The Scottish Greenhouse Gas Emissions Annual Target Report for 2015

incorporating report on impact on emissions of exercise of electricity generation related functions

Laid before the Scottish Parliament by the Scottish Ministers under Sections 33 and 38 of the Climate Change (Scotland) Act 2009

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Contents

Summary

This is the sixth report on the Scottish greenhouse gas emissions annual target required under section 33 of the Climate Change (Scotland) Act 2009 ('the Act'), and relates to the 2015 target year. It also fulfils the requirement under section 38 of the Act to report on the impact on emissions resulting from the exercise of electricity generation related functions (see Part 4).

For the purposes of this report, reporting requirements under section 33 of the Act have been separated into four parts as follows:

Part 1: Annual and Domestic Effort Targets

Part 1 of this report shows that both the annual and domestic effort targets for 2015 were met.

Part 2: Net Scottish Emissions

Part 2 of this report contains information on net Scottish emissions. "Net Scottish emissions" are defined in the Act as the amount of "Scottish emissions", reduced by the amount of "Scottish removals" of a greenhouse gas.

"Scottish emissions" covers all emissions from sources territorially located within Scotland, plus Scotland's share of mobile transport emissions, including domestic and international aviation and shipping.

"Scottish removals" refer to the removal of carbon dioxide from the atmosphere by carbon sinks. Carbon sinks are defined by the United Nations Framework Convention on Climate Change (UNFCCC) as "any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere" – for instance woodlands.

In 2015, net Scottish emissions are estimated to have been 48,051,092 tCO_2e. This was 3.0 per cent lower than the 2014 figure of 49,515,198 tCO_2e, or a 1,464,106 tCO_2e decrease. Between 1990 and 2015, there was a 37.6 per cent reduction in net Scottish emissions.

Part 3: The Net Scottish Emissions Account (NSEA)

Achievement of Scotland's greenhouse gas emissions targets is measured against the level of the net Scottish emissions account (NSEA). The NSEA is defined in the Act as the aggregate amount of "net Scottish emissions" of greenhouse gases, reduced / increased by the amount of carbon units credited to / debited from it in accordance with the Carbon Accounting Scheme Regulations made under the Act.

There are two mechanisms by which carbon units can be credited to / debited from the NSEA.

i. As the result of the operation of the EU Emissions Trading System (EU ETS) in Scotland. The details of this mechanism are set out in the Annex to this report.
ii. Ministers may credit to the NSEA any international carbon units purchased by them, thereby offsetting domestic emissions.

In 2015, 2,546,649 units were credited to the NSEA as a result of the operation of the EU ETS. No units were credited to the NSEA as a result of the purchase by Ministers of international carbon units. The NSEA figure was 45,504,443 tCO_2e. The fixed annual target for 2015, as set by the Climate Change (Annual Targets) (Scotland) Order 2010, is to reduce emissions to 45,928,000 tCO_2e. This means that the fixed annual target for 2015 was met by 423,557 tCO_2e.

Based on the NSEA, Scotland's emissions increased by 1.8 per cent in 2015 on the previous year. The longer term trend to date shows a reduction of 41.0 per cent from the 1990/1995 baseline period.

Part 4: Scottish electricity consumption and generation

Part 4 of this report shows that in 2015, gross electricity consumption was 36,410 GWh. In 2015, Scottish electricity generation was 51,200 GWh. In 2015, the average greenhouse gas emissions per megawatt hour of electricity generated is 151 gCO_2e/kWh.

Section 38 of the Act is also reported on in this section. This requires a report in respect of each year in the period 2010-2050 that, in so far as reasonably practicable, sets out the impact on net Scottish emissions during that year resulting from the exercise by the Scottish Ministers of the functions conferred on them by virtue of any enactment relating to electricity generation.

In 2015, seven projects in Scotland were consented after consideration under section 36 of the Electricity Act 1989. Of these, six related to onshore wind projects (totalling 231 MW) and one to an offshore wind project (30 MW). There were a further two projects licensed by Marine Scotland (in addition to those licensed under section 36 of the Electricity Act). These additional projects were both tidal devices (totalling 10.5 MW).

Results of modelling suggest that these consented projects, should they become operational, could reduce GB system wide carbon emissions by an estimated 0.25 $MtCO_2$ in the year 2022.

