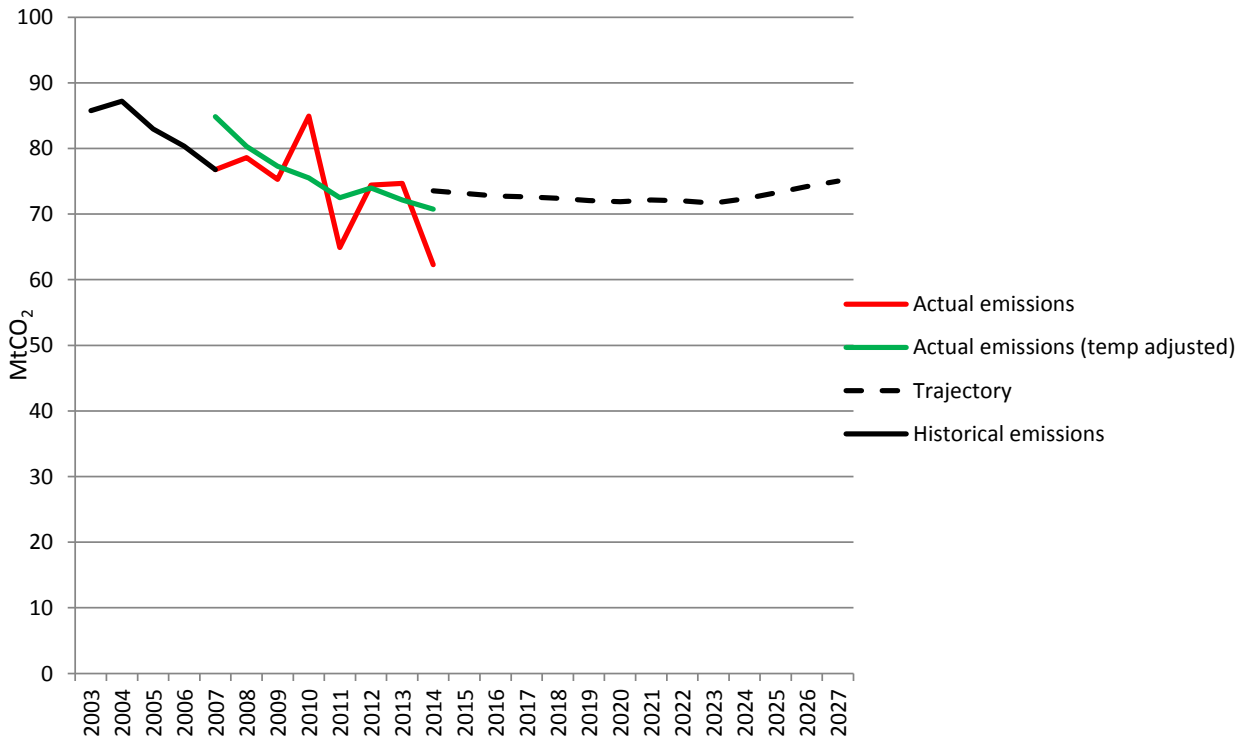
Technical Annex 2: Buildings

1. Residential buildings

Figure A2.1 shows actual direct emissions (including temperature adjusted emissions) to 2014 in the residential sector. The trajectory reflects the reduction in direct emissions from energy efficiency measures required to meet carbon budgets. It does not include the required savings from low-carbon heat technologies, which we will include following our advice to Government on the fifth carbon budget later this year.

While emissions are currently below the trajectory, a slow-down in the installation of insulation measures since 2012 means that future emission reductions could be at risk.

