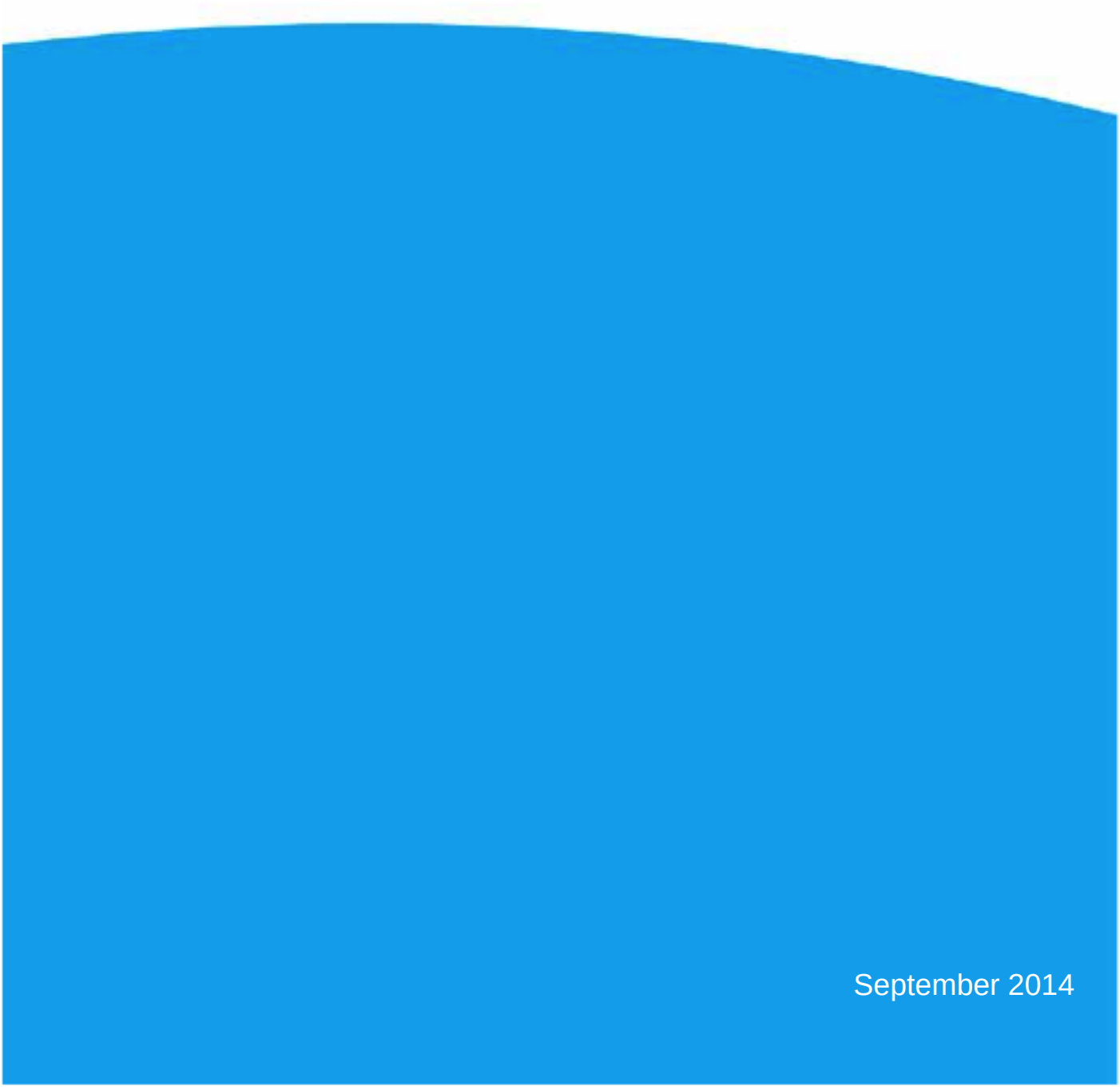
Department of Energy & Climate Change

Updated energy and emissions projections 2014



September 2014

© Crown copyright 2014: revised edition 27th October 2014. Revised figures in tables are marked r

URN 14D/198

You may re-use this information (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence.

To view this licence, visit www.nationalarchives.gov.uk/doc/open-government-licence/ or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or email: psi@nationalarchives.gsi.gov.uk.

Any enquiries regarding this publication should be sent to us at emissionsprojections@decc.gsi.gov.uk.

Contents

List of figures

List of tables

Executive Summary

The Department of Energy and Climate Change (DECC) updates projections of energy demand, supply and greenhouse gas (GHG) emissions annually. These projections are an important way of assessing whether current and planned policies are consistent with achieving UK carbon budgets in future years. The last full set was published in September 2013[1]. This report updates those figures and extends the projections to 2035.

The UK met its first carbon budget by 36 $MtCO_2e$[2]. The government has a suite of policies to meet carbon budgets two and three. Projections for 2013 to 2022 suggest that the UK will meet both. The projected margin for carbon budget two is less than projected last year (by 3 $MtCO_2e$), whilst that for budget three is greater (by 38 $MtCO_2e$). Table i and figure i summarise progress against the budgets.

The projections for the fourth budget period, from 2023-27, and afterwards give expectations in the absence of any additional policy effort, i.e. no new policies. They show that there is a shortfall of 133 $MtCO_2e$ (82 $MtCO_2e$ less than projected last year). The Carbon Plan sets out scenarios for how the UK might achieve the fourth carbon budget[3].

The main drivers of changes in the projections are macro-economic updates (economic growth, fossil fuel prices and household projections), revisions to the UK GHG Inventory, updated policy savings estimates and improvements to Land Use, Land-Use Change, and Forestry (LULUCF) projections. Higher economic growth projections, lower fossil fuel price projections, and higher estimates of methane emissions in the revised GHG Inventory, lead to higher non-traded emissions in the second carbon budget. In the third and fourth carbon budgets, these changes are more than offset by lower household growth, higher temperature projections, higher policy savings estimates and revised estimates of the impact of forests in the updated LULUCF projections.

[1] See *Updated energy and emissions projections: 2013*: https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2013

[2] See page 4 of *2012 UK Greenhouse Gas Emissions, Final Figures*: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/295961/20140204_2012_UK_Greenhouse_Gas_Emissions_Final_Figures_-_revised_27_March_2014.pdf

[3] See *The Carbon Plan: Delivering our Low Carbon Future* https://www.gov.uk/government/publications/the-carbon-plan-reducing-greenhouse-gas-emissions--2

Table i: Summary of projected emissions by carbon budget period

$MtCO_2e$

	EEP 2014			*Change since EEP 2013* [a]		
	Carbon budget:			Carbon budget:		
	2 (2013-17)	3 (2018-22)	4 (2023-27)	2 (2013-17)	3 (2018-22)	4 (2023-27)
Territorial emissions	2,686	2,206	1,940	*79*	*-17*	*-153*
Non-traded sector emissions	1,628	1,479	1,393	*3*	*-38*	*-82*
Traded emissions	1,058	727	547	*75*	*21*	*-71*
Net carbon account [b]	2,706	2,464	2,083	*3*	*-38*	*-82*
Carbon budget	2,782	2,544	1,950	-	-	-
Budget shortfall [c]	*-76*	*-80*	*133*	*3*	*-38*	*-82*

Notes

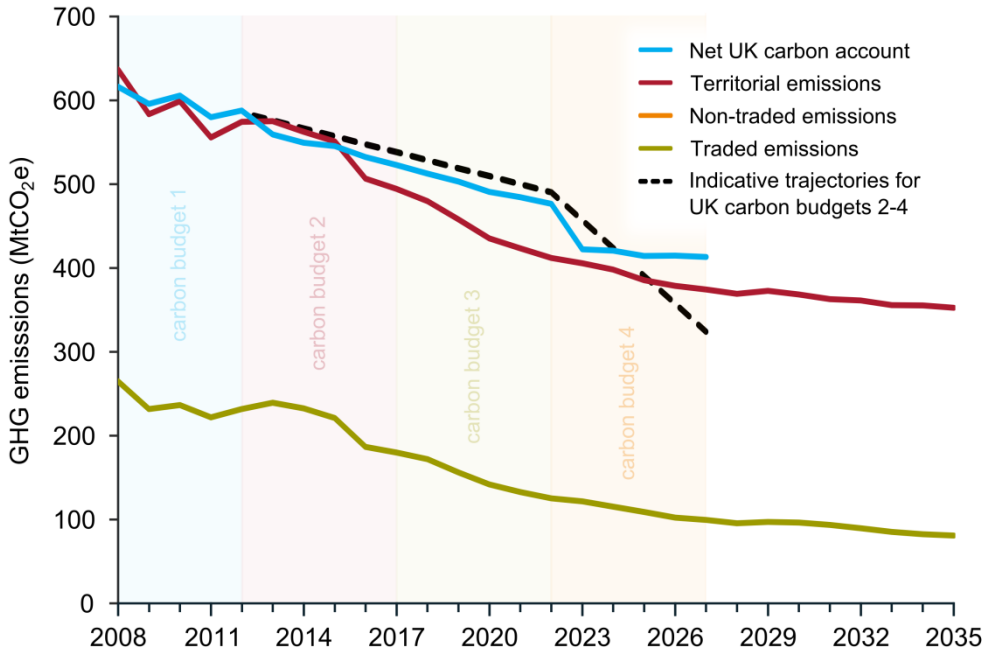
Figures have been rounded in this table. Totals are calculated from the un-rounded data so these may appear not to be the sum of the component parts.

a. Values for change are the figures from EEP 2014 less those from EEP 2013. Therefore, *positive numbers* indicate that emissions are higher in this edition, *negative numbers* that they are lower.

b. The traded sector caps used to calculate the net carbon account for the second and third budgets and fourth carbon budgets are the estimates agreed when the budgets were set. Any agreed updates to these figures will be reflected in future projections. .

c. *Positive numbers* indicate that emissions are over budget; *negative numbers* that emissions are inside the budget.

Figure i: Projected UK emissions of greenhouse gases against targets



These projections are subject to uncertainty. Modelling of the impact of uncertainty in key assumptions shows that carbon budgets two and three lie above the 95% confidence intervals for net carbon emissions. This suggests that there is a low risk of failing to meet these budgets.

Compared with last year's projections, the analysis of energy demand suggests a higher demand up to 2021 and then a lower demand than in last year's figures. Table ii gives our projected total final demand and a breakdown by final fuel of percentage changes from the previous edition. The projections take account of adopted, implemented and planned policies that affect energy use and GHG emissions.

Overall demand for electricity[4] is similar to that projected last year. Gas and solid/manufactured fuel demand is lower. The three main drivers for this are lower household projections, incorporation of Met Office temperature projections and higher policy savings. Higher renewables estimates from 2020 onwards are primarily due to higher estimates for biofuels in transport. This is due to changes to the modelled profile of biofuels (assuming road fuel contains 8% of biofuel from 2020 onwards) and higher projected demand for road transport. The inclusion of domestic RHI policy savings and higher estimates for non-domestic RHI impacts also contribute to higher projected renewables demand.

Changes to the projection methodology this year include: the incorporation of Census 2011 results for population and household projections; a change to the geographical coverage of the projections to better align with the carbon budgets; the alignment of projections of future climate with Met Office data; the introduction of separate modelling for the Northern Irish electricity market; the introduction of EU definitions to classify our policies; the extension of our modelling to 2035; and the completion of a formal quality assurance process.

Under the projection methodology supply is modelled to meet demand. Electricity supply is therefore equal to demand and is on average 3% higher than projected last year, from 2014 to 2020 and 2% lower from 2021 to 2030. Under these updated demand projections, renewables generation is higher up until 2020 (around 3% higher). For non-renewables generation, the projections show continued displacement of gas in favour of coal up until 2020.

Table ii: Changes in projected final demand since the last edition

mtoe

	2015	2020	2025	2030	2035
Total demand [a]	129	121	118	121	124
					percentages
Change in demand since last edition:					
Total final demand:	*2*	*0*	*-2*	*-3*	*n/a*
Change for individual fuels:					
Electricity	*3*	*1*	*-2*	*-3*	*n/a*
Gas	*-1*	*-6*	*-10*	*-11*	*n/a*
Petroleum	*5*	*4*	*1*	*3*	*n/a*
Solid/manufactured fuels	*9*	*-4*	*-16*	*-23*	*n/a*
Renewables	*-11*	*11*	*43*	*42*	*n/a*

Notes

a. This excludes international aviation.

[4] Including electricity used by the energy industry.

1 Introduction

Background

The Government has published projections of UK energy demand and supply since the late 1970s[5]. Estimates of projected carbon dioxide emissions (CO_2) were included from the 1990s[6]. The Government has published projections on an annual basis since 2006. This document updates the last edition which was published in September 2013[7]. From first publication, the projections have been used for a wide range of different purposes across Government. These include: evaluating the likely impact of policies and European Union (EU) Directives, investigating the effects of taxation and examining issues of security of energy supply.

In 2008, the Climate Change Act introduced a legally binding target to reduce the UK's greenhouse gas (GHG) emissions to at least 80 per cent below 1990 levels by 2050. The Act introduced five-year "carbon budgets" to ensure progress towards this target. The first four carbon budgets (for 2008-2012, 2013-2017, 2018-2022, and 2023-2027) have been set through secondary legislation[8]. Budgets are set following advice by the Climate Change Committee (CCC). The Government measures progress against the carbon budgets through the net carbon account. Under current accounting rules the net carbon account is calculated by adding the traded sector cap[9] to actual non-traded emissions.