Introduction

The Climate Change (Scotland) Act 2009[1] ("the Act") set targets to reduce Scotland's greenhouse gas emissions by 80 per cent below the baseline period[2] in 2050, with an interim target to reduce emissions by at least 42 per cent by 2020.

The Act also requires Scottish Ministers to set, by order, annual targets for Scotland's greenhouse gas emissions, consistent with achieving the long-term (2050 and interim 2020) targets, at least 12 years in advance. In October 2010 the Scottish Parliament passed legislation introducing the first batch of annual targets, for the years 2010 to 2022[3]. The second batch, for 2023-2027, was set in October 2011[4]. The third batch, for 2028-2032, was set in October 2016[5]. Future batches are required to be set at 5-year intervals.

Reports on annual targets

Section 33 of the Act requires that Scottish Ministers lay before the Scottish Parliament a report in respect of each year in the period 2010-2050 for which an annual target has been set – a "target year". Reports must be laid before the Parliament no later than 31 October in the second year after the target year.

The report must state:

- Whether the annual target for the target year has been met. If the annual target has not been met, the report must explain why.
- Whether the domestic effort target has been met in the target year to which the report relates. If the domestic effort target has not been met, the report must explain why.
- The report must contain information mentioned in section 34 of the Act, including the amount of net Scottish emissions and the net Scottish emissions account (NSEA).

Content

This report relates to the 2015 target year.

Further Information

The latest greenhouse gas emissions data for Scotland are available in the Official Statistics publication *Scottish Greenhouse Gas Emissions, 2015*[6], which is based on data published at the same time in *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2015*[7].

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[1] http://www.legislation.gov.uk/asp/2009/12/contents

[2] The basket of greenhouse gases covered by the Climate Change (Scotland) Act comprises carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), for which the baseline is 1990; and hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3), for which the baseline is 1995.

[3] The Climate Change (Annual Targets) (Scotland) Order 2010, SSI 2010 no. 359: http://www.legislation.gov.uk/ssi/2010/359/contents/made

[4] The Climate Change (Annual Targets) (Scotland) Order 2011, SSI 2011 no. 353: http://www.legislation.gov.uk/ssi/2011/353/contents/made

[5] The Climate Change (Annual Targets) (Scotland) Order 2016, SSI 2016 No. 328 http://www.legislation.gov.uk/ssi/2016/328/contents/made

[6] http://www.gov.scot/Publications/2017/06/9254

[7] http://naei.beis.gov.uk/reports/reports?report_id=932

Part 1 – Annual and Domestic Effort Targets

Requirements of the Act

Section 33 of the Act requires that:

- The Scottish Ministers must lay before the Scottish Parliament a report in respect of each year in the period 2010-2050 for which an annual target has been set (a "target year") (subsection (1)). The report under this section must be laid before the Parliament no later than 31 October in the second year after the target year (subsection (7)).
- The report must state whether the annual target for the target year has been met (subsection (2)).
- If the annual target has not been met, the report must explain why (subsection (3)).
- The report must also state whether the domestic effort target has been met in the target year to which the report relates (subsection (4)).
- If the domestic effort target has not been met, the report must explain why (subsection (5)).
- The report must contain information mentioned in section 34 of the Act (subsection (6)). This is covered in parts 2, 3 and 4 of this report.

Annual target

The annual target for 2015 was met

Achievement of Scotland's greenhouse gas emissions annual targets is measured against the level of the net Scottish emissions account (NSEA). The NSEA accounts for the greenhouse gas emissions from sources in Scotland, Scotland's share of emissions from international aviation and international shipping, the effect of any relevant emissions sequestration (e.g. "carbon sinks" such as woodland) and the effect of the sale and purchase of relevant carbon units (tradable emissions allowances). Part 3 of this report contains information on the NSEA, including the total amount of carbon units that have been credited to or debited from the NSEA.

In 2015, the amount of the NSEA was 45,504,443 tCO_2e. The fixed annual target for 2015 is to reduce emissions to 45,928,000 tCO_2e[8]. This means that the fixed annual target for 2015 was met by 423,557 tCO_2e.