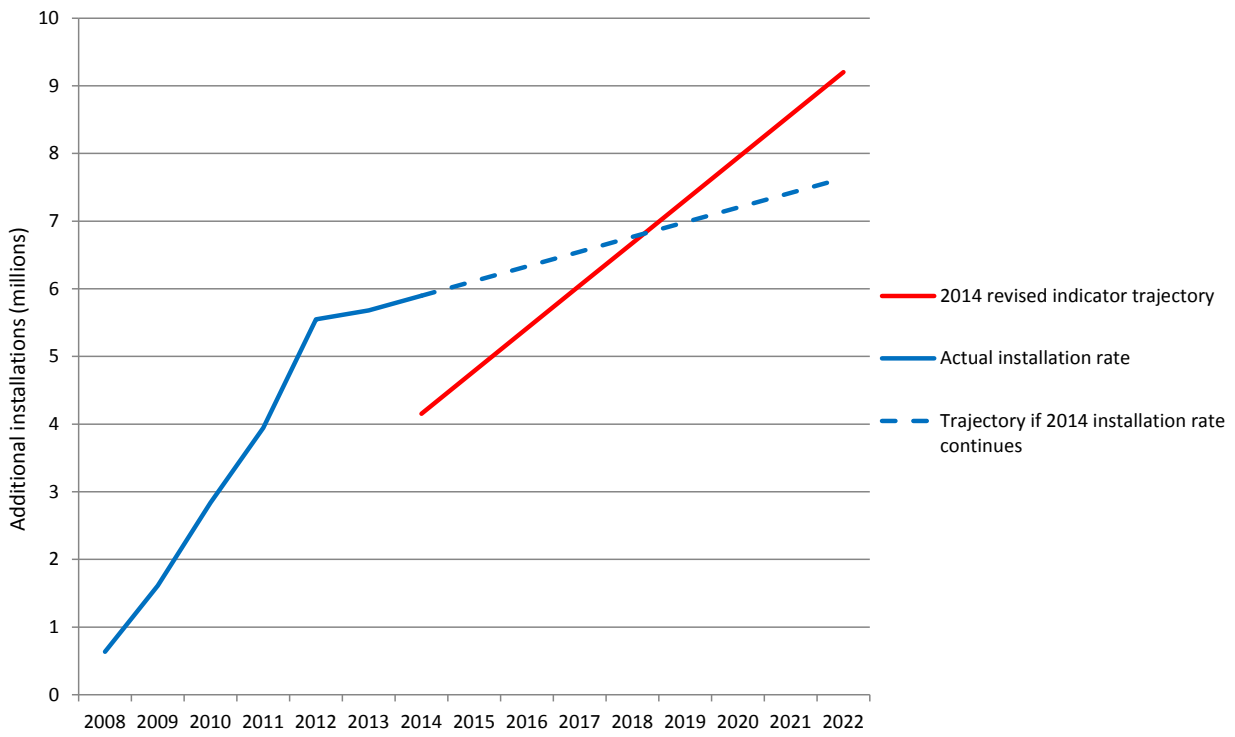
Figure A2.1: Residential sector – historical direct emissions vs indicator trajectory (2003-27)



Source: NAEI (2015), DECC (2015), Energy Trends, March 2015, DECC (2014) DUKES; CCC calculations.
Notes: 2014 emission estimates are provisional. Temperature adjustment is based on CCC calculations.

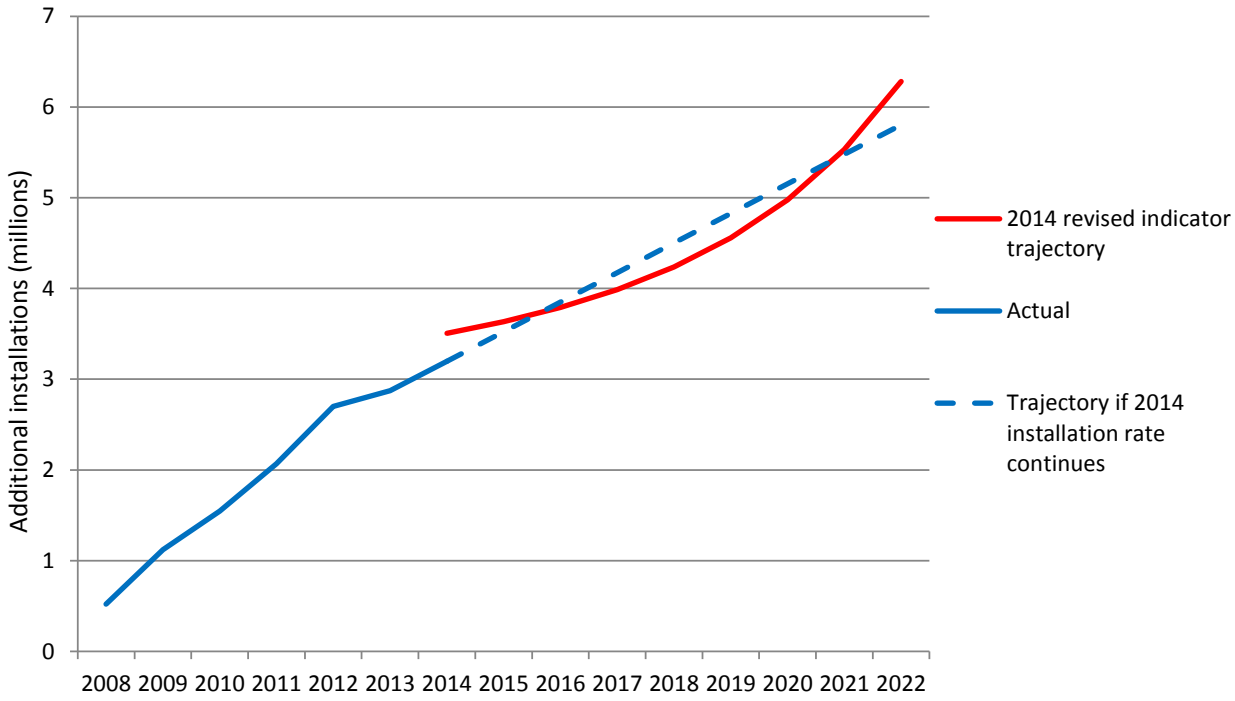
The indicators for the uptake of measures (e.g. fabric measures and efficient appliances) consistent with meeting carbon budgets are given in Figures A2.2 to A2.7. Loft insulation and efficient boiler installations are currently above our indicator trajectory, while cavity wall insulation, solid wall insulation and efficient appliances are below the trajectory, not achieving the required rates of uptake.