The Energy and Emissions Projections are an important way of assessing whether current and projected policies are likely to be sufficient to achieve the carbon targets in future years. When reviewing progress against the carbon budgets, it is important to note that the policies needed to deliver the fourth carbon budget are still being developed; the analysis will incorporate them as they are agreed.

The modelling includes projections of future energy demand. Future energy requirements are central to the emissions projections and important for designing future policies. Figures are shown by economic sector and by fuel type. Results for projecting energy demand are given in Chapter 5: including projected demand for electricity[10]. These projections are used to model the impact of Electricity Market Reform (EMR) policies. Chapter 6 provides projections for generation and capacity. They show the generation mix and capacity projections underlying the projected fall in power sector emissions.

---

[5] See Energy Policy Review Series: Energy Paper 22, Department of Energy (1977), Published by HMSO. ISBN: 0114106061.

[6] Energy and emissions projections in the national archive, available at: http://webarchive.nationalarchives.gov.uk/20130106105028/http:/www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/en_emis_projs/en_emis_projs.aspx#previous-projections

[7] See Updated energy and emissions projections: 2013: https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2013

[8] Reducing the UK's greenhouse gas emissions by 80% by 2050, available at: https://www.gov.uk/government/policies/reducing-the-uk-s-greenhouse-gas-emissions-by-80-by-2050/supporting-pages/carbon-budgets

[9] In this report, the caps used for the second and third budgets are the estimates agreed when the budgets were set. Any agreed updates to these figures will be incorporated in future projections. An illustrative cap of 690 $MtCO_2e$ is assumed for carbon budget four. This is in line with the Committee on Climate Change's (CCC) assumptions in their recommendations for the fourth carbon budget.

[10] Note that our modelling assumes that demand for electricity is met by the electricity supply. Our discussion therefore covers both.

Overview of sources for the projections

The DECC Energy and Emissions Projections model (EEP) is used to produce projections of all types of energy demand and emissions except:

a) Those arising from LULUCF and

b) Those non-CO_2 emissions like methane which are associated with non-combustion activities ("non-energy-related non-CO_2 emissions")

In the EEP, a series of equations capture the relationship between energy demand and its major drivers such as Gross Domestic Product (GDP) growth. The model adjusts demand to take account of the impacts of policies affecting energy use and its associated emissions. Multiplying projected energy demand by emissions factors and then calibrating the results against the GHG Inventory yields estimates of energy related GHG emissions. CO_2 emissions which are not associated with energy use are projected directly in line with a key predictor for each.

Projections of non-energy-related non-CO_2 emissions and LULUCF emissions come from different models. The recent update for non-energy-related non-CO_2 projections (*Projected emissions of non-CO_2 gases*[11]*)* has been incorporated into the figures. Chapter 2 of that publication describes the methodology and changes in non-CO_2 projections since the last edition.

The Centre for Ecology and Hydrology estimates the net CO_2 emissions from LULUCF using a methodology that is consistent with the UK Greenhouse Gas Inventory. They updated the projections in July[12], and these figures have been included in the projections.

Part of the modelling of energy and emissions involves a detailed representation of electricity supply in Great Britain, which is based on the DECC Dynamic Dispatch Model (DDM)[13]. This represents how producers meet demand, invest in new capacity and retire old plant. The Northern Irish market is modelled separately. Results from both models underpin the discussion of electricity in chapter 6.

The main input assumptions in the EEP model are reviewed or updated each year. Updates include revised policy impacts, new DECC fossil fuel and carbon price projections, updated power sector assumptions and updated economic, population and household growth projections. Projections for fossil fuel prices, population and carbon prices (with Carbon Price Support (CPS)) are lower than last year whilst economic growth and policy savings are higher.

This year a number of methodological changes have also been implemented. They include redevelopment of the equations that estimate demand in the residential sector, the alignment of projections of future climate with Met Office data, a change to the geographical coverage to better align with carbon budgets, and the introduction of separate modelling for the Northern Irish electricity market.

[11] See *Projected emissions of non-CO_2 gases* at:
https://www.gov.uk/government/statistics/non-co2-greenhouse-gas-emissions-projections-report-summer-2014

[12] See *Projections of emissions and removals from the LULUCF sector to 2050*:
http://uk-air.defra.gov.uk/assets/documents/reports/cat07/1407090749_Projections_of_emissions_and_removals_from_the_LULUCF_sector_to_2050-PUBLISHED_VERSION-JULY2014.pdf

[13] See *DECC Dynamic Dispatch Model (DDM)* at:
https://www.gov.uk/government/publications/dynamic-dispatch-model-ddm

The changes are described in detail in *Updated energy and emissions projections 2014: methodology update*[14] which also describes the formal quality assurance procedures which have been applied to the projections.

Please note that figures in the tables are rounded. Totals are calculated from the un-rounded data so these may appear not to be the sum of the component parts.

The rest of this document is structured as follows: the main emissions projections are set out and compared with last year's in Chapter 2. Uncertainty in the estimates is covered in Chapter 3. Chapter 4 examines the impact of policy on emissions. Final and primary demand for energy is discussed in Chapter 5 and Chapter 6 covers the electricity market. Chapter 7 sets out the key assumptions for the modelling. Many of the results are available as downloadable Microsoft Excel tables (the Annexes): these are listed in Chapter 8.

[14] See Updated energy and emissions projections 2014: methodology update

2 UK emissions projections

This chapter summarises and discusses projections of GHG emissions in the reference case. It provides overall "headline" emissions projections as well as sector breakdowns.

In this chapter we report both the UK “net carbon account” and actual territorial emissions. Performance against emissions targets is measured using different accounting practices for different purposes. Performance against UK carbon budgets is measured by comparing the UK “net carbon account” against the carbon budget level set in the legislation. Both are measured cumulatively by summing annual emissions across the carbon budget period. The UK “net carbon account” is measured by adding the traded sector cap to the actual level of non-traded emissions. Actual traded sector emissions have no impact on performance against carbon budget targets.

Breakdowns for emissions are provided according to two different reporting frameworks. The United Nations Framework Convention on Climate Change (UNFCCC) defines the first of these, the National Communication (NC) basis, which the Convention requires for its reporting. The second approach (Energy and Emissions Projections (EEP)) basis is consistent with the Digest of United Kingdom Energy Statistics (DUKES[15]). The latter is an important source of input data for the DECC Energy and Emissions Projections model.

The main difference between the frameworks is that the NC breakdown groups emissions by the type of generating process whereas the EEP/DUKES basis attributes them to the source economic sector. It is important to note that projected values of the net UK carbon account and territorial emissions are the same whatever basis is used - the framework only affects how these totals are split into their components.

Chapter 3 looks at uncertainty in these reference projections and their sensitivity to economic growth assumptions and fossil fuel prices. In chapter 4 the impact of government policies on emissions is investigated.

Progress towards the carbon budgets

The 2009 Budget set levels of the first three carbon budgets at the “interim” level recommended by the CCC in the absence of a global agreement on reductions[16]. They require emission decreases of 35% from 1990 levels by 2020. The fourth carbon budget level was set at 1,950 $MtCO_2$ in June 2011[17].

The UNFCCC’s Kyoto Protocol (1997) mandated a UK reduction of 12.5% in greenhouse gas emissions for the period 2008-12 in a “basket” of gases relative to 1990 levels. Reporting

[15] See the *Digest of UK energy statistics, July 2014:*
https://www.gov.uk/government/statistics/digest-of-united-kingdom-energy-statistics-dukes-2014-printed-version

[16] See *Reducing the UK’s greenhouse gas emissions by 80% by 2050:*
https://www.gov.uk/government/policies/reducing-the-uk-s-greenhouse-gas-emissions-by-80-by-2050/supporting-pages/carbon-budgets
and *The Carbon Budget Order 2009, May 2009*. See:
http://www.legislation.gov.uk/uksi/2009/1259/contents/made

[17] *The Carbon Budget Order 2011, June 2011*. See:
http://www.legislation.gov.uk/uksi/2011/1603/made

against the carbon budgets gives CO_2 equivalents for the non-CO_2 gases in the basket based on their assessed Global Warming Potentials (GWP)[18].

Carbon budgets are set on a UK-only territorial basis. This geographical scope differs slightly from that for EU purposes (such as the Effort Share Decision), which also includes Gibraltar. UNFCCC reporting includes the Crown dependencies[19] and those UK overseas territories that have ratified the Kyoto Protocol[20].

DECC's emissions projections provide the basis for assessing progress against meeting the UK carbon budgets. They help us to set indicative annual ranges for the net UK carbon account[21] and report on carbon budget-related proposals or policies[22]. This year modelling has been extended to 2035 in anticipation of the fifth carbon budget setting process.

Figure 2.1: Net UK carbon account and territorial emissions

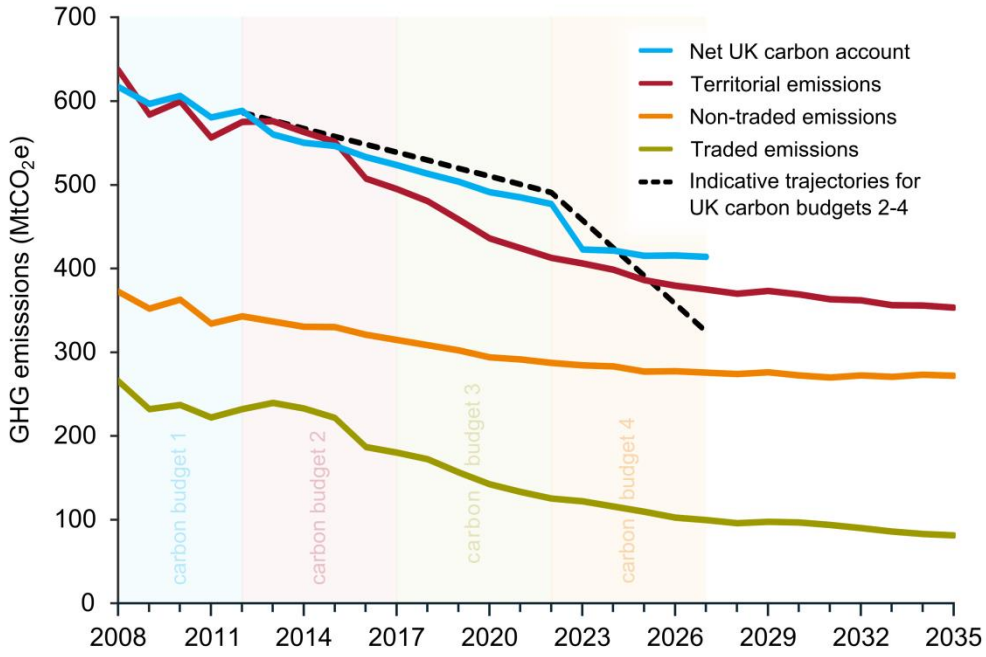


Figure 2.1 shows the latest projections of territorial and net carbon account emissions compared with carbon budgets. Table 2.1 summarises the updated projections and compares them with the previous values from September 2013. The UK has met its first carbon budget. These projections indicate that the UK is likely to meet its second and third carbon budgets but further policy effort would be required to meet the fourth. This year, territorial emissions are higher in the second carbon budget but lower in the third and fourth carbon budget periods than projected in 2013. The reasons for this are given below.

[18] GWP values consistent with the Intergovernmental Panel on Climate Change (IPCC) *Second Assessment Report* (1996) for carbon budget purposes.
[19] The Crown dependencies are the Isle of Man, Jersey and Guernsey.
[20] UK Overseas Territories that have ratified the Kyoto Protocol are the Cayman Islands, the Falkland Islands, Bermuda, Montserrat and Gibraltar.
[21] Climate Change Act. 2008, Section 12: setting Indicative annual ranges for net UK carbon account.
http://www.legislation.gov.uk/ukpga/2008/27/pdfs/ukpga_20080027_en.pdf
[22] Ibid.

Table 2.1: Net UK carbon account and territorial emissions

$MtCO_2e$

	EEP 2014				*Change since EEP 2013* [a]		
	Carbon budget:				Carbon budget:		
	1	2	3	4	2	3	4
	(2008-12)	(2013-17)	(2018-22)	(2023-27)	(2013-17)	(2018-22)	(2023-27)
Traded sector	1,185	1,058	727	547	*75*	*21*	*-71*
Traded sector cap [b]	1,227	1,078	985	690	-	-	-
EUAs purchased [c]	-41	-20	-258	-143	*75*	*21*	*-71*
EUAs cancelled by UK Government	4	-	-	-	-	-	-
Non-traded sector	1,760	1,628	1,479	1,393	*3*	*-38*	*-82*
of which non-CO_2	*524*	*476*	*429*	*397*	*45*	*36*	*29*
Territorial emissions	2,945	2,686	2,206	1,940	*79*	*-17*	*-153*
Carbon budget	3,018	2,782	2,544	1,950	-	-	-
Net carbon account	2,982	2,706	2,464	2,083	*3*	*-38*	*-82*
Budget shortfall [d]	*-36*	*-76*	*-80*	*133*	*3*	*-38*	*-82*

Notes

a. Values for change are the figures from EEP 2014 less those from EEP 2013. Therefore, *positive numbers* indicate that emissions are higher in this edition, *negative numbers* that they are lower.

b. The traded sector caps for the second, third and fourth carbon budgets are the estimates agreed when the budgets were set. Any agreed updates to these figures will be reflected in future projections.

c. *Negative numbers* imply allowances sold; *positive numbers* are those bought. The projected EUA purchases shown here are estimated by subtracting the assumed UK traded cap from the projected level of traded emissions.

d. *Positive numbers* indicate that emissions are over budget; *negative* that emissions are inside the budget.

