

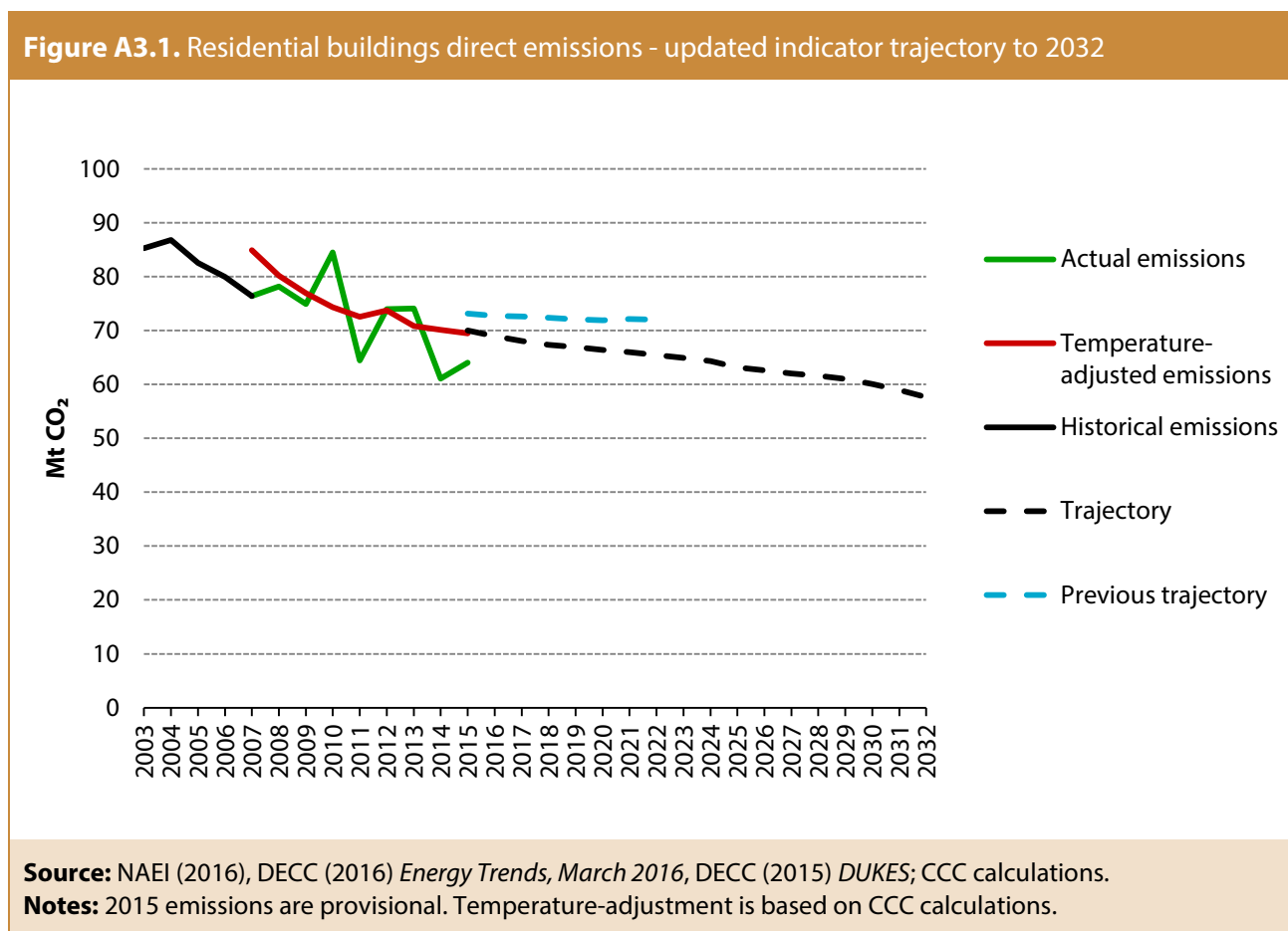
Technical Annex 3: Buildings

This Technical Annex supports the buildings chapter of the report *Meeting Carbon Budgets - 2016 Progress Report to Parliament*, covering the following sections:

1. Residential buildings
2. Non-residential buildings
3. Assessment of current and planned policies
4. Indicator table

1. Residential buildings

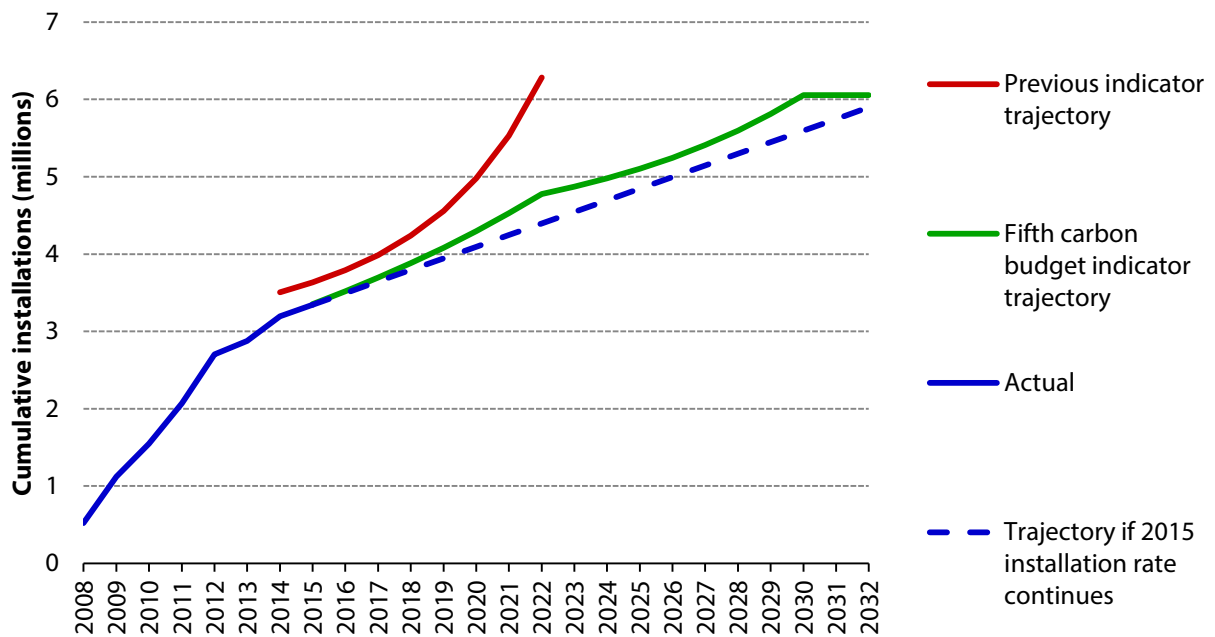
Figure A3.1 shows actual (and temperature adjusted) direct emissions from buildings, along with our updated and previous indicator trajectories. Temperature adjusted residential emissions have been declining with the uptake of insulation and more efficient appliances. However, the rate of improvement slowed in 2015 and will need to accelerate for our trajectory, which is based on our fifth carbon budget analysis.



The uptake of energy efficiency measures against our indicator trajectories is shown in Figures A3.2-3.7. For cavity wall, loft and solid wall insulation our updated indicators are shown alongside our previous indicators. The updated indicators reflect uptake to date and the evidence underpinning our fifth carbon budget analysis. Cavity wall insulation rates are close to

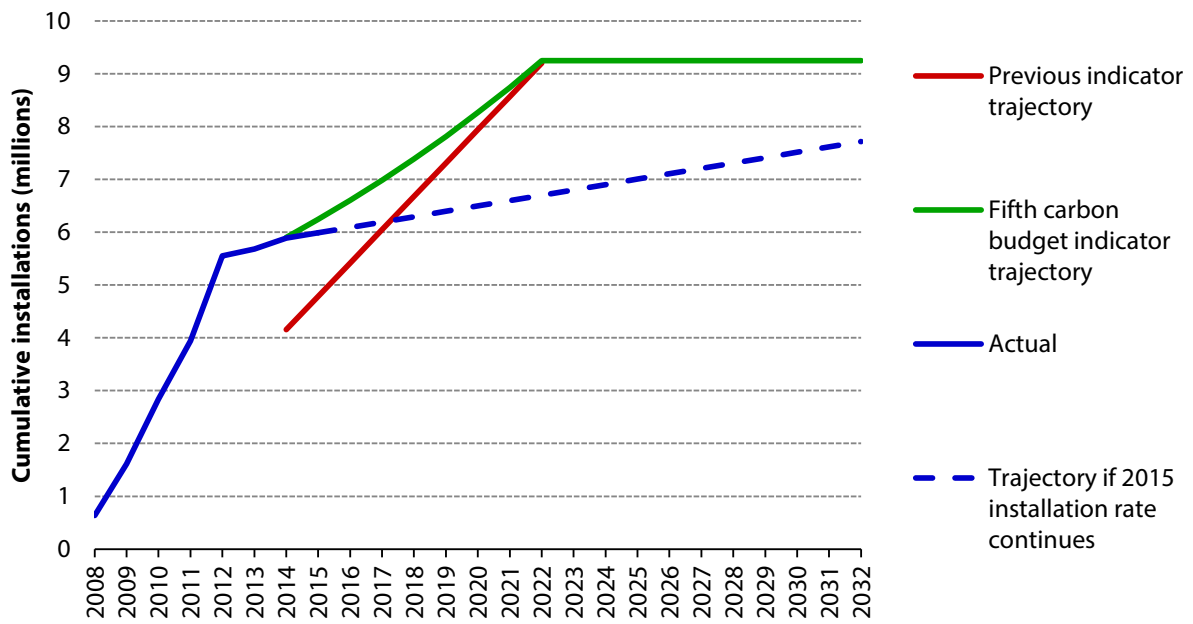
our updated indicator, but loft insulation and solid wall insulation rates will need to increase. We will consider updates to other indicators for the next progress report. A-rated boiler uptake has exceeded our indicator. The uptake of the most efficient wet and cold appliances and LED lighting are below our indicators.