Figure A2.2: Loft insulation cumulative installations (2008-22)



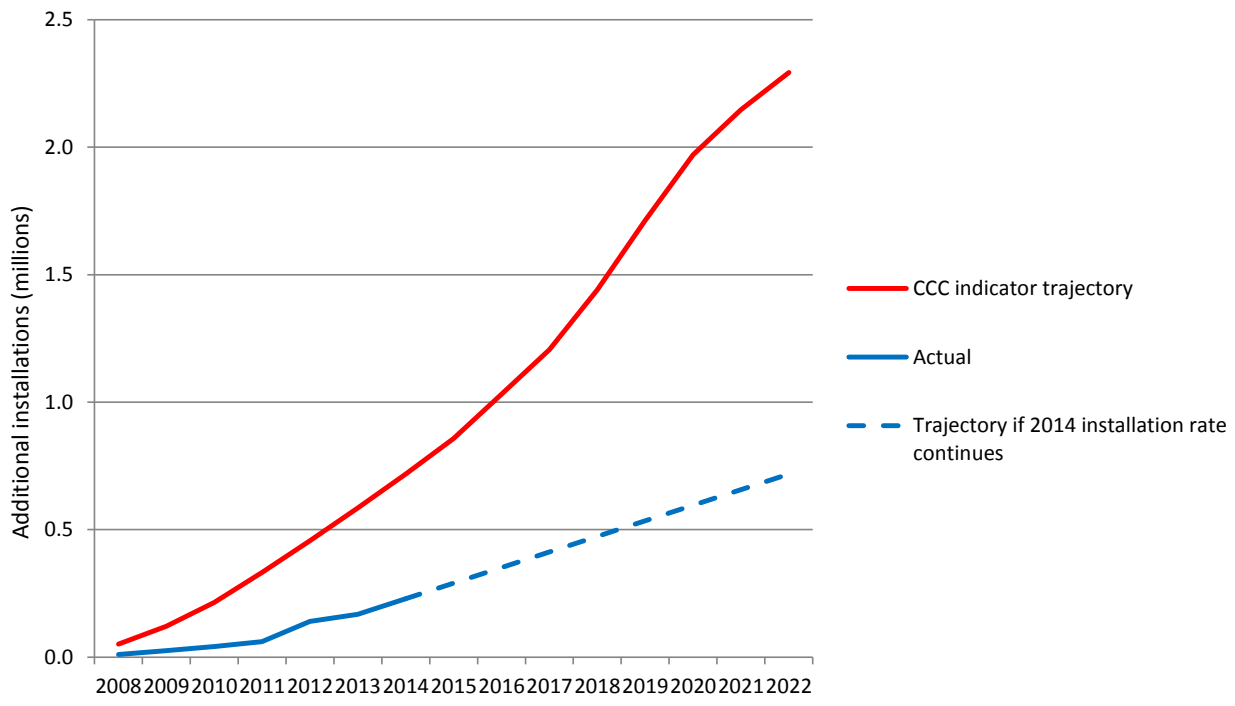
Source: DECC, CCC calculations.