Traded and non-traded emissions

Table 2.1 also provides a breakdown of traded and non-traded emissions. Compared with last year's projections, traded emissions are higher in the second and third but lower in the fourth carbon budget. Non-traded emissions and the net carbon account are higher in the second but lower in the third and significantly lower in the fourth. The net effect of these differences is that the UK is still expected to overachieve against the second and third budgets whilst the shortfall against the fourth is reduced under current assumptions.

Traded CO_2 emissions include those from: fuel combustion by energy industries (encompassing power stations, refineries and offshore oil and gas installations); process emissions from some industries (e.g. iron and steel, cement, glass); and fuel combustion in large boiler / CHP installations by industry and, to a lesser extent, by the service sector and agriculture.

Phase III of the EU ETS (2013-20) includes some emissions of non-CO_2 GHG in the traded sector: these are nitrous oxide releases from nitric and adipic acid plants, and perfluorocarbon (PFC) emissions primarily from aluminium manufacture.

The current UK carbon budget legislation does not currently include international aviation. The scope of aviation ETS has been temporarily reduced to include intra-European flights up to 2016 pending discussions to set up an international framework for tackling aviation emissions.

Non-traded emissions encompass those from: fuel combustion by the residential sector; the majority of fuel combustion in the commercial, public services and agriculture sectors; combustion for traction in the transport sector; combustion by smaller boilers and engines in the industrial sector; net emissions due to LULUCF; and non-CO_2 GHG. The last excludes those emissions that Phase III of the EU ETS categorises as traded.

Emissions by economic sectors

Table 2.2 shows projected total territorial emissions since 1990 together with a breakdown by NC sector. This year was the base for the Kyoto Protocol targets; it is also the baseline for the legislated carbon budget reductions. Figures are given for five-year intervals from 2010 so as to align with the midpoints of the first four carbon budgets.

The results suggest that emissions from the energy supply industries will fall by 140 $MtCO_2$ between 2010 and 2030. This is primarily due to the assumed decarbonisation of the electricity grid[23] despite a projected slight rise in total electricity consumption over the period. Even without new policies, emissions fall between 2010 and 2030 from business (around 24 $MtCO_2$), transport (around 18 $MtCO_2$) and residences (around 18 $MtCO_2$). The majority of these occur in the first three carbon budget periods and are largely due to the impacts of existing policies.

Table 2.3 gives a similar breakdown by sector on the EEP basis. The table includes summaries for each of the traded and non-traded sectors by budget period.

Changes in sectors since the September 2013 projections

Table 2.4 shows the changes in projected emissions since last year broken down into traded and non-traded emissions and then by sector.

Compared with the last edition, the traded sector has higher emissions in carbon budget two, and to a lesser extent in carbon budget three, but lower in carbon budget four. This is a consequence of more coal being burnt in power stations in the short term as, under current fossil fuel price assumptions, it becomes relatively cheap compared with gas. It also reflects the £18/tCO_2 cap set on the Carbon Price Support (CPS) rate[24] in the March Budget. In the longer term, unabated coal stations close earlier than projected last year since their total operating hours are capped under the Industrial Emissions Directive.

In the non-traded sector, residential emissions are lower. The main drivers of this are lower household projections, higher policy savings and the incorporation of Met Office projections. The latter project warmer winters leading to a reduced need for winter heating.

LULUCF emissions are substantially lower than projected last year. The changes incorporate the inclusion of unmanaged forest. This increases the size of the forest as a carbon sink leading to the reductions shown.

Non-CO_2 GHG emissions are higher, in particular methane emissions. This is because of inventory revisions to baseline emissions from agricultural waste and flaring from landfill. The impact of these changes on the projections reduces gradually over time.

[23] See electricity assumptions in Chapter 6: Electricity generation (Electricity Market Reform)

[24] The CPS is a climate change levy payable by the power sector in the UK only. CPS rates are set per tonne of CO_2 emitted. The Carbon Price Floor (CPF) is made up of the price of CO_2 from the EU Emissions Trading System (EU ETS) and the CPS rate.

Table 2.2: Projected territorial emissions by NC sector [a]

Annual UK $MtCO_2e$

	1990[b]	2010	2015	2020	2025	2030	2035
Agriculture	71	57	55	50	49	49	49
Business	116	90	87	77	71	66	62
Energy supply	272	204	186	107	75	64	50
Industrial processes	55	12	10	9	8	8	7
Land use change (LULUCF) [b]	2	-7	-8	-10	-11	-12	-13
Public	13	10	9	8	7	8	7
Residential	80	89	74	67	67	71	73
Transport [a]	121	120	117	109	104	102	103
Waste Management	47	23	20	17	15	14	13
Total UK territorial emissions [b]	**777**	**598**	**550**	**435**	**385**	**368**	**352**
Overall change since 1990	-	*-23%*	*-29%*	*-44%*	*-50%*	*-53%*	*-55%*
Change since September 2013 projection	*4*	*6*	*24*	*-1*	*-33*	*-28*	*n/a*

Notes

a. The United Nations Framework Convention on Climate Change (UNFCCC) National Communication (NC) definition of the transport sector is used here. This is the sum of road transport and other categories including domestic aviation (from 2008), rail, national navigation, and military aviation and shipping.

b. The 1990 and 2010 GHG estimates are for territorial emissions from the UK, including LULUCF, based on the scope in the UK National Atmospheric Emissions Inventory (NAEI). See: https://www.gov.uk/government/publications/final-uk-emissions-estimates.

Table 2.3: GHG emissions by EEP economic sector

$MtCO_2e$

	Carbon budget:			
	1	2	3	4
	(2008-12)	(2013-17)	(2018-22)	(2023-27)
Non-traded sector, CO_2 emissions from:				
Industry	159	133	125	121
LULUCF [a]	-39	-44	-52	-58
Residential [b]	381	350	330	330
Services	91	107	87	75
Transport	644	606	561	529
Non-traded sector, non-CO_2 emissions:	524	476	429	397
Total non-traded	**1,760**	**1,628**	**1,479**	**1,393**
Traded sector, CO_2 emissions [e] from:				
Aviation	1	9	9	10
Industry	310	288	268	254
Power stations	781	677	362	192
Refineries	83	79	84	88
Services [c]	10	4	3	3
Total traded [d]	**1,185**	**1,058**	**727**	**547**
Traded sector cap [f]	1,227	1,078	985	690
EUAs cancelled by UK Government	4	0	0	0
EUAs Purchased [g]	*-41*	*-20*	*-258*	*-143*
Net UK carbon account	**2,982**	**2,706**	**2,464**	**2,083**
Carbon budget	**3,018**	**2,782**	**2,544**	**1,950**
Budget shortfall [h]	*-36*	*-76*	*-80*	*133*

Notes

a. LULUCF differs from other sectors in that it contains both sources and sinks of GHGs. Sinks remove GHGs from the atmosphere and can therefore give rise to negative figures.

b. Corresponds to the DUKES "domestic" sector.

c. 'Services' includes public services and commercial services.

d. Traded sector non-CO_2 emissions are insignificant. They are included in the traded sector total. From 2013, the EU ETS includes N_2O emissions from nitric acid plants and PFC emissions from primary aluminium manufacture. UK nitric acid plants were opted-in in 2012.

e. The EU ETS includes domestic aviation emissions from 2012. Non-traded transport emissions include them prior to this.

f. The caps used for the second and third and fourth budgets are the estimates agreed when the budgets were set. Any agreed updates will be reflected in future projections.

g. *Negative numbers* imply allowances sold; *positive numbers* are those bought. The projected EUA purchases shown here are estimated by subtracting the assumed UK traded cap from the projected level of traded emissions.

h. *Negative numbers* imply emissions less than the carbon budget; *positive numbers* mean emissions are greater.

Table 2.4: Changes in emissions by EEP economic sector since the last edition [a]

$MtCO_2e$

	Carbon budget:		
	2	3	4
	(2013-17)	(2018-22)	(2023-27)
Non-traded sector, CO_2 emissions from:			
Industry	-14	-8	-4
LULUCF	-33	-47	-60
Residential	-33	-42	-53
Services	23	20	14
Transport	15	4	-8
Non-traded sector, non-CO_2 emissions:	45	36	29
Total non-traded	**3**	**-38**	**-82**
Traded sector, CO_2 emissions from:			
Aviation	-	-	-
Industry	19	10	7
Power stations	67	20	-68
Refineries	-6	-4	-5
Services	-5	-5	-4
Total traded	**75**	**21**	**-71**
Traded sector cap	-	-	-
EUAs Purchased	75	21	-71
Net UK carbon account	**4**	**-38**	**-82**
Carbon budget	**-**	**-**	**-**
Budget shortfall	*4*	*-38*	*-82*

Notes

a. The values here are those from EEP 2014 less those from EEP 2013. Therefore, *negative numbers* mean that EEP 2013 emissions are higher, *positive numbers* that those in this edition (Table 2.3) are.

Impact of changes since the September 2013 projections

Table 2.5 provides a breakdown of the changes in our data, assumptions and modelling between the 2013 and 2014 projections. Changes in traded and non-traded emissions are presented separately and include the main reasons for the differences. This analysis is for CO_2 emissions alone.

Traded sector emissions are higher in carbon budgets two and three than projected last year. This is primarily due to the impact of capping the CPS rate until 2019/20. This, together with changes in the coal to gas fossil fuel price ratio leads to higher coal generation over this period. Higher economic growth projections also contribute to higher traded sector emissions due to their impact on demand but these are more than offset from carbon budget two onwards by lower household projections.

In carbon budget four emissions are lower primarily because of the interaction between the Industrial Emissions Directive (IED) and the CPS cap. The latter reduces the cost of coal bringing forward coal generation. As a result coal plants retire earlier than projected previously to meet the IED leading to lower coal generation in the fourth carbon budget. Lower household projections also contribute to lower traded emissions through their impact on demand.

In the non-traded sector the main factors leading to lower CO_2 emissions are lower household projections, higher policy savings and lower LULUCF emissions. New policies such as domestic RHI have contributed to the increase in the estimated impact of policies. However, the higher policy impact is in large part due to changes in the modelled profile for biofuels in transport, together with a projected overall increase in transport demand. The latter increases the projected impact of vehicle efficiency improvements and the RTFO.

GHG inventory changes have contribute to the lower CO_2 projections for LULUCF but higher non-CO_2 projections. The former is largely caused by revisions to the estimated impact of forests which act as a sink, removing CO_2 from the atmosphere. This impact is offset by upward revisions to estimates of methane from agriculture.

DUKES 2014 revisions led to a reallocation of gas consumption between sectors. This has the effect of moving emissions from a mostly traded sector (DUKES industry) to a largely non-traded sector (DUKES miscellaneous). The energy and emissions projections are adjusted to take account of these revisions.

Table 2.5: Summary of how modelling changes have affected emission projections [a]

$MtCO_2e$

	Changes since EEP 2013		
	Carbon budget:		
	2 (2013-17)	3 (2018-22)	4 (2023-27)
CO_2 emissions			
Traded sector			
Increased emissions from:			
Economic growth update	17	11	8
Fossil fuel prices update	6	2	15
New Policies and policy changes	7	6	5
Decreased emissions from:			
Population & Household growth	-4	-13	-17
Inventory update	-7	-7	-7
CHP update	-2	-2	-9
Quality assurance review of model	-3	-2	-4
No simple emissions change:			
Updated carbon price and CPS cap	28	6	-52
Modelling improvements	21	8	-8
DUKES 2014 & consequent adjustments	4	8	-1
Other updates	-4	1	-1
Total traded	65	17	-71
Non-traded sector / net carbon account			
Increased emissions from:			
Transport projections/policies	13	19	13
Fossil fuel prices update	10	19	12
DUKES 2014 and consequential adjustments	5	9	15
Economic growth update	11	4	1
CHP update	1	3	5
Other Updates	-7	-7	-5
Decreased emissions from:			
LULUCF Update	-33	-47	-60
New Policies and policy changes	-12	-34	-46
Population & Household growth	-8	-13	-19
Winter Degree Days	-1	-12	-15
Inventory update	-8	-8	-8
Remove CDs from Inventory	-4	-3	-3
Total non-traded	-32	-70	-111
All CO_2 emissions	33	-53	-182
Non-CO_2 Greenhouse Gases	46[r]	36	29
Territorial emissions	79	-17	-153

Notes

a. The values here are those from EEP 2014 less those from EEP 2013. Therefore, *negative numbers* mean that EEP 2013 emissions are higher, *positive numbers* that those in this edition (Table 2.3) are.

[r] Revised value

3 Uncertainty in emissions projections

There are two main possible sources of error or uncertainty in our emissions projections. Firstly, the structure of the model will not exactly reflect the way that energy use and emissions respond to changes in prices, economic growth or other drivers such as temperature and population. Secondly, future values for key model inputs are inherently uncertain. For example, DECC projections for fossil fuel prices will not turn out to be exactly as predicted. Some understanding of the impact of the second source of uncertainty can be obtained through modelling, the results of which are presented in this chapter.

The examination of uncertainty has three sections. The first provides estimates for the uncertainty in projected emissions, taking account of the combined impact of different model input uncertainties. The second focuses on sensitivities to economic growth assumptions. The third considers uncertainty in the projections of EU ETS allowances. Details of the modelling methods used to obtain these results are in *Updated energy and emissions projections 2014: methodology update*[25], published with this year's projections.

