



Department for
Business, Energy
& Industrial Strategy

ANNUAL STATEMENT OF EMISSIONS

**Reporting UK 2016 emissions to Parliament under the
Climate Change Act 2008**



March 2018

Annual Statement of Emissions for 2016

Presented to Parliament pursuant to section 16 of the Climate
Change Act 2008

March 2018

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Introduction

1. The Climate Change Act 2008¹ requires that the Government reports annual emissions to Parliament. This is the ninth annual statement of emissions required under section 16 of the Climate Change Act 2008. It confirms emissions for 2016 – the fourth year of the second carbon budget.
2. The second carbon budget period runs from 2013 to 2017 with an emissions cap of 2,782 MtCO_{2e}. The third budget will cover the period 2018–2022 (2,544 MtCO_{2e}) and the fourth budget 2023–2027 (1,950 MtCO_{2e}). In June 2016, the Government set the level for the fifth carbon budget (2028–2032) at 1,725 MtCO_{2e}.
3. Annual statements are based on national greenhouse gas emissions statistics² which take two years to be compiled so this annual statement covers emissions for the year 2016. The annual statement of emissions for 2017 will be published in March 2019.

Structure of the report

4. **Part one** of this statement shows the total amount of UK greenhouse gases (GHGs) emitted to and removed from the atmosphere in 2016; the methods used to calculate those figures; and whether there was an increase or a decrease in emissions from the previous year. In 2016, net UK emissions were 468 MtCO_{2e}. This is a 41% reduction in GHG emissions from the 1990 base year.
5. **Part two** of this statement sets out the steps taken to calculate the “net UK carbon account” for 2016, the UK’s total GHG emissions after we have taken into account the effect of carbon trading. The net carbon account for the second carbon budget must not exceed 2,782 million tonnes of carbon dioxide equivalent (MtCO_{2e}).
6. The net carbon account allows us to reflect the EU Emissions Trading System (EU ETS) in the carbon budget system and we call this the ‘traded sector’. When we set the second carbon budget, the rules around the EU ETS were not known and therefore we estimated the size of the UK’s share of the EU ETS. The rules are now known and so we are able to more accurately calculate the UK share of the cap in

¹ Under Section 16 of the Climate Change Act 2008 Government must lay an annual statement of emissions: <http://www.legislation.gov.uk/ukpga/2008/27/contents>.

² The final 2016 estimates of UK greenhouse gas emissions were published on 6 February 2018. See: <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2016>

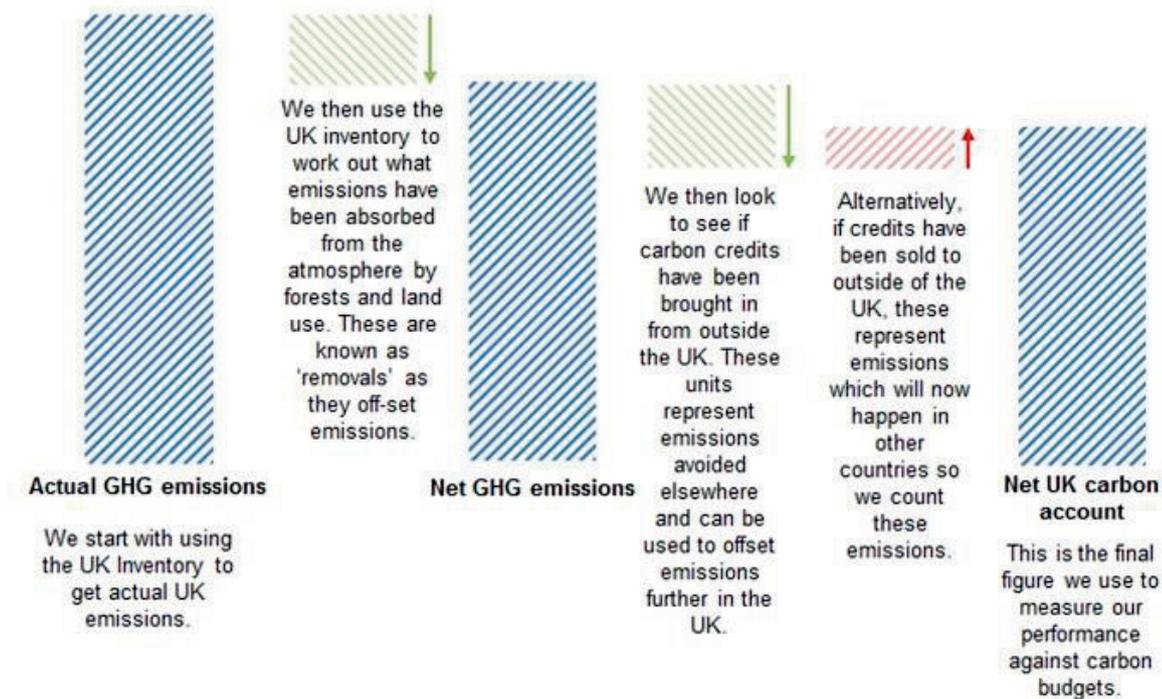
carbon budgets. This shows that after taking into account crediting or debiting of units due to the EU ETS and domestic aviation emissions, the net UK carbon account in 2016 was 467 MtCO_{2e}. This means that in 2016 the ETS cap was approximately 67 MtCO_{2e} smaller than that included in the fixed cap approach³.