Table 1: Margin between the annual emissions target and the net Scottish Emissions Account (NSEA) in 2015 (tCO_2e)

Annual target (A)	45,928,000
Net Scottish Emissions Account (B)	45,504,443
Margin by which target is met (+) or missed (-) (A – B)	+423,557

[8] The Climate Change (Annual Targets) (Scotland) Order 2010, SSI 2010 no. 359: http://www.legislation.gov.uk/ssi/2010/359/contents/made

Domestic Effort Target

The domestic effort target for 2015 was met

Section 8 of the Act places a duty on the Scottish Ministers to ensure that reductions in net Scottish emissions of greenhouse gases account for at least 80 per cent of the reduction in the net Scottish emissions account in any target year – the "domestic effort target". For the specific purpose of ascertaining whether this target has been met, the Act stipulates that the use of carbon units through the operation of the EU ETS is treated as though it is a reduction in "net Scottish emissions".

Table 5 in Part 3 of this report shows the change in net Scottish emissions (including the operation of the EU ETS) between 2014 and 2015 as a proportion of the change in the NSEA between 2014 and 2015. It shows that 100 per cent of the change in the NSEA is accounted for by changes in net Scottish emissions and, for the purposes of this report, the domestic effort target has been met.

Part 2 – Net Scottish emissions

Requirements of the Act

Section 34 of the Act requires that, in respect of each greenhouse gas, the report must:

- state the amount of net Scottish emissions for the baseline year (subsection (1)(a)).
- state the amount of net Scottish emissions for the target year (subsection (1)(b)).
- state whether the amount of net Scottish emissions represents an increase or decrease compared to the equivalent amount for the previous target year (subsection (1)(c)).
- identify the methods used to measure or calculate the amount of net Scottish emissions (including in particular any change to those methods) (subsection (1)(d)).

The report must also set out the aggregate amount for the target year of net Scottish emissions (subsection (2)).

If the method of measuring or calculating net Scottish emissions changes and that change is such as to require adjustment of an amount for an earlier target year, the report must specify the adjustment required and state the adjusted amount (subsection (6)). An adjustment must, in so far as reasonably practicable, be made in accordance with international carbon reporting practice (subsection (7)).

Net Scottish emissions of each greenhouse gas

Table 2 provides data for each of the seven greenhouse gases covered by the Act. This includes details of:

- The amount of net Scottish emissions for the baseline year, and for 2015 (the target year);
- Whether any of those amounts represent an increase or decrease compared to the equivalent amount for the previous year; and
- The aggregate amount for 2015 of net Scottish emissions.

Table 2: Net Scottish emissions for each greenhouse gas (tCO_2e)[9]

Greenhouse gas	Base year	Net base year emissions	Net Scottish emissions 2014	Net Scottish emissions 2015	Change in net Scottish emissions 2014 - 2015
Carbon dioxide CO_2	1990	58,520,749	37,500,226	36,234,616	-1,265,610
Methane CH_4		13,466,016	6,749,260	6,657,029	-92,232
Nitrous oxide N_2O		4,825,089	3,801,774	3,721,123	-80,651
Hydrofluorocarbons HFCs	1995	126,416	1,290,169	1,286,353	-3,816
Perfluorocarbons PFCs		115,777	142,008	119,549	-22,459
Sulphur hexafluoride SF_6		36,020	31,481	32,115	+634
Nitrogen trifluoride NF_3 [10]		501	279	307	+28
Aggregate net greenhouse gas emissions		**77,090,568**	**49,515,198**	**48,051,092**	**-1,464,106**

[9] Figures may not sum due to rounding.
[10] The Climate Change (Additional Greenhouse Gas) (Scotland) Order 2015 (http://www.legislation.gov.uk/ssi/2015/197/introduction/made) adds nitrogen trifluoride (NF_3) to the basket of greenhouse gases covered by the Climate Change (Scotland) Act 2009.

Methods used to measure or calculate the amount of net Scottish emissions

The basket of greenhouse gases consists of carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). Greenhouse gases are weighted by Global Warming Potential (GWP) and presented in *carbon dioxide equivalent* units. The GWP for each gas is defined as its warming influence relative to that of carbon dioxide, as specified by the Intergovernmental Panel on Climate Change (IPCC).

Greenhouse gas emissions estimates are provided by Ricardo Energy and Environment and Aether under contract to the UK Government and the devolved administrations. Reports are published on the National Atmospheric Emissions Inventory (NAEI) website[11] and the latest figures for Scotland are published in the Official Statistics publication *Scottish Greenhouse Gas Emissions, 2015*[12], which is based on data published at the same time in *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2015*[13].