Overall uncertainty

Uncertainty in the overall projections is modelled through Monte Carlo analysis of 15 key model parameters. These fall into the following broad categories:

- Macroeconomic drivers such as GDP and GVA
- Households and population
- Key Government policies
- Temperature

To capture the impact of uncertainty in assumptions, input values of the above are randomly varied and the resulting projections recorded over a large number of simulations. This method underpins the 95% Confidence Interval (CI) estimates in Tables 3.1 and 3.2. The values there represent the projected emissions corresponding to the lower 2.5% and upper 97.5% percentiles of the simulations respectively. Figure 3.1 shows that the range of uncertainty increases over time (the CI bands become wider: the inset chart demonstrates this more clearly). This analysis suggests that the UK is likely to meet the first three carbon budgets. See *Updated energy and emissions projections 2014: methodology update* for further details of the methodology[25].

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

Table 3.1: Confidence intervals for the net UK carbon account and shortfalls against carbon budgets

$MtCO_2e$

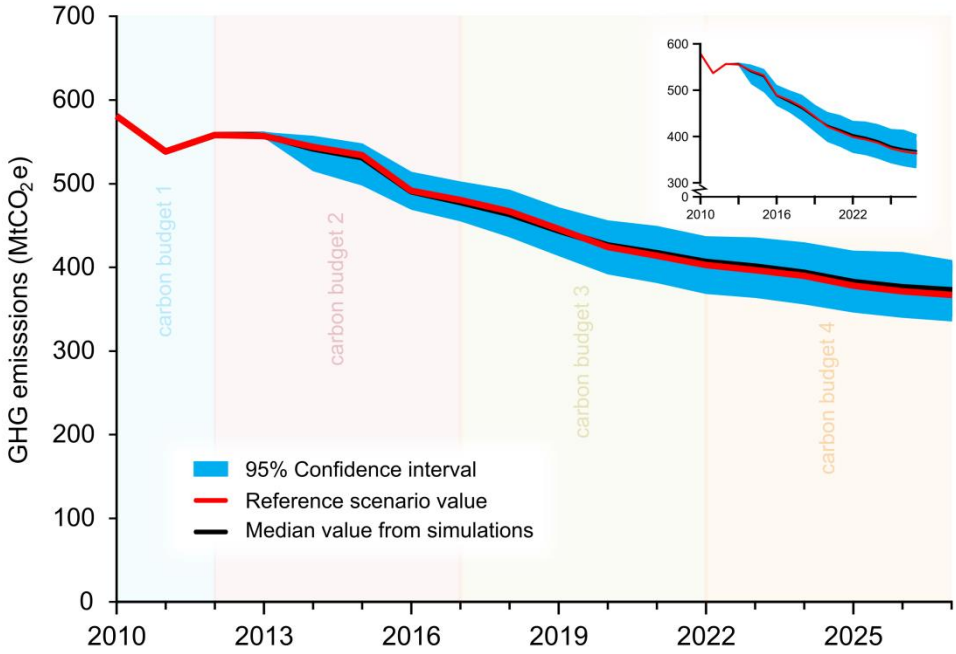
	Carbon budget: 2 (2013-17)	3 (2018-22)	4 (2023-27)
Net UK carbon account:			
Lower 95% confidence interval	2,674	2,391	1,979
Reference value	2,706	2,464	2,083
Upper 95% confidence interval	2,738	2,528	2,169
Carbon budget	2,782	2,544	1,950
Budget shortfall			
Lower 95% confidence interval	-108	-153	29
Reference value	-76	-80	133
Upper 95% confidence interval	-44	-16	219

Table 3.2: Uncertainty in territorial emissions

$MtCO_2e$

	Carbon budget: 2 (2013-17)	3 (2018-22)	4 (2023-27)
Traded emissions			
Lower 95% confidence interval	985	641	475
Reference value	1,058	727	547
Upper 95% confidence interval	1,085	796	620
Non-traded emissions			
Lower 95% confidence interval	1,595	1,405	1,288
Reference value	1,628	1,479	1,393
Upper 95% confidence interval	1,661	1,544	1,480
Total emissions			
Lower 95% confidence interval	**2,607**	**2,059**	**1,771**
Reference value	**2,686**	**2,206**	**1,940**
Upper 95% confidence interval	**2,738**	**2,338**	**2,101**

Figure 3.1: Uncertainty in projected overall territorial emissions



Sensitivity to GDP growth assumptions

One of the main drivers of emissions is the overall rate of economic growth. The uncertainty analysis in the preceding section takes account of both uncertainty in economic growth and other factors. Here, the sensitivity of projections to GDP growth assumptions is investigated by assuming that all other parameters remain unchanged. Tables 3.3 and 3.4 show how the projections would change if GDP growth were one quarter of a percentage point higher or lower than the reference projection in each year. They show that although the projections are sensitive to GDP growth, the UK would still meet carbon budgets two and three under these growth scenarios.

Table 3.3: Sensitivity of the net UK carbon account and shortfall against carbon budget to economic growth assumptions

$MtCO_2e$

	Carbon budget: 2 (2013-17)	3 (2018-22)	4 (2023-27)
Net UK carbon account:			
Scenarios:			
Low growth	2,704	2,456	2,071
Reference	2,706	2,464	2,083
High growth	2,709	2,471	2,095
Carbon budget shortfall [a]			
Scenarios:			
Low growth	-78	-88	121
Reference	-76	-80	133
High growth	-73	-73	145

Notes

a. *Positive numbers* indicate that emissions are over budget; *negative numbers* that emissions are inside the budget.

Table 3.4: Sensitivity of territorial emissions projections to economic growth

$MtCO_2e$

	Carbon budget: 2 (2013-17)	3 (2018-22)	4 (2023-27)
Traded sector:			
Scenarios:			
Low growth [a]	1,054	716	539
Reference	1,058	727	547
High growth [a]	1,062	736	559
Non-traded sector:			
Scenarios:			
Low growth [a]	1,626	1,471	1,381
Reference	1,628	1,479	1,393
High growth [a]	1,630	1,486	1,405
Total:			
Scenarios:			
Low growth [a]	2,680	2,187	1,920
Reference	2,686	2,206	1,940
High growth [a]	2,692	2,223	1,964

Notes:

a. In the l*ow growth scenario* GDP growth is one quarter of a percentage point lower than in the reference scenario. In the *high growth scenario* GDP growth is one quarter of a percentage point higher than in the reference scenario.

Uncertainty in projections of EUA purchases and sales

The actual EU ETS allowances allocated to UK installations in future carbon budget periods is uncertain. This affects projections of the net UK carbon account and figures for projected purchases or sales of the allowances themselves. In the main projections, the value of the traded sector cap is set equal to the forecast allocations of UK EU ETS allowances that the 2008 UK Climate Change Act anticipated. These values are used because the true figures will not be known until after the end of the budget period to which they relate.

However, DECC produces separate projections of the actual level of future allowances which it uses for internal monitoring. They are reported in Table 3.5, along with the corresponding figures for projected UK EU ETS allowance purchases or sales. The estimated traded sector caps agreed when the budgets were set are also shown. It is the estimated traded sector cap that is used elsewhere in this report to show projected performance against carbon budgets. This indicates how sensitive the projections are to uncertainty about the number of EU ETS allowances that will be allocated to the UK.

Table 3.5: EUA purchases and sales

$MtCO_2e$

	Carbon budget:	
	2 (2013-17)	3 (2018-22)
Traded sector emissions	1,058	727
Traded sector cap for carbon budgets [a]	1,078	985
Latest DECC projections of EUAs the UK will receive [b]	915	833
EUAs purchased [c]	*-20*	*-258*
EUAs purchased using DECC projection [c]	*143*	*-106*

Notes:

a. The traded sector caps shown here are the estimated UK traded sector caps agreed when the budgets were set.

b. These are preliminary estimates and may change in future. Potential reasons for their modification include new values for the volume of allowances granted to UK new entrants and amendments to free allocations so as to reflect operators' capacity changes. The 2018-2022 estimate assumes that the existing EU ETS cap trajectory will continue post-2020. It will change once a 2030 EU emissions reduction target is agreed.

c. *Negative numbers* imply allowances sold; *positive numbers* are those bought. Projected EUA purchases are estimated by subtracting the traded sector cap from the projected level of traded emissions.

4 Effect of policies on emissions

The energy and emissions projections include a wide range of Government policies which directly affect GHG emissions. This chapter explains how they are modelled. The impacts of policies on non-traded emissions are then considered in more detail[26].

The analysis includes those policies where decisions on policy design are sufficiently advanced to allow robust estimates of policy impacts to be made. In a change from last year, the standard EU/UNFCCC definitions are used to categorise policies as expired, implemented, adopted or planned:

- 'Expired' are closed policies that still provide legacy carbon savings;
- 'Implemented' are policies that are being applied;
- 'Adopted' are policies that have been agreed and where the process of implementation is well advanced but not yet complete.
- 'Planned': are policies at an earlier stage towards implementation, e.g. where the government's intentions have been announced or are still being consulted on.

Under this definition, projections that take account of expired, implemented and adopted policies are described as "With Existing Measures" (WEM). Those with planned policies too are "With Additional Measures" (WAM). The 2014 reference projection is "With Additional Measures" i.e. "planned" policies are included. This is the definition that aligns most closely with previous practice[27].

The WEM scenario in Annex D provides an emissions projection shows the effect of removing planned policies from the modelling. The "Baseline" scenario (also in Annex D) provides projections which exclude all non-baseline[28] policies (of whatever status) from 2009 onwards.

Including policies in the model

Policy impacts are assessed in accordance with the DECC-HM Treasury policy appraisal guidelines[29]. This means that the impact of each policy is scored against what would have been expected to happen in its absence. The majority of policies in the residential, commercial services, public services, industrial and agricultural economic sectors are modelled as increases or decreases in demand for different types of energy. The DECC EEP model projects what demand would be in the absence of these modelled policy savings–this is sometimes referred to as the Business as Usual (BAU) projection. The policy savings are then subtracted from the projected BAU demand to give projected final demand.

[26] We give projections for the impact of policies on the traded sector in Annex D. We do not discuss these here as they do not affect whether or not the Government meets the carbon budgets.

[27] The previous definition was: "policies that affect energy use and GHG emissions where funding has been agreed and decisions on policy design are sufficiently advanced to allow robust estimates of policy impacts"

[28] Baseline policies are those we adopted before the April 2009 Budget set carbon budgets. The Low Carbon Transition Plan of summer 2009 announced new policies to meet the new targets.

[29] See *Using evidence and analysis to inform energy and climate change policies*:

https://www.gov.uk/government/policies/using-evidence-and-analysis-to-inform-energy-and-climate-change-policies/supporting-pages/policy-appraisal

This supplements the *HMT's The Green Book: appraisal and evaluation in central government*:

http://www.hm-treasury.gov.uk/data_greenbook_index.htm

The impact of road transport policies is modelled through changes to projected vehicle efficiencies, vehicle kilometres driven and the share of fossil fuel displaced (by biofuels or electrification). Some policies are incorporated directly—for example, through the way they affect prices. The EU ETS and EMR policies are modelled in this way.

Impacts of policies

Table 4.1 shows savings from policy measures in the non-traded sector. Policies to achieve the fourth budget will be incorporated once they have been agreed.

Note that the figures for savings from policies may differ from those in the relevant impact assessments. There are four main reasons for this:

- Policy savings are re-evaluated periodically. This may be because of new evidence, improved assessment methods or after changes to the policy.
- Some estimates of policy savings depend on underlying trends in energy demand. If the latter change then so will the former.
- Updates to the emissions factors used to convert fuel use to GHG emissions may affect the absolute level of savings expected in certain cases.
- Treatment of overlaps between different policies may differ to the way it is done for policy appraisal purposes. Several criteria are used to determine the order that to attribute savings to different policies when overlaps occur. These include: the extent to which the policy is binding (e.g. policies underpinned by regulations score highly, voluntary measures less so), when the Government announced it (very recent policies are less likely to have an impact than established ones), and how cost-effective the measure is expected to be (cost-effective policies are more likely to lead to savings). In contrast, the approach for appraisal purposes is to estimate the marginal impact of each new policy after accounting for any policies that have already been announced.

Table 4.1 provides estimates of the emissions savings in the non-traded sector that come directly from policies. It excludes indirect effects such as savings from reduced fuel use where the price consumers pay includes the policy cost. This table groups policies across EEP economic sectors. Annex D includes more detailed tables and includes policy savings in the traded sector.