Explaining the net UK carbon account

7. Section 27 of the Climate Change Act defines the “net UK carbon account”. This is what we compare against carbon budgets to determine whether we are meeting them. The net UK carbon account must not exceed the level of the carbon budget at the end of each budgetary period. The process for determining the net UK carbon account in each year is summarised in Figure 1.
8. The starting point is UK emissions for the year, using data from the annual statistical release of UK greenhouse gas emissions, published as National Statistics each February². These comprise emissions from all sources in the UK, including those from land use, land use change and forestry (LULUCF). These are then adjusted to take into account removals of carbon dioxide from the atmosphere by sinks associated with LULUCF activity. The new total is referred to as net UK emissions.
9. Net UK emissions are then further adjusted to account for:
 - a. carbon units which have been brought in from overseas by Government and others (e.g. installations covered by the EU ETS) to offset UK emissions (“credits”), thereby reducing the net UK carbon account; and
 - b. UK carbon units which have been sold to a third party outside the UK or otherwise disposed of (“debits”), which increase the net UK carbon account as the recipient can use these units to offset their own emissions and it would lead to double counting if they were also used to offset UK emissions.

³ A full comparison of the traded sector cap approach will be made in the End of Budgetary Statement in 2019.

Figure 1: The UK net carbon account



Effort Sharing Decision

10. The EU Effort Sharing Decision (ESD) establishes binding annual greenhouse gas emission targets for Member States for the period 2013–2020 and creates a new carbon unit to measure Member State compliance. The ESD covers emissions from most sectors not included in the EU ETS, such as transport (except aviation and international maritime shipping), buildings, agriculture and waste but excludes emissions from LULUCF.
11. The first formal confirmation of the UK’s compliance with the ESD began in 2017. To date the European Commission has confirmed that UK ESD emissions for years 2013-15 were 73 MtCO_{2e} below the target for this period. Provisional 2016 ESD emissions⁴ suggest the UK will continue to increase this surplus with emissions 11 MtCO_{2e} below its target for that year. The UK does not intend to trade its ‘Annual Emissions Allocation’ units associated with this surplus with other countries. As such ESD trading will not be included in the net carbon account calculation.

⁴ All ESD emissions reported to the European Commission are reviewed before final performance is confirmed. We therefore expect final 2016 performance to be known towards the end of 2018.

Part 1 – UK greenhouse gas emissions

12. The information contained in this part of the statement is derived from the UK greenhouse gas emissions statistics for 2016², which were published on 6 February 2018. Emissions coverage under the Climate Change Act 2008 comprises UK territory only (i.e. England, Wales, Scotland and Northern Ireland)⁵. Unless otherwise stated, all figures in this section are stated in tonnes of carbon dioxide equivalent (tCO₂e)⁶.

1.1 2016 and base year emissions by gas

Section 16(3) and 16(8) of the Climate Change Act

13. Table 1 below sets out the base year emissions – the emissions in the year against which progress is measured – for each greenhouse gas covered by the Climate Change Act. The table also sets out the total UK emissions for 2016.

14. Each year the UK greenhouse gas inventory is reviewed and updated to include methodological improvements, changes to international reporting guidelines or new data, all of which may change base year emissions. Overseen by the National Inventory Steering Committee, this process decreased the total emissions in 1990 by 1% when compared with the 2015 Annual Statement of Emissions. See section 1.2 for more details.

⁵ Section 89 of the Climate Change Act specifies that this includes UK coastal waters and the UK sector of the continental shelf.

⁶ This is the usual way of reporting greenhouse gases to account for the different global warming potentials of each gas. The global warming potential (GWP) of a gas is a measure of its impact on global warming relative to carbon dioxide. The GWP used for each gas in the UK inventory are based on those published in the Intergovernmental Panel on Climate Change's (IPCC's) 4th Assessment report: <http://www.ipcc.ch/report/ar4/>.