The greenhouse gas inventory covers anthropogenic sources of greenhouse gas emissions from a wide variety of emissions sources, which require different approaches to their estimation. There are a large number of data sources used in its compilation, obtained from Government statistics, regulatory agencies, trade associations, individual companies, surveys and censuses. The methods used to compile the greenhouse gas inventory are consistent with international guidance on national inventory reporting from the IPCC.

Most emission estimates are compiled by combining activity data (such as fuel use) with a suitable emission factor (such as amount of CO_2 emitted per unit of fuel used). Estimates of emissions from the industrial sector are often compiled based on plant-specific emissions data. Emissions from some sectors are based on more complicated models - such as the model used to estimate emissions from landfill, and the model used to estimate the carbon dynamics in soils when trees are planted. Much of the data on net emissions from agriculture and related land use, land use change and forestry emissions are based on modelled data for Scotland, which are consistent with, but not constrained to, the UK totals and thus are known as "bottom up" estimates.

Many of the remaining emissions sources within the inventory have been collated on a "top down" approach where estimates of emissions have been apportioned to Scotland using proportions of energy use in the UK Department for Business, Energy and Industrial Strategy publication "*Digest of UK Energy Statistics* (DUKES)"[14]. This approach is prompted by data availability on emissions being more limited at the sub-UK level.

[11] http://naei.beis.gov.uk/
[12] http://www.gov.scot/Publications/2017/06/9254
[13] http://naei.beis.gov.uk/reports/reports?report_id=932
[14] https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

Changes to methods used to measure or calculate the amount of net Scottish emissions

Scottish greenhouse gas emissions are reviewed every year, and the whole historical data series is revised to incorporate methodological improvements and new data. As a result, both net Scottish emissions and the net Scottish emissions account for each target year are revised every year. The latest published Scottish greenhouse gas inventory (1990-2015) represents the best available data and supersede any previous data, which should be disregarded.

The Scottish greenhouse gas inventory is a subset of the UK inventory, which is assembled using international guidelines that require countries to keep it under review and take account of amongst other things:

- new data and revisions to data;
- international developments in inventory methods;
- the need for the inventory to take account of policy needs as they evolve;
- results of research.

All of the revisions to the 1990-2015 Scottish and UK inventories were for one of the reasons above.

Revisions for the 1990-2015 inventory

Due to methodological improvements and new data, as described above, the baseline has been revised upwards in every successive inventory between 1990-2008 to 1990-2013, with a downwards revision to the baseline between the 1990-2013 and 1990-2014 and 1990-2015 inventories.

Despite the recent downwards revision, there has been an overall upward revision to the baseline to 77.1 $MtCO_2e$, which is 6.9 $MtCO_2e$ higher than estimated at the time annual targets for 2010 to 2027 were set based on the 1990-2008 Inventory.

Detailed information on revisions are published in the Official Statistics release *Scottish Greenhouse Gas Emissions 2015* (Section D)[15]. The most notable revisions are:

Forestry

Forestry is a carbon sink which means that it removes emissions from the atmosphere. Methodological revisions to the forestry data show that the size of the forestry sink has reduced by approximately 30 per cent over the whole time series compared with previous estimates. Despite these revisions, the forestry sector remains a significant carbon sink in Scotland.

[15] http://www.gov.scot/Publications/2017/06/9254

Waste Management

Methodological changes have reduced waste management emissions by approximately 40 per cent across the series. The reduction in emissions as a result of the methodological changes is greater at the start of the time series (early 1990s) than it is in later years which means that actual emissions reductions across the time series are less than previous estimates.

Adjustment of an amount for earlier target years

Revisions to estimates of net Scottish emissions for earlier target years are detailed in Table 3. These represent revisions to estimates reported in the 2014 Annual Target Report for the 1990-2014 inventory. Revisions to net Scottish emissions arising from previous inventory reports are available in previous annual target reports[16].