Table 4.1: Savings from policies in the non-traded sector

$MtCO_2e$

Policy [a]	Projections Carbon budget: 1 (2008-12)	2 (2013-17)	3 (2018-22)	4 (2023-27)	Increase from last year Carbon budget: 2 (2013-17)	3 (2018-22)	4 (2023-27)
Baseline policies [b]:							
Building Regs (2002+2005)	24.7	39.1	45.4	36.7	*0.9*	*1.0*	*0.7*
Carbon Trust measures	6.9	3.4	1.0	0.1	*3.4*	*1.0*	*0.1*
EEC1/2 & Baseline CERT	9.7	11.0	9.9	9.0	*0.2*	*0.2*	*0.2*
EPBD	1.4	1.4	1.4	1.4	*1.4*	*1.4*	*1.4*
Road biofuels (RTFO 5%) [c,d]	13.7	13.7	13.6	13.9	*13.7*	*13.6*	*13.9*
SME & SALIX Loans	0.3	0.3	0.3	0.3	*0.3*	*0.3*	*0.3*
Warm front and fuel poverty	-3.1	-3.7	-1.3	1.3	*-3.7*	*-1.3*	*1.3*
Baseline policies total	**53.7**	**65.2**	**70.4**	**62.7**	***2.5***	***2.7***	***4.1***
2009 LCTP or later policies [b]:							
Non-transport policies:							
Afforestation policies [d]	-	3.0	6.8	10.6	*3.0*	*6.8*	*10.6*
Agriculture action plan	-	5.2	16.5	18.0	*3.1*	*1.6*	*1.0*
Building Regs 2010	0.5	9.2	18.4	24.6	*-0.3*	*-0.3*	*-0.3*
Building Regs 2013	-	-	0.1	0.2	-	*0.1*	*0.2*
CERT+20% & Extension	1.9	6.6	6.6	6.2	*0.1*	*0.1*	*0.1*
CESP	0.1	0.3	0.3	0.2	-	-	-
CRC	0.3	2.3	5.5	7.8	-	-	-
Domestic RHI	-	1.1	6.0	7.3	*0.5*	*2.7*	*3.4*
ECO/Green Deal	-	-0.2	0.2	1.0	*-1.7*	*-3.3*	*-3.9*
ESOS	-	0.2	0.5	0.5	*0.2*	*0.5*	*0.5*
ND RHI	-	4.4	12.3	13.8	*1.7*	*3.1*	*3.2*
Products policy [e]	-1.5	-7.3	-5.5	2.0	*0.4*	*4.5*	*10.7*
PRS Regulations [f]	-	0.1	0.7	1.0	*-1.1*	*-3.7*	*-1.2*
Smart Metering	-	1.6	7.2	8.0	*-1.3*	*-1.3*	*-0.8*
Zero Carbon Homes	-	0.1	2.0	4.7	-	-	-
Non-transport policies total	**1.4**	**26.6**	**77.6**	**105.9**	***1.6***	***4.0***	***12.9***

Table 4.1: Savings from policies in the non-traded sector (continued)

$MtCO_2e$

Policy[a]	Projections Carbon budget: 1 (2008-12)	2 (2013-17)	3 (2018-22)	4 (2023-27)	Increase from last year Carbon budget: 2 (2013-17)	3 (2018-22)	4 (2023-27)
2009 LCTP or later policies [b]:							
Transport policies:							
LSTF	1.3	3.8	2.3	0.3	*0.1*	*0.1*	-
Rail electrification	-	0.1	2.1	2.1	-	*-0.1[r]*	*-0.1[r]*
Road biofuels (RTFO 8%) [c]	-	1.4	23.8	26.8	*-4.2*	*13.1*	*26.8*
Road vehicle efficiencies	2.3	21.3	56.3	96.5	*5.4*	*4.3*	*-0.3*
Transport policies total [d]	**3.6**	**26.6**	**84.4**	**125.7**	***1.3***	***17.3[r]***	***26.4[r]***
2009 LCTP or later policies total	**5.0**	**53.2**	**162.0**	**231.7**	***3.0***	***21.4[r]***	***39.3[r]***
All policies total	**58.7**	**118.5**	**232.5**	**294.4**	***5.5***	***24.1[r]***	***43.4[r]***
Of which:							
Policies not quantified last year [h]	*13.7[r]*	*16.7[r]*	*20.4[r]*	*24.5[r]*	-	-	-

Notes

a. Full policy names are provided in appendix A.

b. A *baseline policy* is a measure introduced or announced in or before the Low Carbon Transition Plan (LCTP) of 15th July 2009. Baseline policies, for Transport, Agriculture and Waste, are not shown separately but are included these in the baseline projections. Following consultation with the CCC, Carbon Trust administered Small Business Interest Free Loans and Salix Public Sector loans have been reclassified as baseline measures. They had previously been combined with later policies.

c. Last year, the 5% RTFO policy was included in the baseline and the savings were not shown separately. This means a comparison with the last edition is not possible. The two biofuels policies (current 5% and planned increase to 8%) combined, make up a 35 TWh renewables contribution to transport energy demand. This is consistent with the 10% transport sub-target set out in the Renewable Energy Directive. It includes the principle that certain biofuels products count as double towards this target.

d. Products policy implements the EU EcoDesign and Eco-labelling Directives. It relates primarily to energy efficiency improvements in electrical appliances. These lead to reductions in traded sector emissions due to reduced demand for electricity. However, more efficient electrical appliances produce less waste heat and so small increases in non-traded emissions are expected from the extra space heating required to make up for this.

e. The savings for the PRS regulations policy cover both residential and non-residential sectors. The expected savings from the Non-Domestic Green Deal was previously shown separately but is now included within the savings from the PRS.

f. The savings from the EU voluntary agreements on new car CO_2 emissions up to 2009 are taken into account since the baseline for newer measures includes savings from older policies. However, we are not able to estimate the savings associated with them.

g. Policy was not quantified in EEP 2013, though impact was included in the baseline

h. This comprises Road Biofuels (RTFO 5%) and Afforestation policies.

r Revised value.

Transport shows a large increase in savings compared with last year. This is partially due to an increase in transport fuel demand from an improved economic outlook and lower fuel prices. Because of higher projections of fuel demand, savings from fuel efficiency and renewable policies are also higher.

In the longer term, about 60% of the increase in transport savings is due to a different modelling approach for the Renewable Transport Fuel Obligation (RTFO). The RTFO is modelled by assuming road fuel contains 8% of biofuel from 2020 onwards. The previous assumption was that the proportion of biofuel would fall from 8% to 5% after 2020. The rest of the increase in transport savings comes from vehicle efficiencies, the impact of which is now higher due the increase in projected demand for travel. This in turn is driven by higher economic growth and lower fossil fuel projections. The relative attribution of savings between these two policy areas is, however, sensitive to the order in which the marginal impacts are assessed.

Outside of transport estimated non-traded savings from policies are similar to last year's projections. The exceptions are decreases for some existing policies in carbon budget four. This particularly affects the Energy Company Obligation (ECO) policy. This is the result of a combination of two factors. The first is the short-run reduction in overall ECO support announced in December 2013 as part of a package to reduce consumer bills. The second is an increase in the projected number of low income households switching from electric heating to more efficient gas boilers as a result of the policy. The net effect of this is an increase in traded sector savings which does not appear in the figures here.

In carbon budget four, new policies included in this year's projections, largely compensate, for the lower estimated impact of some older polices. They include elements of products policy, domestic Renewable Heat Incentive (RHI), Energy Savings Opportunity Scheme (ESOS) and the planned Private Rented Sector (PRS) Regulations. In both carbon budgets three and four a significant increase in savings is expected from the newly agreed EcoDesign regulation for ventilation systems for commercial buildings.

5 Demand for energy

This chapter sets out projections for energy demand.

There are two standard ways of presenting energy demand estimates – final energy demand or primary demand.

Primary energy sources are products such as natural gas or crude oil or coal 'at the wellhead' which are used to generate electricity, or otherwise transformed, to produce a final energy "product". Primary energy includes primary electricity from nuclear or from renewable sources such as hydroelectricity, wind turbines, and solar photovoltaics. It also includes the net import of final energy products[30].

Final energy demand gives figures for energy as its final consumers (households, businesses or public bodies) use it. It includes products in the form they are consumed like electricity, burning oil or transport fuels which are manufactured from primary forms of energy. These production processes involve some energy use and energy losses. They include: electricity generation, transmission and distribution; oil and gas production, distribution and refining; and the manufacture of solid fuel products such as coke.

Primary energy demand

Figure 5.1 shows that primary energy demand is expected to continue its general downward trend up until 2025. After 2025, demand increases as the impact of existing policies declines. This is because, in the absence of policy intervention, trend improvements in energy efficiency and the impact of fossil fuel prices are insufficient to offset the impact of economic and population growth. Policies to deliver the fourth carbon budget will be included as they are agreed, changing projected demand.

Figure 5.2 depicts a large projected decline in solid fuel use, while natural gas and oil use remains relatively stable through the whole projections period. In contrast, renewables and nuclear fuels use increases strongly, although the latter only starts increasing in the mid-2020s. Annex E contains the data supporting both figures. The main driver of this changed profile is changes in the projected electricity generation mix driven by power sector policies.

This year's total primary energy demand projections are similar to last year's—at least up until 2020. After this, they are lower than in the last update. This is largely as a result of lower projected gas demand which in turn is due to lower household projections, lower gas prices, higher policy savings and the incorporation of Met Office climate projections.

Final energy demand

Table 5.1 gives projections for final energy demand by final (end) user for broad economic sectors and main types of fuel. Figure 5.1 provides a graphical breakdown of this by main fuel type and Figure 5.2 shows final demand by broad economy sector. These projections are based on the reference scenario. The figures here and elsewhere in this chapter use the EEP economy sector disaggregation[31] giving values which are consistent with DUKES[32]. Annex F provides more detailed disaggregation broken down by year and into more detailed economic sectors.

[30] This is because we only count energy use and losses from UK production in our primary energy demand figures: we do not include any energy use or losses from final energy production for imported energy.

[31] See Chapter 2 for a discussion of the different frameworks we use to disaggregate our figures.

[32] DUKES final energy demand includes heat sold (steam or hot water). The energy lost transforming fuels to make this are recorded outside final demand in the DUKES energy balance tables. We do not record sold heat as such but instead allocate the fuel used to make it to end-user sectors. This is to maintain consistency with older (pre-1999) statistics.

Figure 5.1: Projections of primary energy demand [a, b]

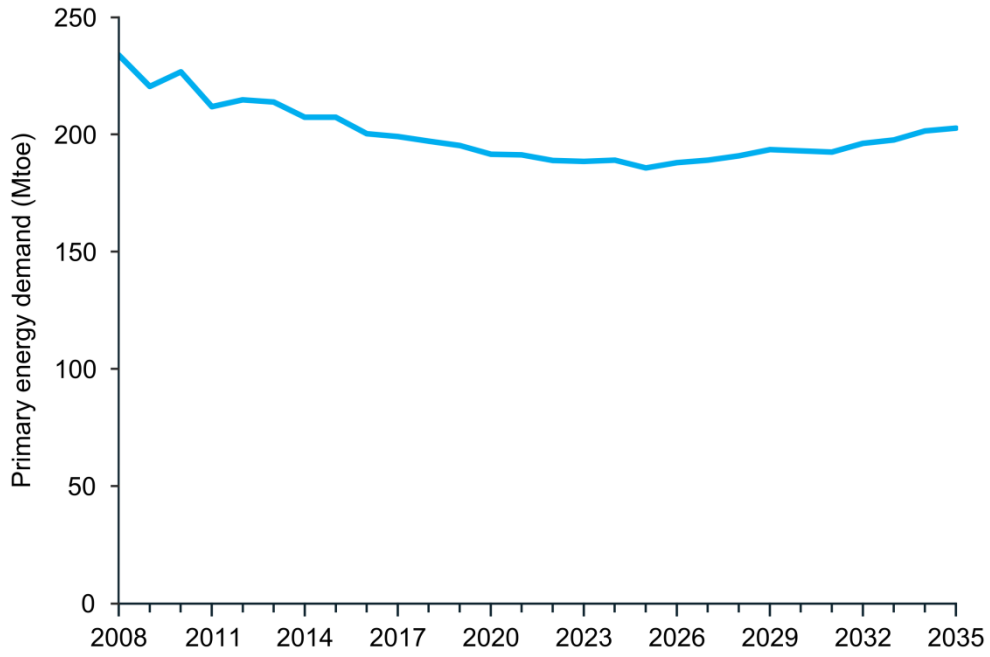
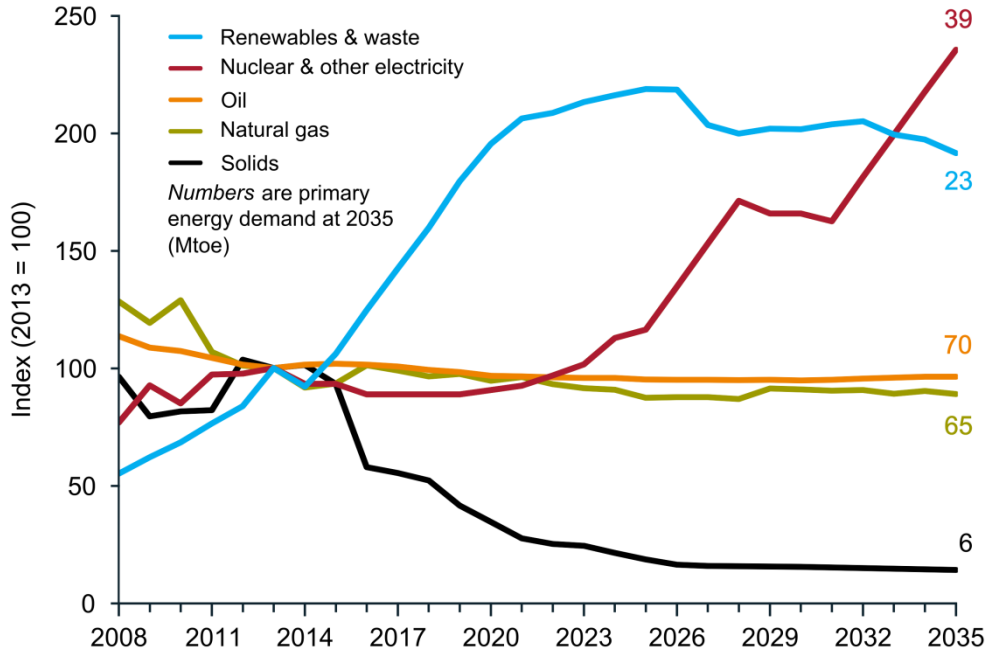


Figure 5.2: Changes over time in primary demand by fuel type [a]



Notes

a. In this figure, we include all renewable energy in “renewables”. In contrast, DUKES places some in other categories. For example, hydro and wind are included with “primary electricity” in the overall energy balances. The renewables category in the above figures and Annex E includes a small amount of non-renewable waste fuel use. The nuclear and other primary electricity includes nuclear fuel use and net imports of electricity from abroad.