Figure A2.3: Cavity wall insulation cumulative installations (2008-22)



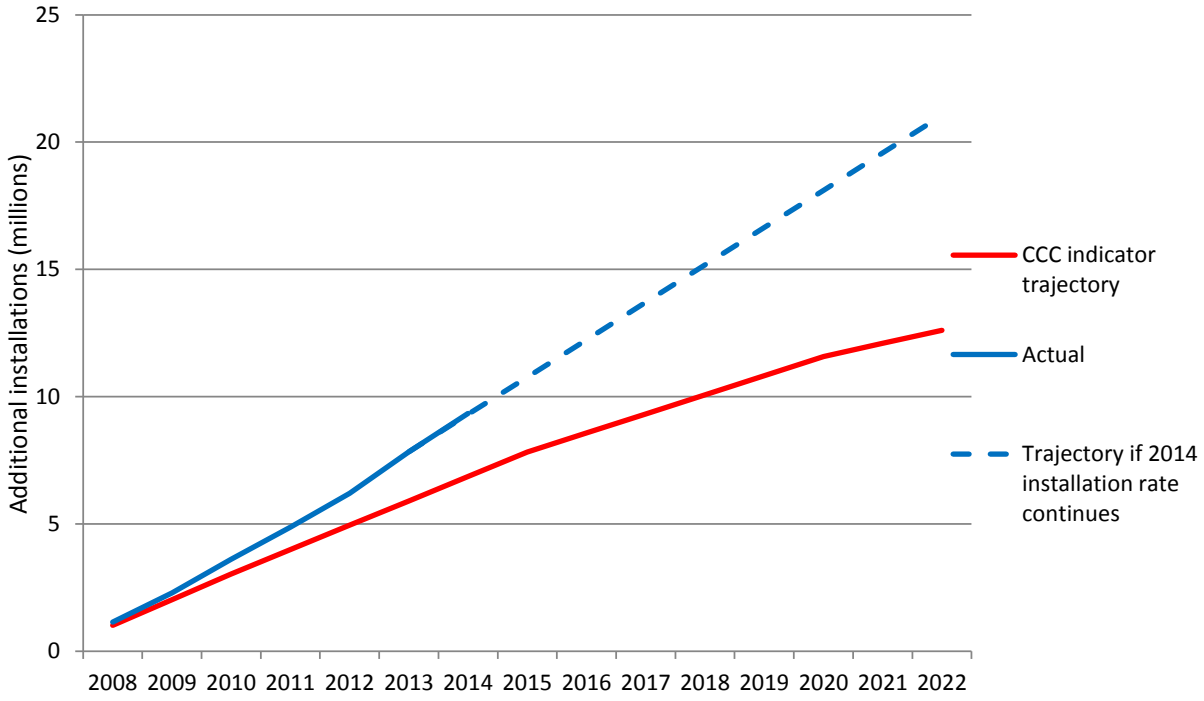
Source: DECC, CCC calculations.

Figure A2.4: Solid wall insulation cumulative installations (2008-22)



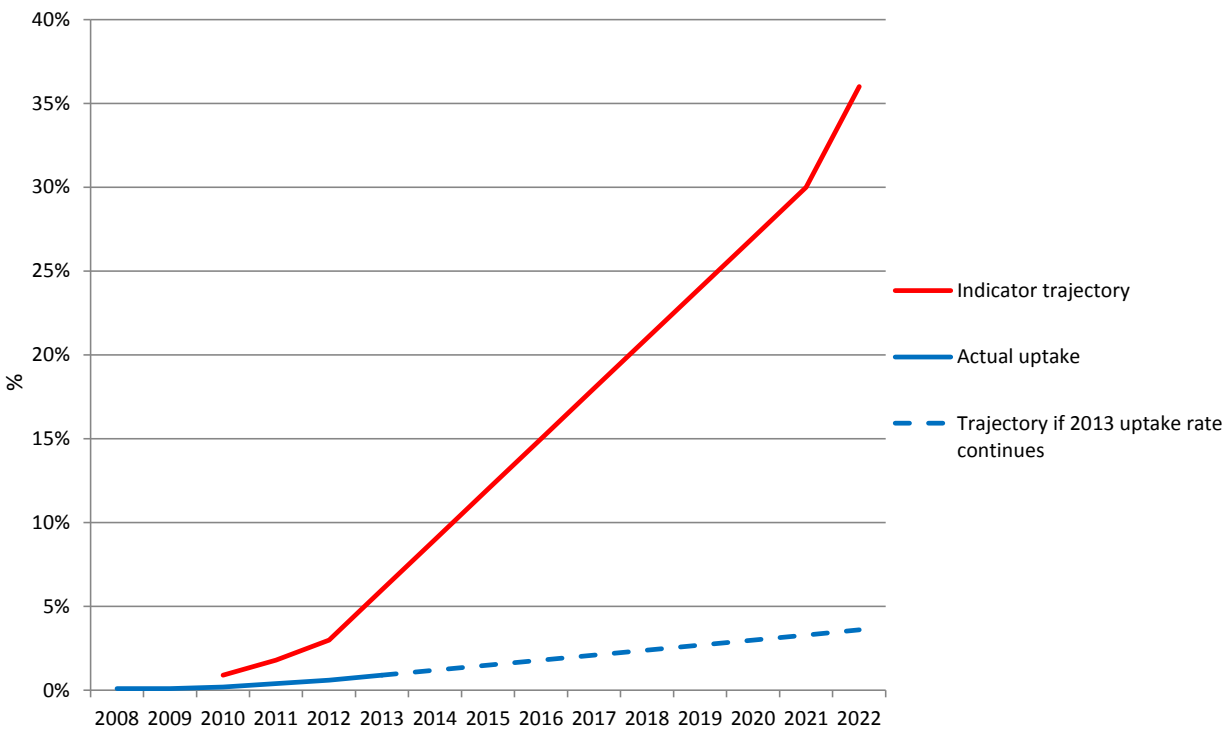
Source: DECC, CCC calculations.
Note: Trajectory by 2030 is 3.5 million installations.