Table 1: Base year and 2016 emissions for each greenhouse gas, tCO₂e

Greenhouse gas	Base year	Net base year emissions	2016 UK emissions excluding net emissions/removals from LULUCF (A)	2016 net UK emissions/removals from LULUCF (B) ⁷	2016 UK emissions including net emissions/removals from LULUCF (A - B)
Carbon dioxide CO₂	1990	594,078,349	394,899,760	-16,025,595	378,874,165
Methane CH₄		133,205,790	51,556,954	34,736	51,591,690
Nitrous oxide N₂O		49,590,620	19,959,894	1,433,385	21,393,279
Hydrofluorocarbons HFCs	1995	19,088,085	15,164,000	0	15,164,000
Perfluorocarbons PFCs		596,760	353,941	0	353,941
Sulphur hexafluoride SF₆		1,264,503	507,031	0	507,031
TOTAL⁸		797,824,107	482,441,580	-14,557,474	467,884,106

15. The Annex at the end of this annual statement provides data for each of the greenhouse gases covered by the Climate Change Act and carbon budgets framework. As required by the Act, this includes details of:

- The amount for 2016 of UK emissions, UK removals and net UK emissions of each gas.
- Whether any of those amounts represent an increase or decrease compared to the equivalent amount for the previous year.

⁷ A positive amount means the net effect is the removal of greenhouse gases from the atmosphere, while a negative figure means the net effect is emissions to the atmosphere.

⁸ Figures may not sum due to rounding.

16. Section 16 also requires that the annual statement includes details of the methods used to measure or calculate those amounts, and this is set out in section 1.2.

1.2 Change of method

Section 16(4) of the Climate Change Act

17. The UK's greenhouse gas inventory is compiled in line with international guidance from the Intergovernmental Panel on Climate Change⁹ (IPCC). Each year the inventory is updated to include the latest data available. Methodological changes are made to take account of new data sources, or new guidance from the IPCC, relevant work by CORINAIR¹⁰, and new research, sponsored by BEIS or otherwise. Improvements to the methodology are backdated as necessary to ensure a consistent time series. The United Kingdom's National Inventory Report¹¹ (NIR), which is submitted each year to the UNFCCC, provides details of the methods used to estimate emissions.

18. Emission inventories will always have some uncertainty. It is not possible to measure directly all the emissions from a country, so inventories are largely based on statistical activity data as well as on emission factors¹², both of which are subject to uncertainty. The UK Greenhouse Gas Inventory assesses uncertainties according to internationally agreed good practice guidance¹³, and this uncertainty information helps prioritise efforts to improve the accuracy of inventories in the future and guide decisions on methodological choice. The uncertainty analysis provides us with a high confidence that UK emissions of greenhouse gases have declined since 1990. The uncertainty associated with estimates of emissions of carbon dioxide (CO₂) is small, at approximately 2% based on 2015 emissions data. The uncertainty associated with the emissions of the other greenhouse gases is higher, and so uncertainty for the

⁹ Further details on IPCC guidance is available from: www.ipcc-nggip.iges.or.jp.

¹⁰ The air pollutant emission inventory guidebook, which provides guidance on estimating emissions from both anthropogenic and natural emission sources, is available from: <http://www.eea.europa.eu/themes/air/emep-eea-air-pollutant-emission-inventory-guidebook>.

¹¹ The NIR is accessible from the UNFCCC website: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10566.php

Alternatively, further details on how the UK's greenhouse gas inventory is compiled can be accessed from: <https://www.gov.uk/government/collections/uk-greenhouse-gas-emissions-statistics>.

¹² The emissions factor is the emissions per unit of activity. Emission factors are typically derived from measurements on a number of representative sources and the resulting factor applied to all similar sources in the UK.

¹³ Intergovernmental Panel on Climate Change guidelines, as adopted by the UNFCCC.

entire group of greenhouse gases is roughly 3%. Further details regarding the calculation of inventory uncertainty are provided in the National Inventory Report¹⁴.

19. To ensure transparency and credibility in carbon budgets reporting, it is important that any methodological changes to greenhouse gas reporting – made in accordance with international practice - are clearly stated. Section 16(4) of the Climate Change Act requires that, where a change in methodology at the international level requires an adjustment in the emissions figures for an earlier year in the same budgetary period, the annual statement of emissions must specify the adjustment required and state the adjusted amount.
20. In preparing the 2016 emissions inventory, a number of revisions were made to the figures previously reported for earlier years, to take account of new methodologies which have been applied in respect of a number of specific sectors. These methodologies have been introduced in accordance with international reporting guidelines and the findings of the annual UNFCCC review of the UK inventory¹⁵, and the revised figures will be included in the UK's submission to the UNFCCC and the European Commission.
21. Tables 2 and 3 show the impacts of these revisions on 2015 emissions and the base-year emissions respectively. As a result of the changes 2015 emissions decreased by 3.4 MtCO_{2e}, whilst base-year emissions decreased by 4.8 MtCO_{2e}. The most significant of these revisions apply to the transport, agriculture and land use sectors. See the list below for further details.