Figure A3.2. Cavity wall insulation uptake and indicator trajectories (2008-2032)



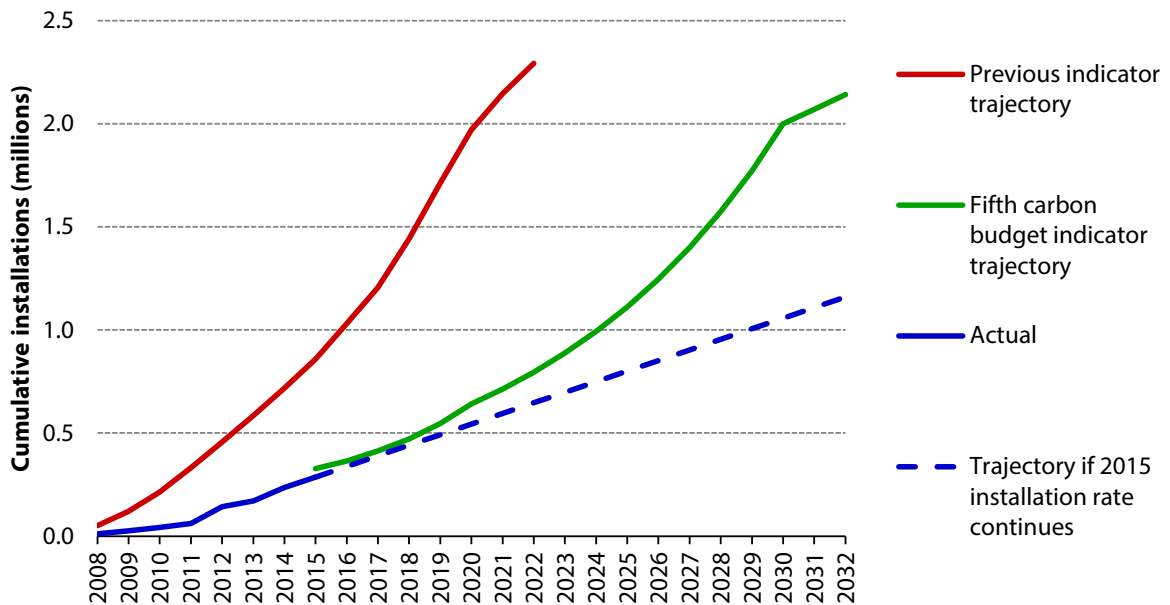
Source: DECC, CCC calculations.

Figure A3.3. Loft insulation uptake and indicator trajectories (2008-2032)



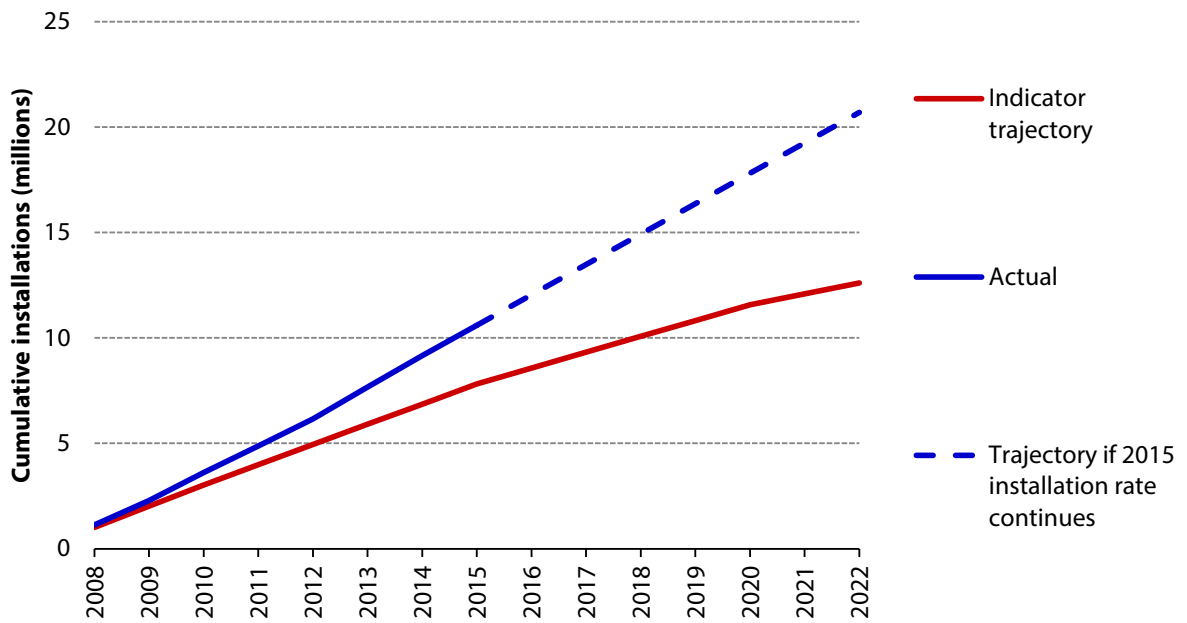
Source: DECC, CCC calculations.