Figure A2.5: A-rated boiler cumulative installations (2008-22)



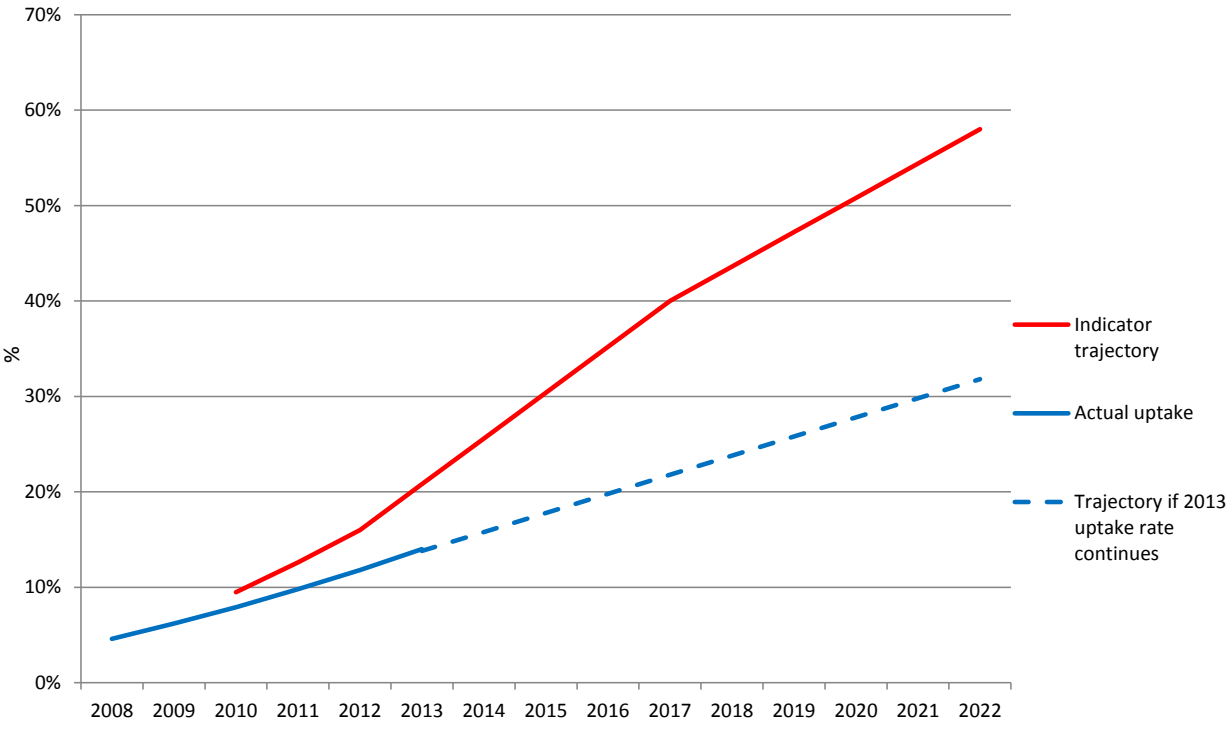
Source: DCLG (2013) Housing statistics - Table 241, Heating and Hot Water Industry Council (2014); CCC calculations.

Figure A2.6: Appliance uptake against trajectory (% of stock) - Cold A++ rated or higher (2008-22)



Source: DECC (2014), *Energy Consumption in the UK*, CCC calculations.