- **Implementation of new shipping emissions model**

Increased availability of high quality ship tracking data prompted a review of the previous shipping model used. The new model was developed using 2014 terrestrial automatic identification system (AIS) data supplied by the Maritime and Coastguard Agency. This carries out an emission calculation, specific to each vessel, for each point of the vessel's voyage tracked by AIS data. This method now meets and exceeds the requirements of a tier 3 methodology set out in the emissions inventory guidebook¹⁶ and 2006 IPCC guidelines¹⁷. Emission factors have also been updated. Emissions estimates have increased by 6.2 MtCO_{2e} in 1990 and 3.6 MtCO_{2e} in 2015.

¹⁴ Uncertainties are based on 2015 data. For further information, see Annex 2 page 662:

http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10116.php

¹⁵ The latest annual review can be found on the UNFCCC website:

http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/9916.php

¹⁶ <https://www.eea.europa.eu/themes/air/emep-eea-air-pollutant-emission-inventory-guidebook/emep>

¹⁷ <https://www.ipcc-nggip.iges.or.jp/public/2006gl/>

- **Changes to estimates of emissions from landfill waste**

The development of Devolved Administration (DA)-specific policies relating to residual waste disposal, and availability of more detailed historic data, enable us to calculate DA-specific emissions for landfill and address previous concerns with regard to the quality of some of the data used. DA-specific data has been provided by environmental regulators, allowing us to create four separate models, one for each DA. These are then aggregated to calculate national methane emissions from this sector. Overall these changes increase our estimates of landfill waste emissions by 0.9 MtCO_{2e} in 2015. Emissions estimates for 1990 are unaffected by this change.

- **Changes to estimates of emissions from harvested wood products in the UK**

The UNFCCC review of the inventory identified that the proportion of harvested wood products allocated to different semi-finished products was inconsistent with FAO¹⁸ data. An improvement was made to harvested wood products to change the mix of semi-finished wood products to vary over time to match the information from this data and Forest Statistics¹⁹. This change decreases our estimate of emissions by 0.6 MtCO_{2e} in 1990 and increases our estimate by 0.8 MtCO_{2e} in 2015.

- **Changes to agriculture model as part of Defra's Smart Inventory**

Changes were made as part of Defra's improvement programme to ensure that the UK inventory accurately represents the UK agricultural sector. This included a move to tier 3 approaches for estimating enteric methane emissions for all cows and sheep and methane from manure management, using UK-specific data. Other improvements included the creation of a new model which incorporates the ammonia and GHG inventories for the agriculture sector, and modelling nitrogen flow through livestock manure management in the UK. Overall, these resulted in a decrease in estimates of emissions of 3.6 MtCO_{2e} and 3.0 MtCO_{2e} in 1990 and 2015 respectively.

- **Changes to estimates of emissions from forest land**

There have been several specific changes in this area. The largest change is to remaining Forest carbon stock change due to new assumptions used in the improvement of the forest carbon (CARBINE) model and changes to deforestation areas leading to changes in carbon stock values and emissions, leading to a decrease in emissions in both 1990 and 2015. A UNFCCC recommendation also led to changes in the Grassland to Forest land stock for the UK, resulting in decreases in emissions for 1990 and 2015. More minor updates include further new assumptions for improvement of the CARBINE model and changes to the Land Use Change matrices. Overall these changes to emissions from forest land decrease estimates of emissions by around 7.1 MtCO_{2e} in 1990 and by around 8.3 MtCO_{2e} in 2015.

¹⁸ Food and Agriculture Organisation of the United Nations: <http://www.fao.org/faostat/en/#home>

¹⁹ Forestry Statistics: <https://www.forestry.gov.uk/forestry/inf-d-7aqdgc>

- **Other changes to emissions**

There have been a number of small changes in the LULUCF sector due to UNFCCC review recommendations and improvements made by the inventory agency. New assumptions were made for settlement, cropland and grassland for improvement of the CARBINE model. The improvements also included continuous improvement for Crown Dependencies and Overseas Territories, and implementation of the UNFCCC recommendation to change the assignment of orchard area to be included in cropland instead of forestland. There have also been minor changes across all sectors as a result of a change in data processing in the emission factor database. The change has been made as part of a wider transition towards processing inventory data in energy units, for consistency with international reporting requirements. Emission factors are now imported in the original units as presented in the literature source for the factors, and converted to NAEI units (mass units for liquid and solid fuels, megatherms for gaseous fuels) centrally in the database. This forces consistency in assumptions across pollutants, and allows variation in the timeseries where the calorific values change from year to year.