Figure A3.4. Solid wall insulation uptake and indicator trajectories (2008-2032)



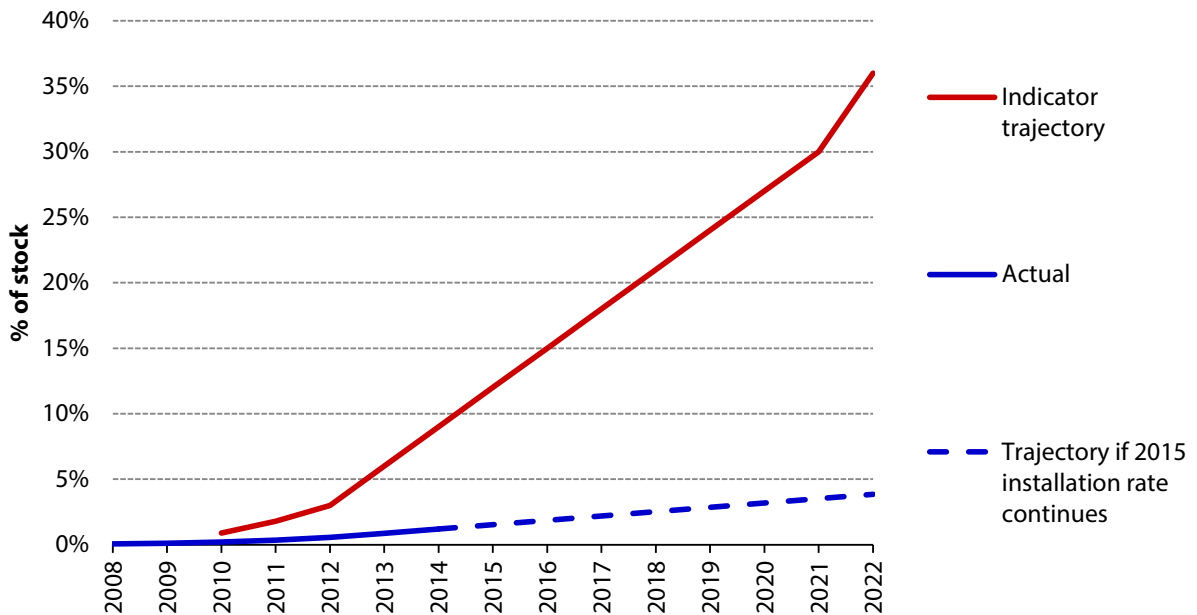
Source: DECC, CCC calculations.

Figure A3.5. A-rated boilers uptake and indicator (2008-2022)