Figure A2.7: Appliance uptake against trajectory (% of stock) - Wet A+ rated or higher (2008-22)



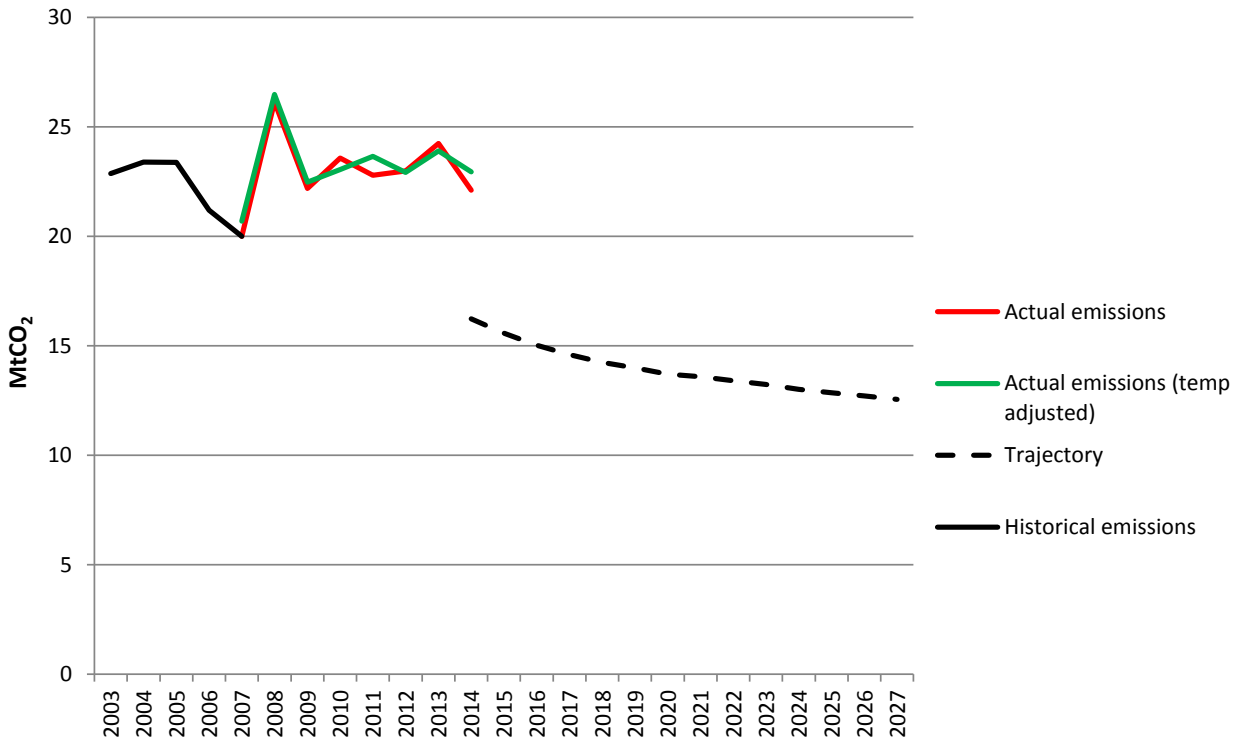
Source: DECC (2014), *Energy Consumption in the UK*, CCC calculations.

2. Non-residential buildings

Figure A2.8 shows actual direct emissions (including temperature adjusted emissions) to 2014 in the non-residential sector. These are currently around 6 $MtCO_2$ above our indicator trajectory.

As with our all buildings trajectory set out in the main report, this only factors in carbon abatement from energy efficiency. We will include the required savings from low-carbon heat technologies following our advice to Government on the 5th carbon budget later this year.

Figure A2.8: Non-residential sector – historical direct emissions vs indicator trajectory (2003-27)



Source: NAEI (2015), DECC (2015), Energy Trends, March 2015, DECC (2014) DUKES; CCC calculations.
Notes: 2014 emission estimates are provisional. Temperature adjustment is based on CCC calculations.