Table 2: Inventory revisions affecting 2015 emissions, reported from 2016 inventory, by sector, tCO_{2e}

Sector	2015 emissions as reported in the 2015 inventory (tCO_{2e})	2015 emissions as reported in the 2016 inventory (tCO_{2e})	Change in emissions reported for 2015 (tCO_{2e})
Agriculture	49,118,167	46,329,168	-2,788,999
Business	84,646,708	86,184,263	1,537,555
Energy supply	144,125,581	144,437,620	312,039
Industrial processes	12,705,553	12,739,461	33,908
Land Use, Land Use Change and Forestry (LULUCF)	-7,376,539	-15,104,043	-7,727,504
Public	8,087,960	8,021,451	-66,509
Residential	66,257,606	67,393,220	1,135,614
Transport	120,021,554	123,430,096	3,408,543

Waste management	18,161,824	18,961,228	799,404
TOTAL	495,748,413	492,392,463	-3,355,950

Table 3: Inventory revisions affecting base year emissions, reported from 2016 inventory, by sector, tCO₂e

Sector	Base year emissions as reported in the 2015 inventory (tCO₂e)	Base year emissions as reported in the 2016 inventory (tCO₂e)	Change in emissions reported for the base year (tCO₂e)
Agriculture	58,896,843	55,321,070	-3,575,773
Business	115,192,013	115,503,352	311,339
Energy supply	277,911,416	277,886,443	-24,973
Industrial processes	62,119,668	62,116,650	-3,017
Land Use, Land Use Change and Forestry (LULUCF)	5,717,581	-2,111,191	-7,828,772
Public	13,496,852	13,497,384	532
Residential	80,797,704	80,823,282	25,578
Transport	121,871,200	128,107,323	6,236,123
Waste management	66,646,713	66,679,793	33,080
TOTAL	802,649,991	797,824,107	-4,825,885

22. In line with the Climate Change Act, any adjustment to annual UK greenhouse gas emissions resulting from improved methodology from annual developments of the inventory is applied retrospectively to all preceding years at the end of the budgetary period. For the second carbon budget these will then be presented in the End of Budgetary Period Statement as final emissions in 2019.

1.3 International aviation and shipping

Section 16(5) of the Climate Change Act

23. Emissions from international aviation and international shipping can be estimated from refuelling from bunkers at UK airports and ports, whether by UK or non-UK operators. Under the reporting guidelines agreed by the UNFCCC, these emissions are not included in the UK's emissions total, but are reported as memo items in the national greenhouse gas inventory. Table 4 below shows greenhouse gas emissions from these sources in 2016.

Table 4: Greenhouse gas emissions from UK-based international aviation and shipping bunkers in 2016, tCO₂e	
International aviation total	33,997,537
Carbon dioxide	33,676,703
Methane	2,211
Nitrous oxide	318,623
International shipping total	8,583,002
Carbon dioxide	8,464,537
Methane	2,728
Nitrous oxide	115,737
TOTAL	42,580,539

Part 2 – the net UK carbon account

24. This part sets out the amount of carbon units which are to be credited to and debited from the net UK carbon account in 2016. Government must follow the rules set out in the regulations when working out the net UK carbon account and so the calculations in this part of the statement are based on the methodologies established by the Carbon Accounting Regulations 2009 and the Carbon Accounting (2013–2017 Budgetary Period) Regulations 2015.

2.1 Total amount of units credited to and debited from the net UK carbon account

Section 16(6) of the Climate Change Act

25. The net UK carbon account for a given year is calculated by taking net UK emissions for that year, with an adjustment made to reflect the amount of units to be credited to, and debited from, the net UK account for that year. Carbon units that are counted as credits reduce the level of the net UK carbon account, while carbon units that are counted as debits increase the level of the net UK carbon account.

26. The amounts of units to be counted as credits and debits in respect of 2016 should be calculated based on three elements:

- amount of units in the credit account which have been declared as credits to the net UK carbon account in respect of 2016
- effect of the EU ETS (including emissions arising from domestic aviation)
- determining whether the Government disposed of any carbon units during the course of 2016.

2.1.1 Units in the credit account

27. The Government set up a “credit account” in the UK Registry in 2009 which is the dedicated route through which carbon units can be credited voluntarily to the net UK carbon account. In 2016, zero units are to be credited to the net UK carbon account under this mechanism.