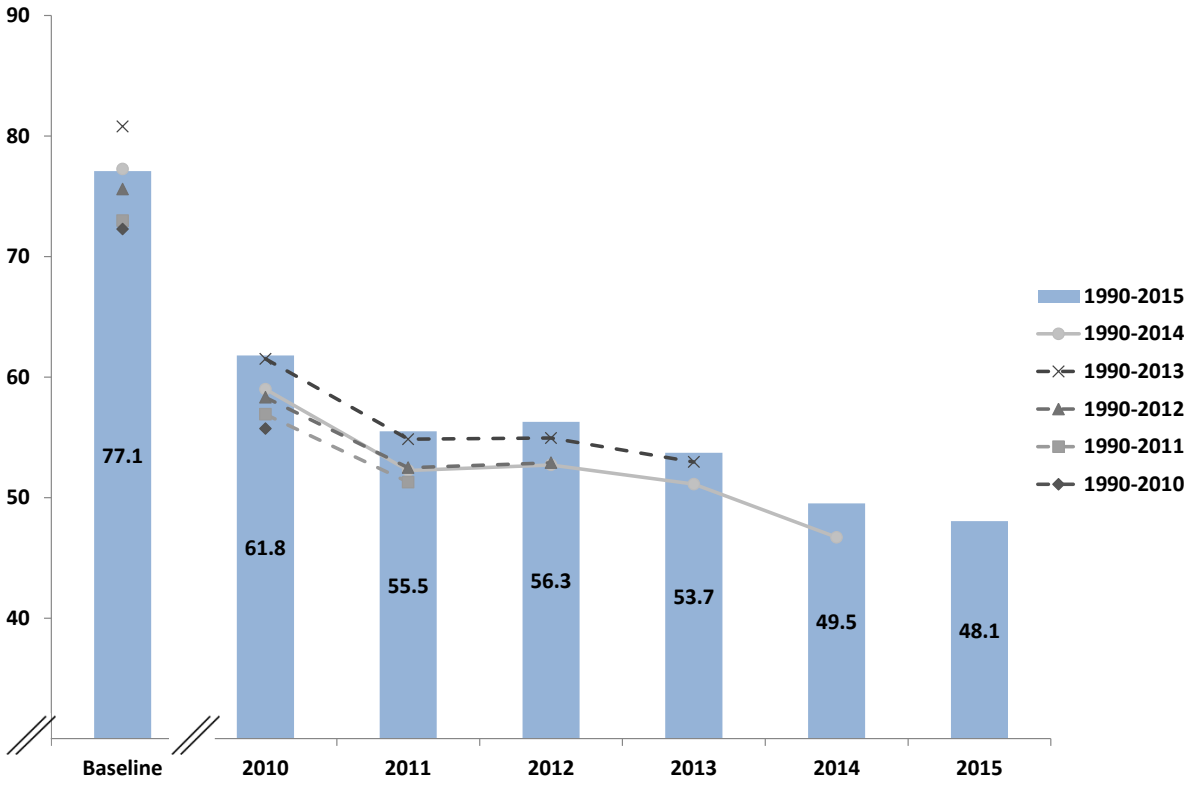
Table 3: Revisions to net Scottish emissions for earlier target years[17]

Target year	Net Scottish emission estimate reported in 2014 Annual Target Report[18] (tCO_2e)	Revision required (tCO_2e)	Revised amount (tCO_2e)
FOR THE 1990-2015 INVENTORY			
2010	58,997,604	+2,800,554	61,798,157
2011	52,252,945	+3,244,301	55,497,246
2012	52,710,674	+3,573,890	56,284,564
2013	51,121,730	+2,605,850	53,727,580
2014	46,704,130	+2,811,068	49,515,198
REASONS FOR REVISIONS. These are described above and in more detail in the Official Statistics Release *Scottish Greenhouse Gas Emissions 2015*[19]			

[16] http://www.gov.scot/Topics/Environment/climatechange/meetingemissionstargets/reportingonprogress
[17] Figures may not sum due to rounding.
[18] http://www.gov.scot/Publications/2016/10/7938
[19] http://www.gov.scot/Publications/2017/06/9986

Chart 1 shows the impact of successive revisions of the inventory on the reported source emissions for the baseline and the years from 2010 to 2014, as well as the source emissions for 2015.