3. Detailed assessment of policies

In Chapter 2, 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 A2.1 sets out the rationale for classifying lower risk policies as such; Table A2.2 sets out the rationale for at-risk policies.[1]

[1] See DECC's Annex D: Policy savings in the projections at

Table A2.1: Lower risk policies	
Policy	**Why the policy is 'lower-risk'**
Buildings (residential)	
Real-time displays/ smart meters	Energy suppliers have an obligation to deliver full roll-out by 2020. A central delivery body has been set up to promote behaviour change via consumer engagement activities in order to achieve energy demand reduction.
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 MtCO2 of lifetime savings was achieved. CESP (Community Energy Saving Programme) achieved 85% of the carbon savings target.
EU Products Policy Tranche 1	The Ecodesign Directive sets minimum standards for appliances which ratchet up over time. Energy labelling helps overcome consumer awareness barriers. Most of the tranche 1 standards are now in place. Some questions remain over the rate of stock replacement and number of consumers choosing the most efficient appliances.
Buildings Regulation Part L 2010	Long-standing effective policy, 2010 tightening of standards significant, provided level of compliance and future build rates are adequate.
Buildings Regulation Part L 2013	Legislated policy, but savings dependent on level of compliance and future build rates
Private sector rented regulations	This is a legislated policy for the introduction of minimum energy efficiency standards by 2018.
Renewable Heat Incentive (RHI) to April 2016	Despite delays to its introduction, the RHI was implemented in 2014. It targets the relevant financial barriers, and broadly incentivises the right mix of low-carbon technologies. Issues around low awareness and consumer confidence still to be addressed, but it should stimulate the market in key off-gas segments and in social housing, although landlord-tenant issues remain an issue in the private-rented sector. Funding has been committed until April 2016.
Buildings (non-residential)	
Business Smart Metering	Although the estimated savings for businesses are based on a single study (in contrast with smart metering in homes, where there is better evidence), smart metering addresses a key information gap, with roll-out driven by the requirement on energy suppliers.
RHI to April 2016	The right mix of technologies is targeted. Policy savings have been revised downwards based on market forecasts, and are now reasonably cautious.

https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2014

Table A2.1: Lower risk policies	
Policy	**Why the policy is 'lower-risk'**
	Although uptake to date has been mainly biomass, government has responded with recent changes to the scheme including new tariffs, which are now broadly at the right level. Funding has been committed until April 2016.
Private Rented Sector Regulations	This is a legislated policy for the introduction of minimum energy efficiency standards by 2018.

Table A2.2: At risk – policies with design/delivery problems or lack of funding	
Policy	**Why the policy is 'at risk'**
Buildings (residential)	
ECO (2013-2015) and domestic Green Deal	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 and the Green Deal has been very low due to low ambition and poor design, and carbon saving targets are off track.
ECO extension (2015-17)	While the supplier obligation means that the savings under ECO should be at low risk of delivery, the continued design and delivery problems of the Green Deal places the overall savings at risk. No commitment post-2017.
EU Products Policy Tranche 2	Question marks over implementation as significant process delays. Estimate of savings in UEP is high – it is not clear how robust the model on which these are based is.
RHI from April 2016	No commitment to RHI funding after the 2015-16 financial year.
Zero Carbon Homes	No clear timetable for introduction of the Zero Carbon Homes standard in 2016. Exemptions have been announced for smaller developments. 'Allowable solutions' will allow developers to choose fossil fuel heating options over low-carbon heat.
Buildings (non-residential)	
EU Products Policy tranche 1	As with domestic products, minimum standards for products are set under the Ecodesign directive and ratcheted up over time. Realised savings are at risk due to delays to implementation and uncertainty around stock replacement rates. Assumptions underpinning modelled savings are unclear and under review. Overall, the risks are greater than with tranche 1 domestic appliances due to a less developed evidence-base.
EU Products Policy tranche 2	Shares same risks as tranche 1, with additional risks due to delays to implementation process.

Table A2.2: At risk – policies with design/delivery problems or lack of funding	
Policy	**Why the policy is 'at risk'**
Non-domestic Green Deal	Whilst the policy tackles a gap around finance for energy efficiency in SMEs, demand is low at the currently high interest rates. Pay-as-you-save model from the domestic sector is less well adapted to complex landlord-tenant relationships in the commercial sector.
CRC Energy Efficiency Scheme	The scheme is targeting energy use not covered by existing policies, incentivising energy efficiency and addressing an information barrier. However, its credibility has been weakened due to the changes to the scheme, including the loss of the reputational lever of the performance league table. It is now a modest carbon tax which is hampered by the original trading scheme design architecture.
Building Regulations part L 2010	Focuses on the right barrier by regulating that developers meet certain CO2 reducing standards compared to previous 2006 regulations. There are however some questions around the modelled savings based on the software tool (the Simplified Building Energy model), which are being reviewed in light of new bills data. This leads to uncertainty around compliance and the 'performance gap' between buildings as designed, built and in-use.
RHI from April 2016	As in residential buildings
Energy Savings Opportunity Scheme	There is little evidence to suggest the energy audits are leading to any uptake of measures or energy savings. The policy has a number of weaknesses (no reporting; can be undertaken by a member of staff, no follow-up) which puts the carbon savings at risk.
Building Regulations part L 2013	These regulations share the same issues as the Buildings 2010 part L regulations, mainly around compliance and potentially buoyant build forecasts.
Salix energy efficiency loans, post-CSR funding	No funding committed – subject to spending review.
Energy Performance of Buildings Directive, Refresh 2013	No detailed timeline or definition in place to deliver Nearly Zero energy buildings.

