiler standards and heating controls (to include phase 2 standards in early 2020s)										
<p>Source: Clean Growth Strategy and CCC analysis. Legend: <i>Green</i> - Government commitment and timing in Clean Growth Strategy; <i>Blue</i> - Government commitment in Clean Growth Strategy with CCC timing; <i>Orange</i> - CCC recommendation.</p>											

Table 4. Timetable for closing the policy gap on residential buildings

Policy	2018 H1	2018 H2	2019 H1	2019 H2	2020	2021	2022	2023	2024	2025	2026-32
Cross cutting	Confirm level of ambition and funding across policies										
	Call for evidence on extension of EPCs and scope for improvement	Framework of measures to improve EPCs, compliance and enforcement, and energy performance more broadly (including the effective use of measured data)				Monitoring metrics and certification reformed					
ECO	Consult on ECO's operation to 2022				Decision on design 2022-28						
Standards in Private Rented Sector (PRS) and social housing	Policy in place to make PRS regulations fully effective		Framework and regulations put in place to deliver longer term policy		Phase in minimum standards across all buildings at point of rental (band C achieved across stock by 2030)						
	PRS band E min goes live, consult on PRS and social housing trajectories										
Owner occupied housing	Action plan and policy framework on additional market based measures, including green mortgages and energy efficiency incentives				Phase in minimum standards across all buildings e.g at point of sale (band C achieved across stock by 2035)						
Existing homes			Review and tighten building regulation standards for new work to existing properties								
New homes	Review and tighten building regulation standards for new build (in line with Energy Performance of Buildings Directive), and to futureproof homes for low-carbon heating				Regulations come into force. Commitment to tightening in 2025.					Tighter standards supporting low-carbon heat come in to force	

Source: Clean Growth Strategy and CCC analysis.

Legend: *Green* - Government commitment and timing in Clean Growth Strategy; *Blue* - Government commitment in Clean Growth Strategy with CCC timing; *Orange* - CCC recommendation.

Table 5. Timetable for closing the policy gap on commercial buildings

Policy	2018 H1	2018 H2	2019 H1	2019 H2	2020	2021	2022	2023	2024	2025	2026-32
New energy & emissions reporting framework	Decide on preferred option		Introduce framework								
Framework to drive 20% energy efficiency improvement	Produce consultation & clarify measurement	Set out plans & proposals for meeting target									
Existing – cross-cutting			Develop new performance-based labelling scheme (e.g. like NABERS)		Phase in minimum standards across all buildings at point of sale (by 2030)						
Private-rented		Consultation on PRS trajectory	Minimum standards in the private-rented sector, tightening over time and set in advance								
SMEs	Develop policy to support SMEs (e.g. peer-to-peer networks, financial support and soft loans)				Policy support to SMEs						
New buildings	Review standards		Consultation on improving requirements		Minimum standards for new build and existing build (in line with EPBD)						
Heating system efficiency					Minimum standards for electric heat pump systems that drive uptake in heat pumps						

Source: Clean Growth Strategy and CCC analysis.

Legend: *Green* - Government commitment and timing in Clean Growth Strategy; *Blue* - Government commitment in Clean Growth Strategy with CCC timing; *Orange* - CCC recommendation.

Table 6. Timetable for closing the policy gap on public buildings

Policy	2018 H1	2018 H2	2019 H1	2019 H2	2020	2021	2022	2023	2024	2025	2026-32
Public sector target	Introduce voluntary target (and reporting framework)		Review voluntary target and consult on future targets			Review evidence for mandatory target in 2025		Legislation in place for 2025 mandatory target		Mandatory target in force	
			Develop options to go further in more ambitious sectors								
Procurement			Develop new performance-based labelling scheme (e.g. like NABERS)		Public building procurement standards that drive market for low-carbon buildings (including leasing)						
New buildings	Work to comply with all new public buildings as nearly-zero energy from 2019 (EPBD)		All new public buildings are nearly-zero energy								
Central government	Set out tighter 2020 mandatory Greening the Government targets, and trajectory for 2020s		2020s targets finalised								

Source: Clean Growth Strategy and CCC analysis.

Legend: *Green* - Government commitment and timing in Clean Growth Strategy; *Blue* - Government commitment in Clean Growth Strategy with CCC timing; *Orange* - CCC recommendation.