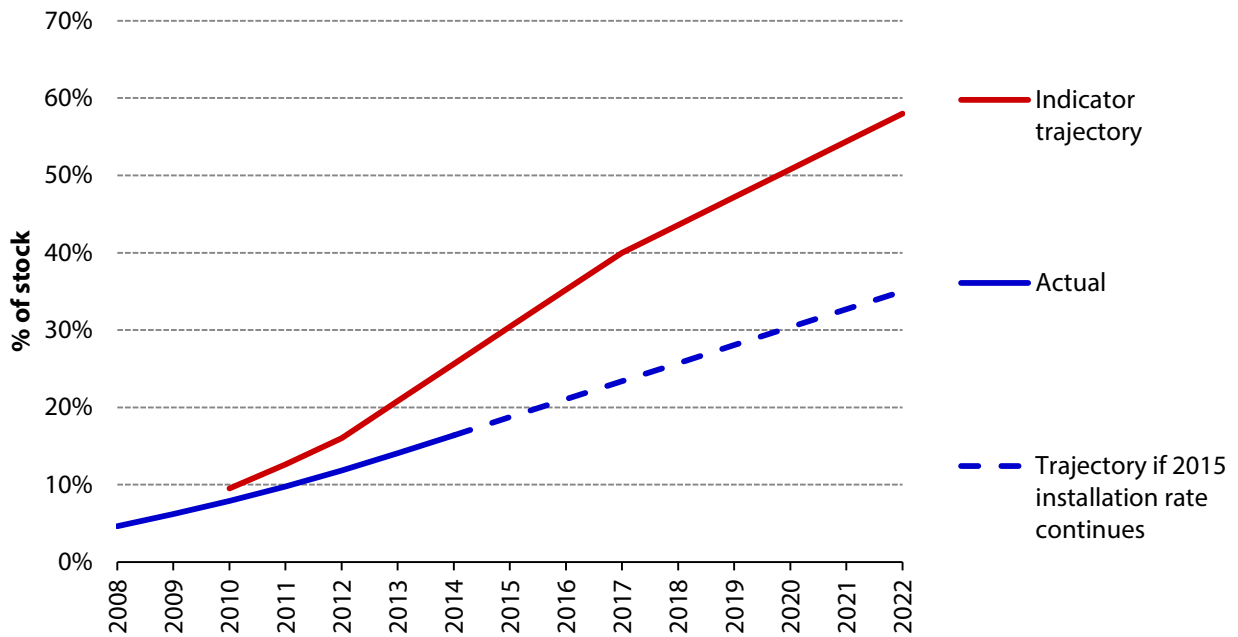
Source: Heating and Hotwater Industry Council (2016), DCLG (2016) *House Building Statistics*, CCC calculations.

Figure A3.6. Uptake against indicator (% of stock) - Cold appliances A++ rated or higher (2008-2022)



Source: DECC (2015) *Energy Consumption in the UK*; CCC calculations.

Figure A3.7. Uptake against indicator (% of stock) - Wet appliances A+ rated or higher (2008-2022)



Source: DECC (2015) *Energy Consumption in the UK*; CCC calculations.

Box A3.1 provides a summary of the NAO's report on the Green Deal and ECO that is referenced in Chapter 3.

Box A3.1. National Audit Office Report: Green Deal and Energy Company Obligation (April 2016)

Findings on the performance of the schemes:

Under delivery – DECC estimates measures financed by Green Deal loans will save just 0.4 MtCO₂ over their lifetime, well below the central scenario of their 2012 impact assessment in which over the course of ten years, Green Deal finance was estimated to contribute 27.5 MtCO₂ lifetime savings.

Less cost effective than previous schemes – The NAO estimate ECO and Green Deal have cost £92-95 per tCO₂ saved in comparison to £34 per tCO₂ under CERT and CESP. This is attributed to: the initial focus on harder-to-treat homes; closing the Green Deal in its early stages; high administrative costs and difficulties for suppliers in identifying eligible households.

Lack of consistency – changes introduced to the ECO in 2014 (reducing the CO₂ saving target and broadening the scope out from harder-to-treat homes) improved cost-effectiveness in the short-term, but has not led to the development of the supply chain for delivering solid wall insulation that will be needed longer term. The lack of consistency has created uncertainty with the main stakeholders which could increase the long-term cost of improving the housing stock. Enterprises in the supply chain require a higher return where there is a risk they are investing in skills and equipment the government could deprioritise.

Box A3.1. National Audit Office Report: Green Deal and Energy Company Obligation (April 2016)

Untested design – DECC should have ensured that the Green Deal was a sufficiently attractive proposition to generate consumer demand. The evidence used to consider consumer behaviour was not entirely transferrable, there were warnings from stakeholders about the design being unlikely to generate demand and the final design was not piloted.

Low additionality from the Green Deal – DECC believes it is “unlikely to have provided any material additional energy and carbon savings over and above what would have been delivered by other policies.”

Lack of blending and private financing - DECC expected households to pay a significant share of measures through a blend of ECO and Green Deal. This blending was important as there were few measures with low enough upfront costs to meet the ‘golden rule’ of the Green Deal, so consumers required another source of finance which DECC expected to be the ECO. This did not happen due to timing, the supply chain adapting and the Green Deal not being sufficiently attractive to households. In reality no more than 1% of measures have blended finance from the Green Deal.