Table 5.1: Energy demand by EEP final user sector and fuel

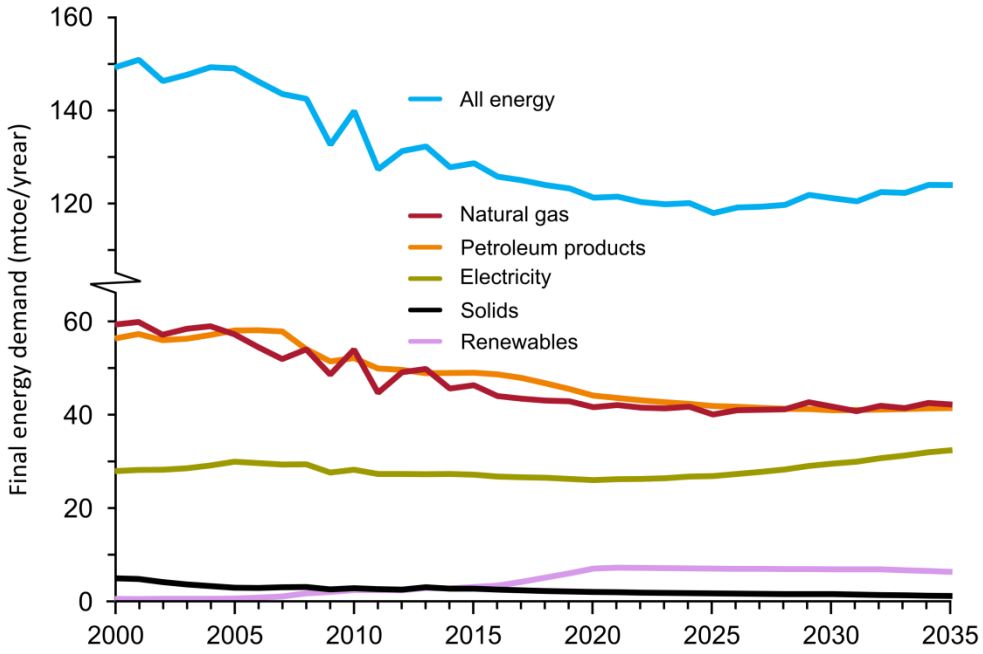
Mtoe

	2010	2015	2020	2025	2030	2035
By EEP economy sector:						
Industry	27	25	24	23	22	22
Of which:						
Electricity	*9*	*9*	*9*	*9*	*9*	*9*
Natural Gas	*10*	*9*	*8*	*7*	*7*	*7*
Petroleum products [a]	*6*	*5*	*4*	*4*	*4*	*4*
Solid / manufactured fuels	*2*	*2*	*2*	*2*	*2*	*1*
Renewables	*0*	*1*	*1*	*1*	*1*	*1*
Residential [b]	49	41	38	38	42	44
Of which:						
Electricity	*10*	*9*	*8*	*9*	*10*	*11*
Natural Gas	*33*	*28*	*26*	*26*	*28*	*29*
Petroleum products	*3*	*3*	*2*	*2*	*2*	*2*
Solid / manufactured fuels	*1*	*1*	*0*	*0*	*0*	*0*
Renewables	*1*	*1*	*1*	*1*	*1*	*1*
Transport	43	42	41	39	39	39
Of which:						
Electricity	*0*	*0*	*0*	*1*	*1*	*1*
Natural Gas	*0*	*0*	*0*	*0*	*0*	*0*
Aviation fuel [a]	*1*	*1*	*1*	*1*	*1*	*1*
Petroleum products (rail)	*1*	*1*	*1*	*1*	*1*	*1*
Petroleum products (shipping)	*1*	*1*	*1*	*1*	*1*	*1*
Petroleum products (road transport)	*39*	*38*	*35*	*33*	*32*	*33*
Solid / manufactured fuels	*0*	*0*	*0*	*0*	*0*	*0*
Renewables (bio-fuels)	*1*	*1*	*3*	*3*	*3*	*3*
Services and Agriculture [c]	21	20	19	18	19	19
Of which:						
Electricity	*9*	*9*	*9*	*9*	*10*	*11*
Natural gas	*11*	*10*	*8*	*7*	*6*	*6*
Petroleum products	*1*	*1*	*0*	*0*	*0*	*0*
Solid / manufactured fuels	*0*	*0*	*0*	*0*	*0*	*0*
Renewables	*0*	*1*	*2*	*2*	*2*	*1*
Total [a]	**140**	**129**	**121**	**118**	**121**	**124**
By fuel:						
Electricity	28	27	26	27	30	32
Natural gas	54	46	42	40	42	42
Petroleum products	52	49	44	42	41	41
Renewables	3	3	7	7	7	6
Solid / manufactured fuels	3	3	2	2	2	1

Notes

a. This excludes international aviation
b. Corresponds to the DUKES “domestic” sector.
c. This includes the agriculture, public services and commercial services sectors.

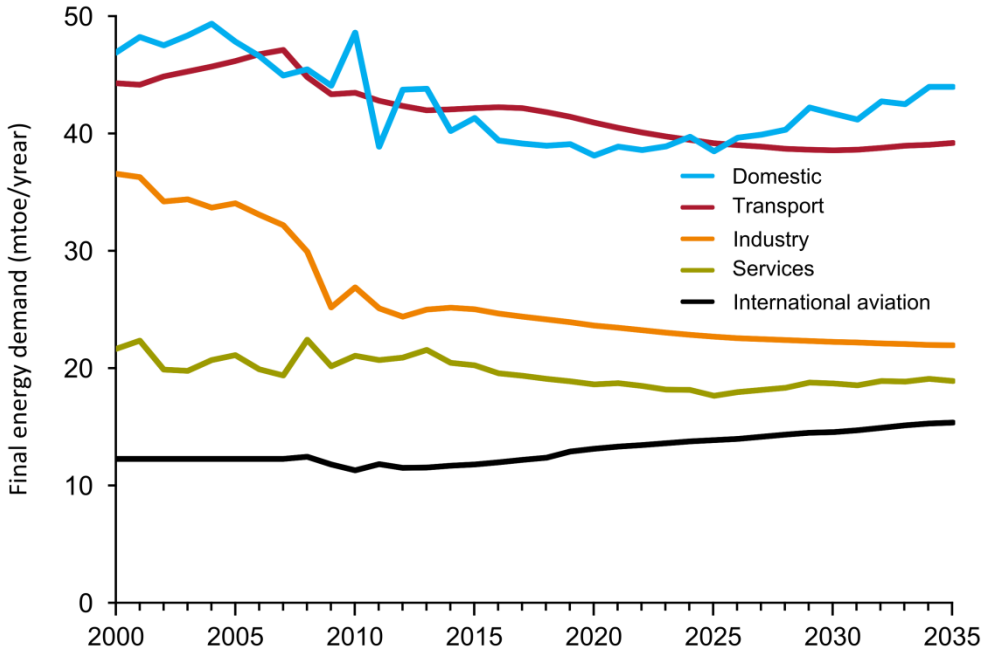
Figure 5.3: Final energy demand by type of energy [a]



Notes:

a. Total energy does not include international aviation

Figure 5.4: Final energy demand by sector [a]



Notes:

a. In a significant revision, DUKES 2014 moved large quantities of natural gas from the Industry economy sector to Miscellaneous (which we include in the Commercial sector, a part of Services in the above). This was backdated to 2008 and explains the apparent drop in Industry and increase in Services: both are statistical artefacts.

Figure 5.3 shows final energy demand projected to fall until 2025. It starts to rise towards the end of the fourth carbon budget. This is because higher demand for energy, driven by rising prosperity and population growth, starts to outweigh the savings delivered by existing energy efficiency policies.

Figure 5.4 shows final energy demand in the residential sector falling until 2020 then starting to rise. The declining impact of existing policies has a more pronounced impact on residential demand projections than other sectors. This is primarily because, without policy intervention, there is little underlying trend improvement in energy efficiency in this sector. This is particularly the case for electricity demand where existing energy efficiency policies drive the medium term fall. In contrast, the falls in industry and services demand are due to underlying reductions in energy intensity as well as policy impacts. These continue to partly offset the impact of economic growth even in the absence of additional policy effort.

Energy use in transport declines gently up to the 2020s despite road traffic forecast to increase by 30%. This is driven by improvements in energy efficiency of the vehicle fleet as a result of our existing policy measures: EU tailpipe emission standards for new cars and vans and supplementary measures such as low rolling resistance tyres. The Department for Transport (DfT) assumptions used in the modelling also factor in some uptake of electric vehicles and the use of natural gas in heavy goods vehicles. In the longer term, the vehicle efficiency improvements are marginally offset by the continued rise in vehicle kilometres. The latter is driven by economic and demographic growth. DfT modelling projects continued growth in international aviation throughout the period. Carbon budgets do not include international aviation at present.

Tables 5.2 and 5.3 show changes in projected energy use, by fuel and by economy sector, compared with last year. They show that total final demand is up slightly in the short term and down slightly in the longer term compared with last year's projections.

Table 5.2: Change in projected final energy use by fuel since last year

percentages

	2010	2015	2020	2025	2030
Electricity	-	*3*	*1*	*-2*	*-3*
Natural gas	-	*-1*	*-6*	*-10*	*-11*
Petroleum products	*1*	*5*	*4*	*1*	*3*
Renewables	*4*	*-11*	*11*	*43*	*42*
Solid/manufactured fuels	*5*	*9*	*-4*	*-16*	*-23*
Total energy	***1***	***2***	***-***	***-2***	***-3***

Table 5.3: Change in projected final energy use by EEP economy sector since last year

percentages

	2010	2015	2020	2025	2030
Residential [a]	-	-3	-8	-11	-10
Industry	-3	4	-2	-5	-7
Services [b]	7	13	17	11	7
Transport	-	3	3	3	4
Total energy	**1**	**2**	**-**	**-2**	**-3**
International aviation	5	1	1	1	1

Notes:

a. Corresponds to the DUKES "domestic" sector.

b. This includes the agriculture, public services and commercial services sectors.

Compared with last year, final energy use for electricity is slightly up in carbon budget two. This is because of higher short term economic growth. It is slightly lower in the longer term for several reasons including increased policy impacts and lower household growth projections.

The large percentage increase in renewables after 2020 is due to the combined effect of changes to the modelling of RTFO (8% biofuel in road transport from 2020 onwards) and higher demand for road travel.

The projected demand for natural gas is lower compared with last year. In the residential sector this is for several reasons including slower growth in household numbers and warmer winters in the new meteorological projections. The domestic RHI policy, announced last year also has an effect.

In the non-residential sectors projections renewables—biomass and biogas, incentivised by the RHI—are higher than last year. They displace other fuels, particularly solid fuels and oil. This year we have also included the effect of the RHI policy incentivising the use of renewables in agriculture. Agriculture is part of services in the EEP disaggregation.

DUKES 2014 included revisions to the allocation of gas consumption between sectors. The estimates for industry were revised downwards and "miscellaneous" sector were revised upwards. The EEP projections are adjusted to take account of these revisions resulting in lower projected industry demand and higher projected services demand.

6 Electricity generation

This chapter gives the results from the electricity market modelling. It presents projections for overall electricity generating capacity (the maximum possible supply of electricity) and for the contributions of different generating technologies which contribute to supply, the generation mix.

It also provides information about those assumptions which are specific to modelling the electricity market; Chapter 7 discusses the general assumptions which are important to the projections. The analysis includes special reference to projections of CHP because this is modelled in a different way to other types of generation. While Chapter 5 sets out the projected demand for electricity, it is important to note that the modelling assumes that demand will be met by supply.

The results presented here are based on the reference scenario. Note that both overall capacity and generation mix are sensitive to demand and fossil fuel price assumptions. The low and high fossil fuel price, and low and high growth scenarios give an indication how these factors affect the projections. Annexes G, H, I, J, K, and L provide the full results for electricity modelling.

It is important to note that projected demand is based on the assumption that there is no additional policy effort beyond current implemented, adopted and planned policies. Policies developed to meet the fourth carbon budget will impact on demand and consequently the level of generation provided by individual technologies. It is assumed that EMR policies are designed to achieve a carbon intensity of generation of 100g CO_2 per KWh of electricity generated by 2030. This is discussed further below.