2.1.2 Accounting for the EU Emissions Trading System (EU ETS)

28. The net carbon account reflects the operation of the EU ETS.

29. The EU ETS is a cap and trade system that sets a limit on the total amount of greenhouse gases that can be emitted by installations in the system²⁰. This cap is reduced over time so that emissions decrease. If EU ETS participants in the UK collectively exceed the UK cap, the amount of emissions in excess of the cap must be considered as a 'credit', as operators must have bought units from other EU ETS participants to cover these emissions. If on the other hand EU ETS participants in the UK collectively reduce their emissions below the UK cap, then the difference between reported emissions from the EU ETS sector and the cap must be considered a 'debit', as operators must have sold or retained excess units which are not required to cover emissions in the UK.
30. The EU ETS is currently in its third phase, which runs from 2013 to 2020. In this phase Member States do not receive a national fixed cap as was the case during the first carbon budget²¹; the ETS operates at installation level²². As the net carbon account calculation relies on a cap for the traded sector, for the second budgetary period a 'notional' cap will be estimated. This notional cap estimates the UK share of a given EU-wide cap, replicating the components of the previous cap as defined in EU regulations.

2.1.3 EU ETS notional cap

31. The methodology for estimating the UK's notional share of the EU-wide cap is set out in tables 5 and 6.
32. The notional cap is created by adding together the volume of EU allowances freely allocated to stationary UK operators, the volume of allowances in the EU-wide auction pot to be auctioned by the UK to stationary operators, and an estimated share of the New Entrants Reserve (NER).
33. The volume of EU allowances freely allocated to stationary UK operators, for the purposes of this calculation, is taken from the UK's finalised NIMs (National Implementation Measures). The NIMs are the installation level list of free EU ETS allocations to stationary UK operators²³.

²⁰ http://ec.europa.eu/clima/policies/ets/index_en.htm.

²¹ Details of this calculation can be found in the end of budgetary statement found here: <https://www.gov.uk/government/statistics/final-statement-for-the-first-carbon-budget-period>.

²² Detailed guidance on Phase 3 of the ETS can be found here: <https://www.gov.uk/participating-in-the-eu-ets>.

²³ Free allocation data based on NIMs are updated annually and can be found in two locations: <https://www.gov.uk/guidance/participating-in-the-eu-ets>
https://ec.europa.eu/clima/policies/ets/registry_en

34. The volume of allowances in the EU-wide auction pot to be auctioned by the UK to stationary operators each year is captured through the UK’s auctioning platform²⁴.
35. The NER is an additional amount of free allowances set aside for new installations that are covered by the scope of the ETS Directive, and installations that increase capacity, covering the whole of Phase III (years 2013–20).
36. The UK’s share of NER allowances will only be known once these allowances have been allocated. This means that it is unknown how allowances will be allocated in total over phase III (and thus, over the second and third carbon budget periods), and to which Member States. An indicative annual split of the NER allowances will be estimated for each year of the second carbon budget for the purpose of calculating the notional cap. The total NER represents 5% of the 2013-20 total fixed installation cap; therefore the annual split will reflect this proportion by taking 5% of the annual fixed installation cap for 2016. An indicative estimate of the UK share of the NER for 2016 is arrived at by assuming that the UK share of the NER will mirror the UK share of free allowances in that year. This method is demonstrated in table 5. Further guidance on participation in the EU ETS, including information on these various types of allowances, is published on the European Commission website²⁵.

Table 5: UK Notional Allocation of New Entrants Reserve for 2016, tCO_{2e}	
Total EU ETS cap for fixed installations in 2016 (A)	1,969,509,118
New Entrants Reserve 2016 as 5% of total cap [(A) x 0.05=(B)]	98,475,456
UK share of free allowances in 2016 (C)	7.8%
UK notional share of NER in 2016 [(C) x (B)=(D)]	7,646,187

²⁴ ICE futures Europe: <https://www.theice.com/emissions/auctions>

²⁵ http://ec.europa.eu/clima/policies/ets/cap/index_en.htm.

Table 6: UK Notional EU ETS cap for 2016, tCO_{2e}	
Amount of free allowances allocated to the UK in 2016 (E)	58,418,225
Amount of auctioned allowances allocated to the UK in 2016 (F)	80,258,000
Estimated amount of New Entrants Reserve for the UK in 2016 (D)*	7,646,187
UK Notional Cap for 2016 [(D)+(E)+(F)]	146,322,412

* See table 5

37. For 2016 the resulting UK notional cap will be 146 MtCO_{2e}, as shown in table 6. Table 7 sets out the number of units surrendered in 2016 by UK operators, thus showing the effect of the EU ETS on the net UK carbon account in 2016.