4. Indicator table

Table A2.3: The Committee's buildings indicators					
BUILDINGS	Budget 2	Budget 3	Budget 4	2014 trajectory	2014 outturn
All buildings					
Headline indicators					
Direct CO_2 emissions (% change on 2007)* direct	-10%	-14%	-11%	-5%	-14%
Final electricity consumption (% change on 2007)* electricity	4%	11%	14%	-1%	-9%
Low-carbon heat					
Headline indicators					
Renewable heat penetration (% of heat demand from renewables) – total buildings and industry	5%	12% in 2020		1.1% (2013)	1.1% (2013)
Renewable heat penetration (% of heat demand)	4%	11% in 2020		1.1% (2013)	0.5% (2013)
Supporting indicators					
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				New
RHI. Commit funding until there is a suitable replacement in place.	Ahead of 2016				Ongoing

Table A2.3: The Committee's buildings indicators					
BUILDINGS	Budget 2	Budget 3	Budget 4	2014 trajectory	2014 outturn
	Progress report				
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)* direct	-4%	-5%	-1%	-3%	-20%
Final electricity consumption (% change on 2007)* electricity	4%	11%	14%	1%	-13%
Supporting indicators					
Uptake of solid wall insulation (million homes, total additional installations compared to 2007 levels)	1.2	2.3	3.5	0.8	0.2
Uptake of loft insulation (top up of between 50- 200 mm) (million homes, total additional installations compared to 2007 levels)	5.6	9.2	9.2	4.2	5.9
Uptake of cavity wall insulation (million homes, total additional installations compared to 2007 levels)	4.0	6.3	7.2	3.5	3.2
Uptake of energy efficient boilers (million homes, total additional installations compared to 2007 levels)	9.3	12.6		6.9	9.2
Uptake of energy efficient appliances – cold A++ rated (% of stock)	18%	36%	45%	6% (2013)	0.9% (2013)

Table A2.3: The Committee's buildings indicators

BUILDINGS	Budget 2	Budget 3	Budget 4	2014 trajectory	2014 outturn
Uptake of energy efficient appliances – wet A+ rated (% of stock)	40%	58%	70%	21% (2013)	14% (2013)
Uptake of LEDs (million bulbs, replacing halogens with LEDs)	87	169	250	21 (2013)	4.6 (2013)
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				
ECO: Decide on focus for future of ECO, in particular the role of solid wall insulation	By mid-2016				
Green Deal: Achieve reduction of Green Deal interest rate (e.g. through government guarantees)	By end 2015				
Fuel poverty: develop additional measures for England to supplement Affordable Warmth under the ECO	By end 2014				Fuel Poverty Strategy published March 2015 committing short-term funding for pilots and off-gas grid homes.
Private-rented sector: Publish proposals for minimum energy performance standards (with a timetable for a progressive tightening of standards)	By end 2014				Regulations legislated early 2015. From 2018, no F & G properties can be rented out.
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				
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.					

Table A2.3: The Committee's buildings indicators					
BUILDINGS	Budget 2	Budget 3	Budget 4	2014 trajectory	2014 outturn
Non-residential buildings					
Headline indicators					
Direct CO_2 emissions (% change on 2007)* direct	-8%	-12%	-16%	-3%	11%
Final electricity consumption (% change on 2007)* electricity	11%	22%	32%	6%	8%
Supporting indicators					
Accelerate the introduction of minimum standards for privately rented non-residential properties		By 2016			Energy Act proposes introduction by 2018
Government decision on the following recommendations for EPCs and DECs:		By 2016			
– 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			No commitment to do this
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
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				New

Table A2.3: The Committee's buildings indicators					
BUILDINGS	Budget 2	Budget 3	Budget 4	2014 trajectory	2014 outturn
Other drivers					
Emissions and fuel consumption by subsector, electricity and gas prices.					

*These figures exclude low-carbon heat
** Indicator trajectory for uptake of loft and cavity wall Insulation revised this year.

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

Key: Headline indicators Implementation indicators Milestones Other drivers