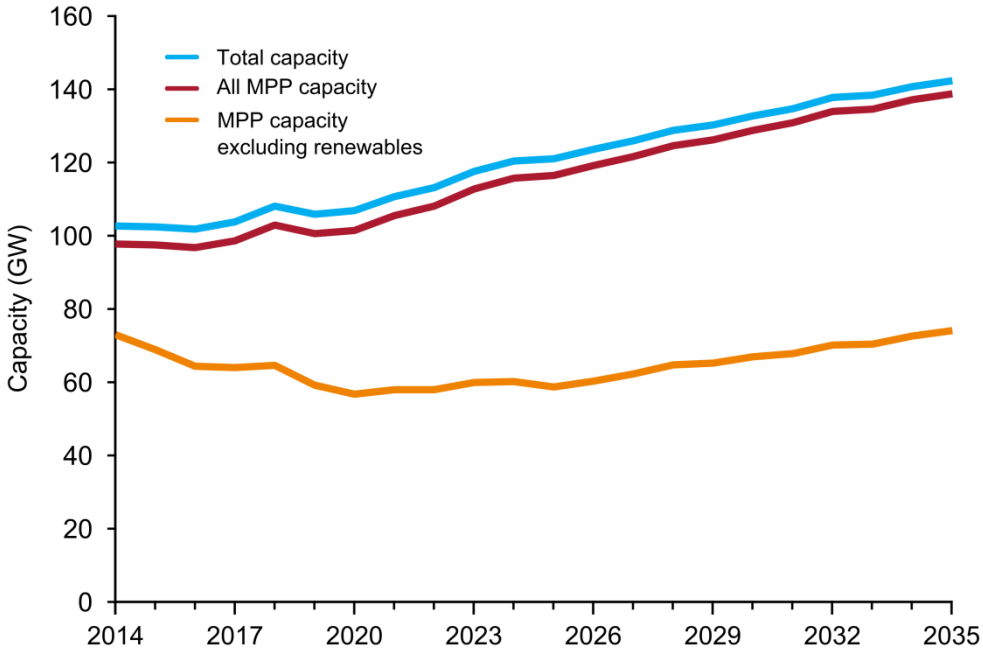
Capacity and New Build

Figure 6.1 shows projected overall capacity stays fairly constant in the short term at approximately 100 GW, rising to 107 GW by 2020 and 142 GW by 2035. The pattern of change for Major Power Producers (MPPs, including renewables) is similar to that for overall capacity. However, if renewables are excluded MPP capacity falls significantly until 2022 before rising slowly.

Compared with last year's projections, overall capacity is expected to be higher until 2018 and then fairly similar thereafter. This is partly due to coal plants staying open longer as a result of cheaper coal prices and also because of the cap in the CPS rate[33]. The capacities of renewables are also higher compared with last year.

[33] See chapter 7.

Figure 6.1: Total capacity from 2014 to 2035



The projections show that renewables capacity is expected to double from 25 GW in 2014 to 50 GW in 2022, and increase further to 65 GW by 2035, in the absence of additional energy efficiency policies. Figure 6.2 reflects this new build. Nuclear capacity stays fairly constant until 2023, when Hinkley Point C is expected to start generating electricity. Nuclear capacity is then projected to increase steadily in the longer term. However, the amount of capacity required in the long run will be affected by policies introduced to meet the fourth carbon budget. These will be included as they are agreed and could lead to higher or lower capacity.

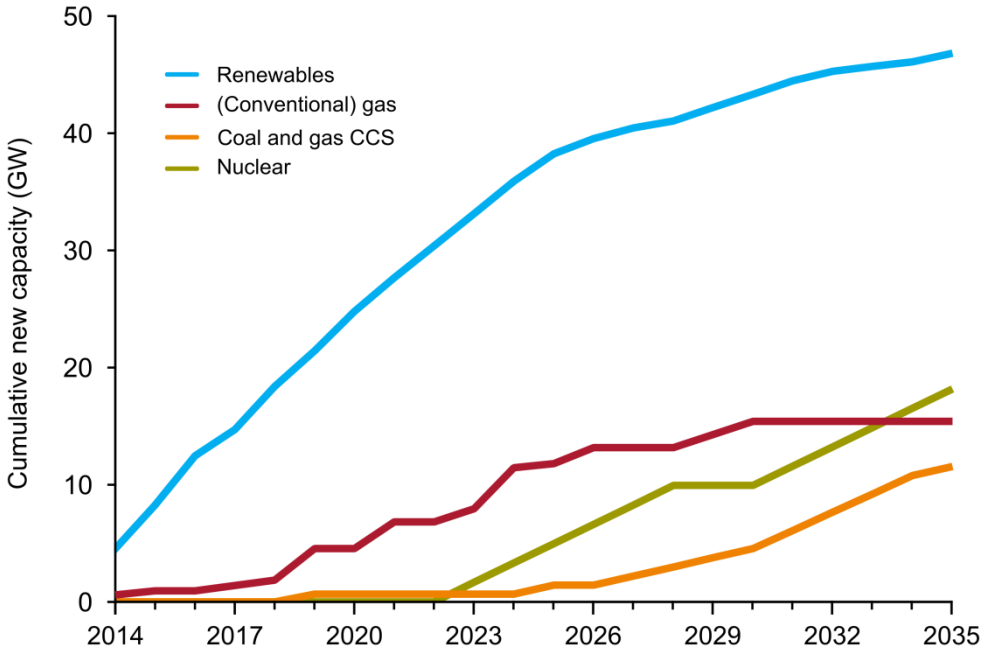
For fossil fuel capacity, the last MPP coal plant without Carbon Capture and Storage (CCS) technology is projected to close by the mid-2020s. In contrast, gas capacity is expected to increase in the early 2020s to take coal's place.

Autogeneration and CHP

Autogenerators are electricity plants owned by businesses whose main activity is not electricity generation. These are mostly CHP plants. However, the expansion of gas CHP capacity has been limited in recent years. This is mainly due to unfavourable market price spreads between gas and electricity, uncertainty in markets for the heat CHP generates, and competition for capital finance with alternative investment options. Table 6.1 shows projections of total installed CHP capacity together with equivalent figures from last year's projections.

Over the last few years, CHP development has been slow. The latest projections suggest that this trend is likely to continue. Of particular note is the slow decrease in projected installed capacity between 2020 and 2035. The main cause of this is the projected rise in carbon prices after 2020 (including the CPS) which has a pronounced effect on the development of CHP in sites which are in the EU ETS. Renewables capacity holds up well into the future under the policy incentives provided by the RHI / Renewables Obligation Certificates (ROCs) / Contracts for Difference (CfDs) currently in place or coming soon.

Figure 6.2: Cumulative new capacity of MPP Nuclear, Renewables and Gas [a]



Notes

a. We project no new unabated coal capacity. We project some new interconnector capacity but this is relatively insignificant.

Table 6.1: Projections of total installed CHP capacity

GW

	2010	2015[a]	2020	2025	2030	2035
EEP 2013 [b]	6.1[r]	8.1[r]	8.4	9.2	8.8	-
EEP 2014 [b]	6.0[r]	7.3	9.2	8.1	7.1	6.9
Of which non-MPP and non-renewables [c]	3.7	4.1	4.5	3.7	3.1	2.7

Notes

a. The values for this year are interpolated from the last historic year's data (2013) and those for the first modelled year (2020).
b. These values include MPPs and renewable CHP plants. We do not include these in the autogenerator category elsewhere but include them in the larger generation categories (i.e. in MPPs or renewables).
c. These figures are net of MPPs and renewable CHP and so are consistent with our other capacity series.

[r] Revised value

Generation mix

Overall, the figures suggest higher renewables generation and lower non-CHP fossil fuel generation in the future.

Renewables plants are projected to generate approximately 112 TWh of electricity by 2020, rising to 148 TWh by 2030[34]. The 2030 renewables projection is lower than last year's figures by 8 TWh. This is because overall electricity demand is lower by approximately 27 TWh.

Fossil fuel CHP generation follows a similar trend to the growth in its capacity (see above), increasing from 17 TWh in 2014 to 19 TWh 2020. After 2020, there is expected to be a slow decline in generation to 11 TWh by 2035.

The effect of greater CHP and renewables generation coupled with declining demand in the medium term mean that projected MPP generation will decline rapidly up until the mid-2020s. After Hinkley Point C comes on line in 2023 we project nuclear generation will follow the same trend as capacity growth.

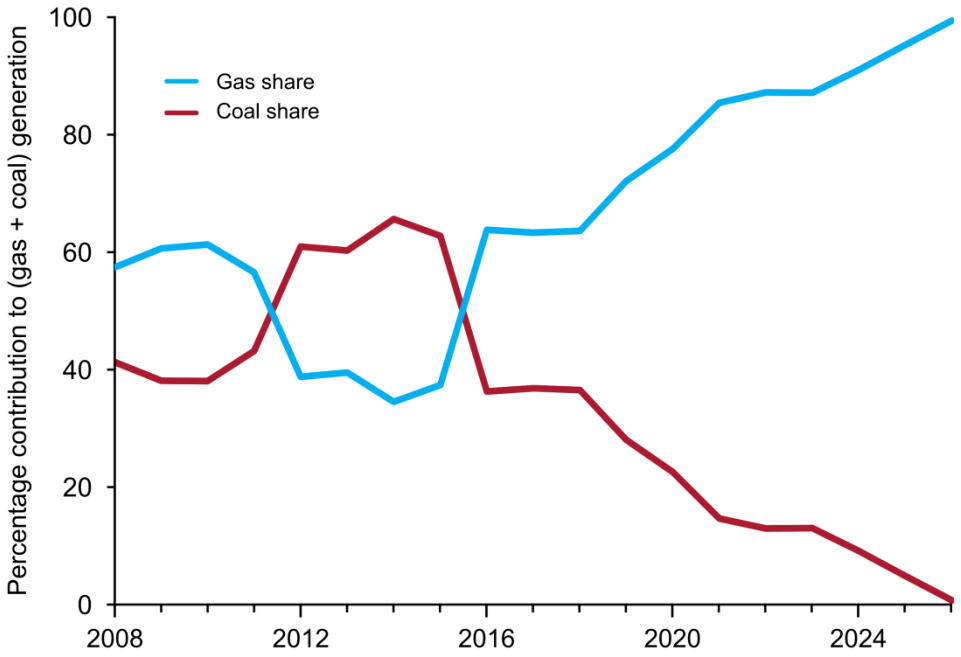
Figure 6.3 shows the relative contributions of coal and gas to their combined total generation. This shows the recent trend of gas being displaced in favour of coal for generating electricity continuing up until 2015. This is despite the closure of some coal plants in the intervening years and is primarily due to changes in the price of coal relative to gas and the CPS cap.

Projected coal generation falls substantially in the 2020s, declining rapidly to zero by 2027. This is because the changing price differential between gas and coal makes coal plants relatively less profitable. The Industrial Emissions Directive comes into force in 2016. This limits particle emissions and requires the closure of some coal plants by 2023[35].

[34] The renewables category in the above figures and annexes include a small amount of non-renewable waste generation.

[35] The Large Combustion Plant Directive (LCPD) and Industrial Emissions Directive (IED) are European Directives aimed at controlling emissions of sulphur dioxide, nitrogen oxides and dust from large combustion plants. Plant owners have a number of options when choosing how to respond to the IED. These include paying for emissions control equipment to comply with the Directive, or opting out and accepting limits on their running hours. Those which opt-out will only be allowed to run for 17,500 hours between 2016 and 2023. There is also a Transitional National Plan option under the IED. Under the current LCPD, plants that have not installed any emissions control equipment are allowed to operate for only 20,000 hours from 2008 until they close at the end of 2015.

Figure 6.3: Relative share of (gas + coal) fossil fuel generation



Modelling approach and assumptions specific to electricity

Most aspects of electricity generation are modelled with DECC's DDM[36] although CHP capacity and generation are modelled independently. Last year's non-CHP projections for the UK were based on the DDM. This year the Northern Irish market is modelled separately to reflect better the fact that the electricity market in Northern Ireland is distinct from the one in Great Britain. There is further information about this in *Updated energy and emissions projections 2014: methodology update* [37]. The change has had little material effect on the results.

DECC's CHP modelling differs from its modelling of other electricity generation. It consists of a Bottom-Up model, operated on behalf of DECC by Ricardo-AEA and an in-house Monte Carlo (MC) model. The former considers the technical potential of individual sites for CHP installation based on their heat and power requirements. The MC model captures behavioural aspects of the industrial decision-making including costs and policies. The overall aim is to produce a realistic projection of what CHP capacity will actually exist in future years.

This year, the MC model was improved to capture better how renewable CHP operators transition from the Renewables Obligation to CfDs, update the CPS rate and to enhance modelling of the Capacity Mechanism. The way it characterises different CHP technologies has also been refined by changing assumptions to better represent load factors, heat to power ratios, efficiencies, plant lifetimes and capital expenditure.

The following list sets out those assumptions which are specific to and important for electricity market modelling and which are not covered in Chapter 7.

[36] See *DECC Dynamic Dispatch Model (DDM)* at:
https://www.gov.uk/government/publications/dynamic-dispatch-model-ddm

[37] See *Updated energy and emissions projections 2014: methodology update* at:
https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2014

Electricity Market Reform

The projections make assumptions about how EMR is implemented. In particular, while a formal decarbonisation target has not been set for the power sector, EMR is modelled to achieve a carbon intensity of generation in 2030 of 100 g CO_2/kWh[38]. It is assumed that EMR measures are generally deployed to achieve a least cost pathway. However, EMR initially supports a broader range of technologies than this would imply in order to mitigate long-run technology risks that are faced in decarbonisation of the power sector.

Under EMR, renewables will be supported using CfDs. A CfD is a contract that pays the generator the difference between the market price for electricity (the "reference price") and the long-term price needed to bring forward investment in a given technology (the "strike price"). DECC announced strike prices up to 2018/19 in December 2013[39]. These have been used in the modelling.

Investor plans

The projections do not include all the planned new plants that energy companies have announced. However, they do incorporate any whose construction has already begun.