Table 7: The effect of the EU ETS on the net UK carbon account in 2016, tCO_{2e}	
Total amount of units surrendered by UK operators (A)	147,423,466
UK's EU ETS annual allocation for 2016 (B)	146,322,412
Difference between 2016 annual allocation and amount of units surrendered (A - B)	1,101,054

38. As the amount of units surrendered by UK operators was greater than the (notional) annual allocation for 2016, a corresponding amount of units must be counted as credits to the net carbon account. **This means 1,101,054 units are to be credited to the net UK carbon account in 2016** as a result of the EU ETS.

2.1.4 Domestic aviation emissions

39. Under the Climate Change Act, the net carbon account must contain emissions generated by domestic aviation (flights between UK airports). Historically this has been reported in the “non-traded” sector of the UK’s emissions, but are now included in the EU ETS. As a result domestic aviation carbon dioxide emissions are included in the “traded sector” of the budgets.

40. In order to determine whether units should be credited to or debited from the net UK carbon account in each year, the number of allowances surrendered is compared with “the annual allocation”, i.e. the domestic aviation emissions cap²⁶.

2.1.4.1 Methodology to calculate domestic aviation cap

41. Using the latest available civil aviation data from the UK greenhouse gas inventory submitted under the EEA, and published on the EEA website²⁷, the steps listed below set out how we estimate a cap against which we report carbon dioxide emissions from UK domestic aviation. The calculation is then summarised in table 8.
42. This approach uses a **baseline** of total EEA domestic flights (i.e. total flights within individual EU countries plus Norway, Liechtenstein and Iceland), and an estimate of what **share of this total** can be attributed to the UK. The cap declines through time (by 95% in 2013–2020), reflecting the ambition to reduce emissions from aviation.
43. There are three steps to the calculation:

1. Calculate a baseline of total EU domestic aviation

The baseline is the average of 2004–06 EEA domestic aviation carbon dioxide emissions²⁸ (flights within individual EEA countries). 2004–06 is used as this is a common baseline used for EU environmental targets.

2. Calculate UK share and apply to the baseline

The UK’s share of EEA domestic aviation carbon dioxide emissions is taken from 2010. The UK’s domestic aviation emissions are compared to total EEA domestic aviation emissions in this year²⁸ (data for both are taken from the EU inventories as reported by EEA). 2010 is used because this was the benchmarking year for the allocation of free allowances to aircraft operators. This UK share of EEA domestic aviation is then applied to the 2004–06 EEA average.

3. Set a declining trajectory in line with ambitions to reduce emissions

For 2013-20, the cap will be 95% of this annual average.

²⁶ Please refer to section 2.1.4 in the Annual statement of emissions for 2014 for a full explanation of domestic aviation emissions:

<https://www.gov.uk/government/publications/annual-statement-of-emissions-for-2014>.

²⁷ EEA website: <http://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-unfccc-and-to-the-eu-greenhouse-gas-monitoring-mechanism-12>.

²⁸ The total EEA figure will differ slightly from that published on the EEA website due to the removal of emissions attributable to UK flights to and from Gibraltar, which are included in the UK submission for the EU inventory, but which are not applicable to UK domestic aviation emissions under the Climate Change Act. This ensures that the UK figures used within the cap are calculated on an equivalent basis to that used for the 2015 UK domestic aviation emissions used to assess performance.

2.1.4.2 Methodology to assess performance against the cap

44. The UK’s carbon dioxide emissions from domestic aviation in 2016 (performance) are taken from the UK inventory.

45. To assess the UK’s performance against this cap, the following methodology is used:

- Compare the national inventory figure for annual UK domestic aviation carbon dioxide emissions with the domestic aviation cap, then
- If emissions exceed the cap then the difference is counted as a credit to the net UK carbon account.
- If emissions are below the cap then the difference is counted as a debit to the net UK carbon account.

2.1.4.3 Calculations

Table 8: Estimate of 2016 domestic aviation emissions cap, tCO _{2e}		
1	Average 2004–06 EEA domestic aviation CO ₂ emissions (A)	20,166,443
2	UK’s share of 2010 EEA domestic aviation CO ₂ emissions (B)	9.5%
3	UK as a proportion of the 2004–06 EEA average (C) =(A x B)	1,906,129
4	For 2016, the cap will be 95% of this annual average (C) x 0.95	1,810,823

Table 9: Performance against the domestic aviation emissions cap, tCO _{2e}	
Domestic aviation cap (A)	1,810,823
2016 domestic aviation CO ₂ emissions (B)	1,456,787
Difference between 2016 cap and performance (A - B)	354,036

46. In 2016 the cap for domestic aviation is estimated as 1.8 MtCO_{2e}. Emissions for domestic aviation (taken from the inventory) in 2016 were 1.5 MtCO_{2e}.