Chart 1. Impact of successive revisions of the inventory on the reported source emissions for the baseline and the years from 2010 to 2014, and source emissions for 2015. Values in $MtCO_2e$



Part 3 – Net Scottish Emissions Account (NSEA) for 2015

Requirements of the Act

Section 34 of the Act requires that the report:

- state the amount of the net Scottish emissions account for the target year (subsection (3)(a)[20]).
- state the proportion of the reduction in the net Scottish emissions account which is accounted for by reductions in net Scottish emissions (subsection (3)(b)).
- state the total amount of carbon units:
  - that have been credited to or debited from the net Scottish emissions account for the target year (subsection (3)(c)(i));
  - that have been purchased in the target year (subsection (3)(c)(ii));
  - that have been held and not surrendered in the target year (subsection (3)(c)(iii)).
- give details of the number and type of those carbon units (subsection (3)(d)).
- for each year in the period 2011-2050[21].
  - state the amount of the NSEA for each preceding target year (subsection (5)(a));
  - state the cumulative amount of the net Scottish emissions account for the target year and all preceding target years (subsection (5)(b)).

Amount of the Net Scottish Emissions Account for 2015

Achievement of Scotland's greenhouse gas emissions targets is measured against the level of the net Scottish emissions account (NSEA). The NSEA is defined in the Act as the aggregate amount of "net Scottish emissions" of greenhouse gases, reduced / increased by the amount of carbon units[22] credited to / debited from it in accordance with the Carbon Accounting Scheme Regulations made under the Act[23].

Table 4 provides the amount of the net Scottish emissions account in 2015, including the total amount of carbon units that have been credited to or debited from the NSEA as the result of the operation of the EU ETS in Scotland.

Table 4: Net Scottish Emissions Account for 2015 (tCO_2e)[24]

Greenhouse Gas Inventory	Net Scottish emissions – see table 2 (C)	48,051,092
Carbon Units	Number of units to be credited to (+ value) or debited from (- value) the NSEA - see table 6 (D)	2,546,649
NSEA	C - D	**45,504,443**

[20] If an amount mentioned in subsection 3(a) or subsection (5)(a) or (b) for an earlier period requires to be adjusted, the report must explain why the adjustment is required; specify the adjustment required; and state the adjusted amount (section (34(8) of Climate Change (Scotland) Act 2009).

[21] Ibid.

[22] Carbon units are emissions allowances that represent 1 tCO_2e each. The types of units specified are internationally recognised and are monitored and tracked under United Nations and European Union rules. The units are subject to significant scrutiny and are accepted as representing genuine and verifiable emissions reductions.

[23] The Regulations were made in 2010, and subsequently amended in 2015, 2016 and 2017.

[24] Figures may not sum due to rounding.

Based on the NSEA, Scotland's emissions increased by 1.8 per cent in 2015 on the previous year. The longer term trend to date shows a reduction of 41.0 per cent from the 1990/1995 baseline period.

Proportion of the reduction in the net Scottish emissions account which is accounted for by reductions in net Scottish emissions

Section 8 of the Act places a duty on the Scottish Ministers to ensure that reductions in net Scottish emissions of greenhouse gases account for at least 80 per cent of the reduction in the net Scottish emissions account in any target year – the "domestic effort target". In effect, this ensures that the majority of the action to meet emission reduction targets is taken domestically, rather than by offsetting domestic emissions through the purchase of international credits.

There are two mechanisms by which carbon units can be credited to / debited from the NSEA.

i As the result of the operation of the EU Emissions Trading System (EU ETS) in Scotland. The details of this mechanism are set out in the Annex to this report.

ii. Ministers may credit to the NSEA any international carbon units purchased by them, thereby offsetting domestic emissions. The Climate Change (Limit on Carbon Units) (Scotland) Order 2011[25] sets limits for the period 2013-2017 which allows Ministers the option to purchase (credit) up to 206,000 carbon units in 2015 in addition to credits or debits to the Scottish account through the operation of the EU ETS.

For the specific purpose of ascertaining whether the domestic effort target has been met, the Act stipulates that the use of carbon units through the operation of the EU ETS is treated as though it is a reduction in "net Scottish emissions".

For the purposes of the domestic effort target in 2014 and 2015, the net Scottish emissions and net Scottish emissions account are the same. This is because no units were credited to the NSEA in either of the years as a result of the purchase of international carbon units. This means that the change in net Scottish emissions of greenhouse gases account for 100 per cent of the change in the net Scottish emissions account in the 2015 target year (see Table 5).