Net imports

The assumptions about the level of imports of electricity via interconnectors with mainland Europe and the Republic of Ireland have been revised. This reflects information from the energy market consultancies Redpoint and Pöyry.

Carbon Capture and Storage

It is assumed that two early stage CCS plants proceed with both plants starting operation in 2019. Commercial CCS technology is available by 2025.

Renewables

The model follows the 2009 Renewable Energy Strategy in assuming that renewables will generate at least 30% of the total electricity supply by 2020[40]. After this, the overall EMR decarbonisation target coupled with CfDs drives decarbonisation.

Industrial Emissions Directive (IED)

It is uncertain how plant operators will decide to operate their plants under the Industrial Emissions Directive (IED)[41]. Analysis from Redpoint and information from the market and engagement with industry have informed the central assumptions about operator decisions and plant operating characteristics relating to the Directive. Note that the freeze in the CPS rate announced in the 2014 Budget has changed the economic incentives of plant operators compared with our 2013 projections and the assumptions have been changed accordingly.

[38] This measure of carbon intensity of electricity generation includes all sources of generation excluding net imports.

[39] See *Investing in renewable technologies – CfD contract terms and strike prices*:
https://www.gov.uk/government/publications/investing-in-renewable-technologies-cfd-contract-terms-and-strike-prices

[40] See *The UK renewable energy strategy*:
https://www.gov.uk/government/publications/the-uk-renewable-energy-strategy
This includes the Renewables Obligation and measures relating to small scale renewables.

[41] See footnote 35

7 Modelling Assumptions

This chapter gives more information about the key assumptions. It includes estimates of:

- Demographic changes i.e. variations in:
  - population
  - number of households
- Changes in economic factors:
  - real GDP growth
  - rates of industrial expansion
  - variations in employment rates
- Prices:
  - international prices for fossil fuels
  - exchange rates
  - carbon price
- Future UK ambient temperatures

The modelling uses official published UK government figures where they exist. The following sections look at each in more detail, while noting that assumptions important for modelling electricity generation were covered in chapter 6.

Demographic assumptions

The assumptions about future population come from the Office for National Statistics' (ONS) 2012-based low migration population projection variant. We use this rather than the principal projection for consistency with projections from the Office for Budget Responsibility (OBR). These population figures include significant revisions following analysis of the 2011 Census.

DECC produces projections of future household numbers by gap-filling and then adjusting the Department for Communities and Local Government's (DCLG) projections and similar data from the Devolved Administrations (DAs). DCLG's 2011 projection were used for this year's projections; figures from the DAs were based on various different reference years. DECC adjustments aim to make the household data as consistent as possible with the economic series from the OBR. Table 7.1 shows the resulting demographic assumptions.

Table 7.1: Demographic assumptions

UK growth rate, % per annum

	2013	2014	2015	2016	2017	2018	2020	2025	2030	2035
Population	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.5	0.4
Households	0.7	0.8	0.8	0.8	0.8	0.8	0.7	0.6	0.5	0.5

Assumptions about economic factors

Table 7.2 sets out assumptions about how real-terms GDP, industrial expansion and employment will change. The first and last of these are based on new figures for both the short and long-term which the OBR has published since our last edition. The short-term growth figures are from its Economic & Fiscal Outlook[42]: this was issued with the Budget in March 2014. Long-term projections of GDP and employment growth are taken from the OBR's Fiscal Sustainability Report[43] published in July 2014.

DECC produces sub-sector projections for industrial growth[44] as part of the general energy and emissions modelling methodology. They are based on econometric models which are driven by estimates of UK and world growth. The world growth projections used here are from the IMF World Economic Outlook (April 2014, updated July 2014).

Table 7.2: Assumptions about changes in economic factors

UK growth rates, % per annum

	2013	2014	2015	2016	2017	2018	2020	2025	2030	2035
Real GDP	1.8	2.7	2.3	2.6	2.6	2.5	2.4	2.4	2.4	2.4
Industry	0.7	2.2	1.6	1.9	1.8	1.5	1.1	1.1	1.1	1.2
Employment	1.4	1.7	0.7	1.0	1.0	0.6	0.2	0.1	0.2	0.2

Prices

DECC bases its projections of wholesale fossil fuel prices on an analysis of the international market. This includes information from forecasts that are published by other organisations. The Department has published new fossil fuel price figures which have been used in our new projections[45]. Retail prices are projected by adding projected price uplifts which take account the impact of government policies.

[42] See the OBR's *Economic & Fiscal Outlook—March 2014*:
http://budgetresponsibility.org.uk/economic-fiscal-outlook-march-2014/

[43] See the *OBR's Fiscal sustainability report – July 2014*:
http://budgetresponsibility.org.uk/fiscal-sustainability-report-july-2014/

[44] For purposes of these projections we use the same definitions of industry and its sub-sectors as DUKES. This therefore includes construction, non-energy mining and quarrying, and water treatment. It excludes the energy industries: see DUKES 2014, p. 26-27:—
https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes#2014

[45] See *Fossil fuel prices projections - Department of Energy and Climate Change, Sept 2014*:
https://www.gov.uk/government/publications/fossil-fuel-price-projections-2014

Clearly, future fossil fuel prices are highly uncertain. This uncertainty is reflected in three different wholesale fuel market scenarios. They are:

- Low fossil fuel prices
- Central estimate of fossil fuel prices (the reference scenario)
- High fossil fuel prices

These scenarios reflect a combination of assumptions about global fossil fuel prices and assumptions about the operation of the northern European wholesale market in which the UK buys its fossil fuels.

Table 7.3 shows the reference scenario prices. Table 7.4 shows the crude oil price assumptions for all scenarios. This illustrates the range of prices the modelling encompasses. The full range of price assumptions for all fossil fuels is shown in Annex M.

Table 7.3: Fossil fuel price assumptions in the reference scenario

Annual average prices (2014 prices)

	Crude oil (Brent) $/barrel	Natural gas (NBP [a]) p/therm	Coal (ARA [b]) $/tonne
2013 [c]	111.2	69.5	83.6
2014	105.0	55.8	77.2
2015	96.4	62.1	80.9
2020	96.2	60.3	93.5
2025	107.7	71.7	98.3
2030	120.6	76.4	103.3
2035	135.0	76.4	108.6

Notes

a. NBP = National Balancing Point. NBP is the main trading market for UK natural gas.

b. ARA = Amsterdam-Rotterdam-Antwerp markets. ARA are the main north west European trading markets for electricity steam coal.

c. Prices for 2013 from the BP Statistical Review of World Energy 2014, given in 2014 prices. See:

http://www.bp.com/content/dam/bp/pdf/Energy-economics/statistical-review-2014/BP-statistical-review-of-world-energy-2014-full-report.pdf

Table 7.4: Crude oil price assumptions for all scenarios

Annual average prices, $/barrel (2014 prices)

	Scenario:		
	Low oil price	Reference	High oil price
2013	111.2	111.2	111.2
2014	90.0	105.0	120.0
2015	89.2	96.4	122.7
2020	85.4	96.2	136.8
2025	81.8	107.7	152.7
2030	78.3	120.6	170.3
2035	75.0	135.0	190.0

Exchange rates are assumed to remain constant and i.e. the same values are used for the whole projection period (2014 to 2035). These were 1.5644 $/£ and 1.1776 €/£. They are the average of calendar year 2013's market rates. DECC's Interdepartmental Analysts' Group (IAG) Guidance for Policy Appraisal gives more details of this methodology[46].

Participants within the EU ETS, including the power generation sector, may either reduce carbon emissions or purchase EU Allowances to emit (EUAs). Table 7.5 shows the EUA price (the carbon price) DECC projects. It is important to note that these figures have been developed for internal DECC modelling purposes and should not be considered official DECC "forecasts" of future carbon prices. The assumptions underlying these values are explained in an explanatory methodology note[47].

Table 7.5 also shows the effective carbon price we assume when modelling electricity supply. This includes the Carbon Price Support (CPS) rate. These prices are consistent with the CPS rate cap of £18/tCO_2 from 2016/17 to 2019/20 the March 2014 Budget announced[48].

Table 7.5: Carbon prices

£/tonne CO_2 (2014 prices)

	2013	2014	2015	2016	2017	2018	2020	2025	2030	2035
Industry and Services [a]	3.9	4.5	4.6	4.7	4.8	5.0	5.3	6.4	7.7	69.8
Electricity supply sector [b]	7.4	12.9	20.3	22.1	21.9	21.7	27.3	55.7	78.0	114.9

Notes

a. This reflects the EU ETS price: there is no Carbon Price Support.

b. i.e. with Carbon Price Support.

[46] See *Using evidence and analysis to inform energy and climate change policies*: https://www.gov.uk/government/policies/using-evidence-and-analysis-to-inform-energy-and-climate-change-policies/supporting-pages/policy-appraisal

[47] See *Updated short-term traded carbon values used for modelling purposes, DECC, Sept 2014*: https://www.gov.uk/government/collections/carbon-valuation--2

[48] See *Carbon price floor: reform*: https://www.gov.uk/government/publications/carbon-price-floor-reform

Future temperatures

An important change this year is the use of Met Office projections of future climate (UKCP09[49]). The Department for Environment, Food and Rural Affairs (DEFRA) commissioned these to estimate the UK-wide impact of climate change. They demonstrate an expected long-term increase in temperatures whilst preserving short-term fluctuations in the weather.

Cold weather in winter has a big impact on energy use—especially so in the residential and service sectors. This is why estimates of Winter Degree Days (WDDs)[50] are included in the modelling. Two slightly different WDD seasons are used: January-March with December of the same year for electric and solid fuel heating, and Jan-April with November-December for gas and oil heating. Table 7.6 shows population weighted WDDs. There is a fuller explanation of how they are derived and used in *Updated energy and emissions projections 2014: methodology update*[51].

Table 7.6: Population weighted winter degree days

Number of UK winter degree days [a]

	2013	2014	2015	2016	2017	2018	2020	2025	2030	2035
4-month heating season (J,F,M,D)	1,391	1,244	1,250	1,181	1,184	1,181	1,182	1,152	1,167	1,146
6-month heating season (J,F,M,A,N,D)	1,911	1,688	1,717	1,625	1,640	1,638	1,609	1,571	1,593	1,561

Notes

a. These values are the averages of 11 model variants.

[49] See *UK Climate Projections 2009 (UKCP09)*:
http://www.metoffice.gov.uk/services/climate-services/uk/ukcp

[50] Winter Degree Days are the number of degrees the external temperature is below 15.5°C on any one particular day summed over all the days in a season.

[51] See *Updated energy and emissions projections 2014: methodology update:*
https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2014

8 List of supporting tables

The following data tables are available for download. They include projections for individual years for a range of scenarios. We give the corresponding annex in EEP 2013 in brackets. Note that an equivalent of Annex C was not produced last year.

Annex A: Greenhouse gas emissions by source (A)

Annex B: Carbon dioxide emissions by source (B)

Annex C: Carbon dioxide emissions by IPCC category

Annex D: Policy savings in the projections (G)

Annex E: Primary energy demand (H)

Annex F: Final energy demand (C)

Annex G: Major power producers' generation by source (D)

Annex H: Major power producers' cumulative new electricity generating capacity (K)

Annex I: Major power producers' total electricity generating capacity (L)

Annex J: Total electricity generation by source (E)

Annex K: Total cumulative new electricity generating capacity (I)

Annex L: Total electricity generating capacity (J)

Annex M: Growth assumptions and prices (F)

Appendix A

List of abbreviations

BAU	Business as Usual
CCS	Carbon Capture and Storage
CO_2	carbon dioxide
CPF	Carbon Price Floor
CPS	Carbon Price Support
CERT	Carbon Emissions Reduction Target
CESP	Community Energy Saving Programme
CCA	Climate Change Agreement
CCC	Climate Change Committee
CCS	Carbon Capture and Storage
CHP	Combined Heat and Power
CI	Confidence Interval
CfD	Contracts for Difference
CRC	Carbon Reduction Commitment
DCLG	Department for Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
DECC	Department of Energy and Climate Change
DfT	Department for Transport
DUKES	Digest of United Kingdom Energy Statistics
DDM	Dynamic Dispatch Model
ECO	Energy Company Obligation
EEC	Energy Efficiency Commitment
EEP	DECC Energy and Emissions Projections
EMR	Electricity Market Reform
ESOS	Energy Savings Opportunity Scheme
EPBD	Energy Performance of Buildings Directive
EU	European Union
EUA	EU (emissions) allowance
ETS	Emissions Trading System
GDP	Gross Domestic Product
GWP	Global Warming Potentials
GHG	greenhouse gas
IED	Industrial Emissions Directive
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land-Use Change, and Forestry
LCPD	Large Combustion Plant Directive

LCTP	Low Carbon Transition Plan
LSTF	Local Sustainable Transport Fund
MPP	Major Power Producer
NC	National Communication
ND	Non-Domestic
PFC	perfluorocarbon
PRS	Private Rented Sector
RHI	Renewable Heat Incentive
RTFO	Renewable Transport Fuel Obligation
ROC	Renewables Obligation Certificate
SME	Small and Medium Enterprise
NAEI	UK National Atmospheric Emissions Inventory
UNFCCC	United Nations Framework Convention on Climate Change
WAM	'With Additional Measures'
WEM	'With Existing Measures'

© Crown copyright 2014
Department of Energy & Climate Change
3 Whitehall Place
London SW1A 2AW
www.gov.uk/decc
URN 14D/198