Recommendations for designing and implementing energy efficiency policies:

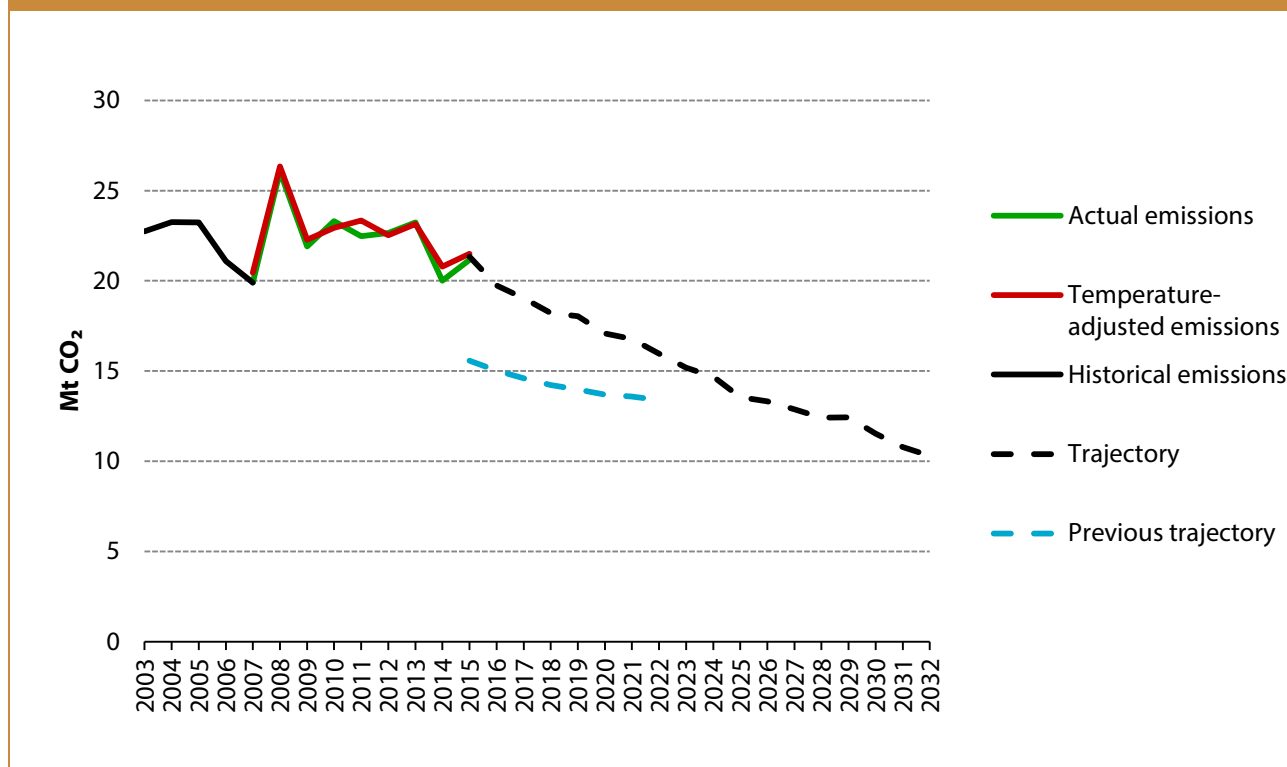
- Be clear about the purpose of schemes from the outset, setting realistic priorities and clear success criteria, developed with stakeholders, including other government departments.
- Understand and plan for how the desired outcomes will be delivered in practice.
- Ensure it has sufficient information to track progress of the schemes towards each of its desired outcomes.
- Consider the long-term impact of its decisions on the overall progress towards increasing household energy efficiency.

Source: NAO (2015) *Green Deal and Energy Company Obligation*. Available at: <https://www.nao.org.uk/report/green-deal-and-energy-company-obligation/>

2. Non-residential buildings

There has been a lack of progress in reducing non-residential building emissions in recent years and provisional data shows an increase in direct emissions in 2015. Figure A3.8 shows actual (and temperature adjusted) direct emissions along with our updated and previous indicator trajectories. The updated trajectory has been rebased to reflect current emission levels and our fifth carbon budget analysis.

Figure A3.8. Non-residential buildings direct emissions - updated indicator trajectory to 2032



Source: NAEI (2016), DECC (2016) *Energy Trends, March 2016*, DECC (2015) *DUKES*; CCC calculations.

Notes: 2015 emissions are provisional. Temperature-adjustment is based on CCC calculations.

3. Assessment of current and planned policies

In Chapter 3, we set out our assessment of the impact of Government policies intended to reduce emissions in the buildings sector, differentiating between those policies which are expected to deliver (classified as “lower risk”) and those at risk of failing to deliver, either due to design and delivery problems, or because they are currently unfunded (classified as “at risk”).

Table A3.1 sets out the rationale for classifying lower risk policies as such; Table A3.2 sets out the rationale for at-risk policies.