47. As carbon dioxide emissions from domestic aviation were less than the cap for 2016, a corresponding amount of emissions will be counted as debits. This means that 0.4 MtCO_{2e} will be debited from the net UK carbon account in 2016, as shown in table 9.

2.2 Net UK carbon account for the year

Section 16(7) of the Climate Change Act

48. As described above, the net UK carbon account is calculated by taking net UK emissions and adjusting these to account for the amount of units to be debited from and credited to the net UK carbon account.

49. The information in table 10 is taken from preceding tables in this report and provides an amount for the net UK carbon account of 467 MtCO_{2e}.

50. The final net carbon account for the second carbon budget will be presented in the End of Budgetary Period Statement in 2019.

Table 10: Summary of how the net UK carbon account for 2016 is calculated, tCO_{2e}	
2016 net UK emissions – see table 1 (A)	467,884,106
Amount of units to be credited (B)	1,101,054
EU ETS Fixed Installations	1,101,054
EU ETS Domestic Aviation	0
Amount of units to be debited (C)	354,036
EU ETS Fixed Installations	0
EU ETS Domestic Aviation	354,036
2016 Net UK carbon account, tCO_{2e} ((A - B) + C)	467,137,088

Annex – 2016 emissions by gas

Section 16(2) of the Climate Change Act

51. The emissions and removals data included in table 11 below are taken from the greenhouse gas emissions data published on 6 February 2018²⁹, derived from the UK's 1990–2016 National Greenhouse Gas Emissions Inventory. The methodologies used to calculate and compile these data are in line with United Nations Framework Convention on Climate Change (UNFCCC) reporting guidelines on annual inventories. These methods include emissions factors (country specific, plant specific and the default emissions factors used under the international framework), as well as emissions and production data reported by operators and regulators, and modelling²⁹.

²⁹ Further details on the methods used in specific sectors are set out in table 13 of the data tables published alongside the final 2016 emissions data, available from:
<https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2016>.

Table 11: 2016 emissions by gas, tCO₂e

	Carbon dioxide	Methane	Nitrous oxide	HFCs³⁰	PFCs³¹	SF₆³²
2016 UK emissions excluding net emissions/removals from LULUCF (A)	394,899,760	51,556,954	19,959,894	15,164,000	353,941	507,031
2015 UK emissions excluding net emissions/removals from LULUCF (B)	419,115,876	51,558,544	20,090,783	15,946,491	327,229	457,582
Increase or decrease on previous year (A – B)	Decrease of 24,216,117 tCO ₂ e on previous year	Decrease of 1,589 tCO ₂ e on previous year	Decrease of 130,889 tCO ₂ e on previous year	Decrease of 782,492 tCO ₂ e on previous year	Increase of 26,712 tCO ₂ e on previous year	Increase of 49,449 tCO ₂ e on previous year
2016 UK emissions/removals from LULUCF³³ (C)	-16,025,595	34,736	1,433,385	0	0	0
2015 UK emissions/removals from LULUCF (D)	-16,569,942	20,760	1,445,139	0	0	0
Increase or decrease on previous year (C – D)	Increase of 544,347 tCO ₂ e on previous year	Increase of 13,976 tCO ₂ e on previous year	Decrease of 11,754 tCO ₂ e on previous year	N/A	N/A	N/A

³⁰ Hydrofluorocarbons.³¹ Perfluorocarbons.³² Sulphur hexafluoride.³³ A positive amount means the net effect is the removal of greenhouse gases from the atmosphere, while a negative figure means the net effect is emissions to the atmosphere.

2016 UK emissions including net emissions/ removals from LULUCF³⁴ (E = A – C)	378,874,165	51,591,690	21,393,279	15,164,000	353,941	507,031
2015 UK emissions including net emissions/ removals from LULUCF (F = B – D)	402,545,934	51,579,304	21,535,922	15,946,491	327,229	457,582
Increase or decrease on previous year (E – F)	Decrease of 23,671,770 tCO ₂ e on previous year	Increase of 12,386 tCO ₂ e on previous year	Decrease of 142,643 tCO ₂ e on previous year	Decrease of 782,492 tCO ₂ e on previous year	Increase of 26,712 tCO ₂ e on previous year	Increase of 49,449 tCO ₂ e on previous year

³⁴ Removals of greenhouse gas from the atmosphere do not apply to HFCs, PFCs or SF₆.