Table A3.1. Lower risk policies

Policy	Why the policy is 'lower-risk'
Buildings (residential)	
CERT (2009-12) and CESP (2008-12)	CERT (Carbon Emission Reduction Target) delivered energy efficiency measures by placing an obligation on energy companies to achieve reductions in carbon emissions. The overall target of 293 MtCO ₂ of lifetime savings was achieved. CESP (Community Energy Saving Programme) achieved 85% of the carbon savings target.
EU Products Policy (Implemented)	The Ecodesign Directive sets minimum standards for appliances which ratchet up over time. Energy labelling helps overcome consumer awareness barriers. Some questions remain over the rate of stock replacement and the number of consumers choosing the most efficient appliances, but these savings are not substantially at risk.
Renewable Heat Incentive (RHI) to April 2016	The delivery under the RHI is not significantly below DECC's forecast deployment in 2015/16.
Buildings (non-residential)	
EU Products Policy (Implemented)	As with domestic products, minimum standards for products are set under the Ecodesign directive and ratcheted up over time. These savings relate to implemented standards, which should be realised subject to replacement rates and compliance.
Renewable Heat Incentive (RHI) to April 2016	The delivery under the RHI is not significantly below DECC's forecast deployment in 2015/16.
Private-rented sector regulations	Legislated policy for the introduction of minimum energy efficiency standards by 2018.

Table A3.2. At risk – policies with design/delivery problems or lack of funding

Policy	Why the policy is ‘at risk’
Buildings (residential)	
Real-time displays/ smart meters	Energy suppliers have an obligation to deliver full roll-out by 2020. The scheme has suffered delays and there are questions around whether the two millions meters installed to date would need to be upgraded again before 2020.
Private-rented sector regulations	This legislated policy for the introduction of minimum energy efficiency standards by 2018 relied on the Green Deal loans as a financing mechanism, which is no longer operational.
Buildings Regulation Part L 2010 Buildings Regulation Part L 2013	Legislated policy, but savings are dependent on level of compliance and future build rates. Evidence suggests that the performance gap is undermining the effectiveness of the regulations, whilst the larger housebuilders have banks of properties with planning permission which may allow them to build to previous standards, diluting the impact in the near-term.
Energy Company Obligation (ECO)	While ECO is aiming to target the right measures and customer types (e.g. fuel poor, hard- to-treat homes and rural households), uptake to date of this has been very low due to low ambition and poor design, and carbon saving targets are off track.
Energy Company Obligation (ECO) extension 2018 - 2022	Design of the scheme is currently unknown.
Products Policy (Adopted)	Question marks remain over implementation, which is frequently subject to significant delays.
Renewable heat incentive, post-CSR funding	Unresolved issues around awareness and trust for domestic consumers.
Buildings (non-residential)	
Real-time displays/ smart meters	Energy suppliers have an obligation to deliver full roll-out by 2020. The scheme has suffered delays, similarly to the smart meters for homes rollout.
EU Products Policy (Adopted)	Realised savings are at risk due to delays to implementation and uncertainty around stock replacement rates. Assumptions underpinning modelled savings are unclear.
Buildings 2010 part L regulations	These regulations share the same issues of uncertainty around compliance and the ‘performance gap’ between buildings as designed, built and in-use.

Table A3.2. At risk – policies with design/delivery problems or lack of funding

Policy	Why the policy is 'at risk'
Building Regulations part L	
CRC Energy Efficiency Scheme	This scheme will be closed from April 2019.
Energy savings opportunity scheme	Poor compliance in the first reporting year and unclear the extent this policy will drive energy saving.
Renewable heat incentive, post-CSR funding	Continuing lack of interest in non-domestic heat pump subsidies.

4. Indicator table

Table A3.3. Buildings indicators

Buildings	Budget 2	Budget 3	Budget 4	2015 indicator	2015 outturn
All buildings					
Headline indicators					
Direct CO ₂ emissions (% change on 2007)*	-17%	-23%	-29%	Updated this year	-12% (-14% temperature-adjusted)
Final electricity consumption (% change on 2007)*	-6%	-8%	-7%	Updated this year	-8%
Low-carbon heat					
Headline indicators					
Low-carbon heat penetration (% of heat demand)*	4%	8% in 2020 10% in 2022	18%	Updated this year	2.5% (2014)
Heat pumps in homes		300k in 2020			~100k
Supporting indicators					

Table A3.3. Buildings indicators					
Buildings	Budget 2	Budget 3	Budget 4	2015 indicator	2015 outturn
Develop an action plan to address the significant shortfall in low-carbon heat covering heat networks, infrastructure planning and links to energy efficiency.	Ahead of 2016 Progress report				No plans
RHI. Commit funding until there is a suitable replacement in place.	Ahead of 2016 Progress report				Funding committed in 2015 to 2020/21
Other drivers					
Uptake and costs of low-carbon heat technologies in buildings - Biomass boilers, GSHP/ASHP, District heating, Biomethane, Solar thermal.					
Residential buildings					
Headline indicators					
Direct CO ₂ emissions (% change on 2007)*	-20%	-23%	-27%	Updated this year	-16% (-18% temperature-adjusted)
Final electricity consumption (% change on 2007)*	-8%	-11%	-11%	Updated this year	-12%
Supporting indicators					
Uptake of solid wall insulation (million homes, total additional installations compared to 2007 levels)*	0.4	0.8	1.4	Updated this year	0.3
Uptake of loft insulation (top up of between 50- 200 mm) (million homes, total additional installations compared to 2007 levels)*	7.0	9.2	9.2	Updated this year	6.0
Uptake of cavity wall insulation (million homes, total additional installations compared to 2007 levels)*	3.7	4.8	5.4	Updated this year	3.3
Uptake of energy efficient boilers (million homes, total additional installations compared to 2007 levels)	9.3	12.6		7.8	9.2
Uptake of energy efficient appliances –	18%	36%	45%	9% (2014)	1.2% (2014)

Table A3.3. Buildings indicators

Buildings	Budget 2	Budget 3	Budget 4	2015 indicator	2015 outturn
cold A++ rated (% of stock)					
Uptake of energy efficient appliances – wet A+ rated (% of stock)	40%	58%	70%	26% (2014)	16% (2014)
Uptake of LEDs (million bulbs, replacing halogens with LEDs)	87	169	250	37 (2014)	4.7 (2014)
ECO: Increase ambition on lofts and cavities to 2017	Now, as changes to ECO are finalised				
ECO/Green Deal: Maintain financial incentives till 2017	Ongoing to March 2017				Green Deal cancelled in 2015.
ECO: Decide on focus for future of ECO, in particular the role of solid wall insulation	By mid-2016				Successor to ECO will focus on fuel poverty.
Green Deal: Achieve reduction of Green Deal interest rate (e.g. through government guarantees)	By end 2015				Green Deal cancelled in 2015.
Fuel poverty: develop additional measures for England to supplement Affordable Warmth under the ECO	By end 2014				Fuel Poverty Strategy published in 2015, but underfunded and gap on low-carbon heat.
Private-rented sector: Publish proposals for minimum energy performance standards (with a timetable for a progressive tightening of standards)	By end 2014				Regulations legislated, but no delivery mechanism and timetable for tightening.
Zero Carbon Homes: Ensure that the Zero Carbon Homes standard requires investment in low-carbon heat unless this is prohibitively expensive. No exemptions for small developments should be given unless there is a clear economic justification.	For 2016 start				Regulations cancelled.

Table A3.3. Buildings indicators					
Buildings	Budget 2	Budget 3	Budget 4	2015 indicator	2015 outturn
Other drivers					
Average SAP rating, implementation of behavioural measures, population (by age), number of households (by type – building and occupants), household disposable income, electricity and gas prices, appliance ownership, weather.					
Non-residential buildings					
Headline indicators					
Direct CO ₂ emissions (% change on 2007)*	-7%	-22%	-37%	Updated this year	+6% (+5% temperature-adjusted)
Final electricity consumption (% change on 2007)*	-4%	-6%	-3%	Updated this year	-3%
Supporting indicators					
Accelerate the introduction of minimum standards for privately rented non-residential properties	By 2016				Regulations legislated in 2015.
Government decision on the following recommendations for EPCs and DECs:					
– All non-residential buildings to have an EPC	By 2017				No commitment to do this
– All non-residential buildings to have a minimum EPC rating of F or higher		By 2020			No commitment to do this
– Roll out of DECs to non-public buildings	By 2017				Ruled out by former DCLG Secretary of State
Conduct a full review of non-residential low-carbon policies to evaluate options for strengthening and rationalising incentives, regulation and information requirements, and implement recommendations	By 2016				Ongoing

Table A3.3. Buildings indicators					
Buildings	Budget 2	Budget 3	Budget 4	2015 indicator	2015 outturn
Set out a timetable and proposals for an interim tightening of Part L in 2016 as part of the Zero Carbon Buildings programme.	By 2016				No commitment to do this
Other drivers					
Emissions and fuel consumption by subsector, electricity and gas prices.					

Note: Numbers indicate amount in last year of budget period (i.e. 2017, 2022, 2027).

* Indicator trajectory for uptake of emissions, energy, low-carbon heat, loft, cavity wall and solid wall insulation revised this year.