[25] http://www.legislation.gov.uk/ssi/2011/440/contents/made

Table 5: Change in net Scottish emissions (including the operation of the EU ETS) between 2014 and 2015 as a proportion of the change in the Net Scottish Emissions Account between 2014 and 2015[26]			
Target Year	**Net Scottish Emissions[27]**	**Net Scottish Emissions Account**	**Proportion of the change in the NSEA which is accounted for by changes in Net Scottish emissions**
2014	44,696,804	44,696,804	100%
2015	45,504,443	45,504,443	
Change between 2014 and 2015	+807,638	+807,638	

Carbon Units credited or debited to the NSEA

Table 6 sets out the effect of the EU ETS on the NSEA in 2015. Further detail on this mechanism are set out in the Annex to this report.

Table 6: The effect of the EU ETS on the Net Scottish Emissions Account in 2015 (tCO_2e)	
Total amount of units surrendered from fixed installations[28]	15,131,603
Estimate of surrendered CO_2 emissions from domestic aviation	506,672
Estimate of surrendered CO_2 emissions from international aviation	1,302,798
Total estimate of surrendered emissions (E)	**16,941,073**
Fixed installations cap	13,029,411
Domestic aviation cap	443,255
International aviation cap	921,758
Total 2015 EU ETS cap ("Specified Amount") for Scotland (F)	**14,394,424**
Number of units to be credited to (+ value) or debited from (- value) the Net Scottish Emissions Account (E - F) [29] [30]	**2,546,649[31]**

[26] Figures may not sum due to rounding.
[27] For the purpose of calculating the domestic effort target, Section 8(3) of the Climate Change (Scotland) Act 2009 stipulates that the use of carbon units through the operation of the EU ETS is treated as though it is a reduction in "net Scottish emissions".
[28] Sourced from SEPA analysis.
[29] If (E – F) is positive, carbon units are credited to the NSEA, thus reducing its level.
[30] If (E – F) is negative, carbon units are debited from the NSEA, thus increasing its level.
[31] The activity of fixed installations accounts for 2,102,192 tCO2e of the total credit. The activity of domestic aviation accounts for 63,417 tCO2e of the total credit. The activity of international aviation accounts for 381,040 tCO2e of the total credit.

Table 7 sets out carbon units which have been purchased, and carbon units which have been held and not surrendered.

Table 7: Total amount of carbon units which have been purchased, and those that are held and not surrendered, 2015		
	Number of Units	**Type of Units**
Number of carbon units purchased	0	Not applicable
Number of carbon units held and not surrendered	0	Not applicable
Amount of carbon units credited to the Net Scottish Emissions Account	**0**	**Not applicable**

Amount of the NSEA for each preceding target year and cumulative amount of the net Scottish emissions account for the target year

Table 8 sets out the amount of the net Scottish emissions account for the target year and each preceding target year based on the 1990-2015 greenhouse gas inventory. Table 8 also states the cumulative amount of the net Scottish emissions account for the target year.

Table 8: Amount of the Net Scottish Emissions Account for each target year, and the cumulative amount of the Net Scottish Emissions Account for the target year (tCO_2e)	
Target Year 2010	60,780,578
Target Year 2011	58,463,949
Target Year 2012	59,138,499
Target Year 2013	50,491,177
Target Year 2014	44,696,804
Target Year 2015	45,504,443
Cumulative 2010-2015	319,075,450

Adjustments to net Scottish emissions account for earlier target years and cumulative amount of the net Scottish emissions account for all preceding target years

Table 9 contains data on revisions to previously reported estimates of the NSEA for earlier target years, together with the revised amount and reason for any revision. These represent revisions to estimates reported in the 2014 Annual Target Report for the 1990-2014 inventory. Revisions to the NSEA arising from previous inventory reports is available in previous annual target reports[32].

Table 9: Revisions to Net Scottish Emissions Account for earlier target years[33] (tCO_2e)

Target year	Net Scottish Emissions Account estimate reported in 2014 Annual Target Report[34]	Revision required	Revised Net Scottish Emissions Account estimate
FOR THE 1990-2015 INVENTORY			
2010	57,980,025	+ 2,800,554	60,780,578
2011	55,219,648	+ 3,244,301	58,463,949
2012	55,564,609	+ 3,573,890	59,138,499
2013	47,885,327	+ 2,605,850	50,491,177
2014	41,885,736	+ 2,811,068	44,696,804
REASON FOR REVISION. This follows similar revisions to the net Scottish emissions as described in Part 2 of this report, and described in more detail in the Official Statistics Release *Scottish Greenhouse Gas Emissions 2015*[35].			

Table 10 shows the revisions to the cumulative amounts of greenhouse gas emissions for preceding target years.

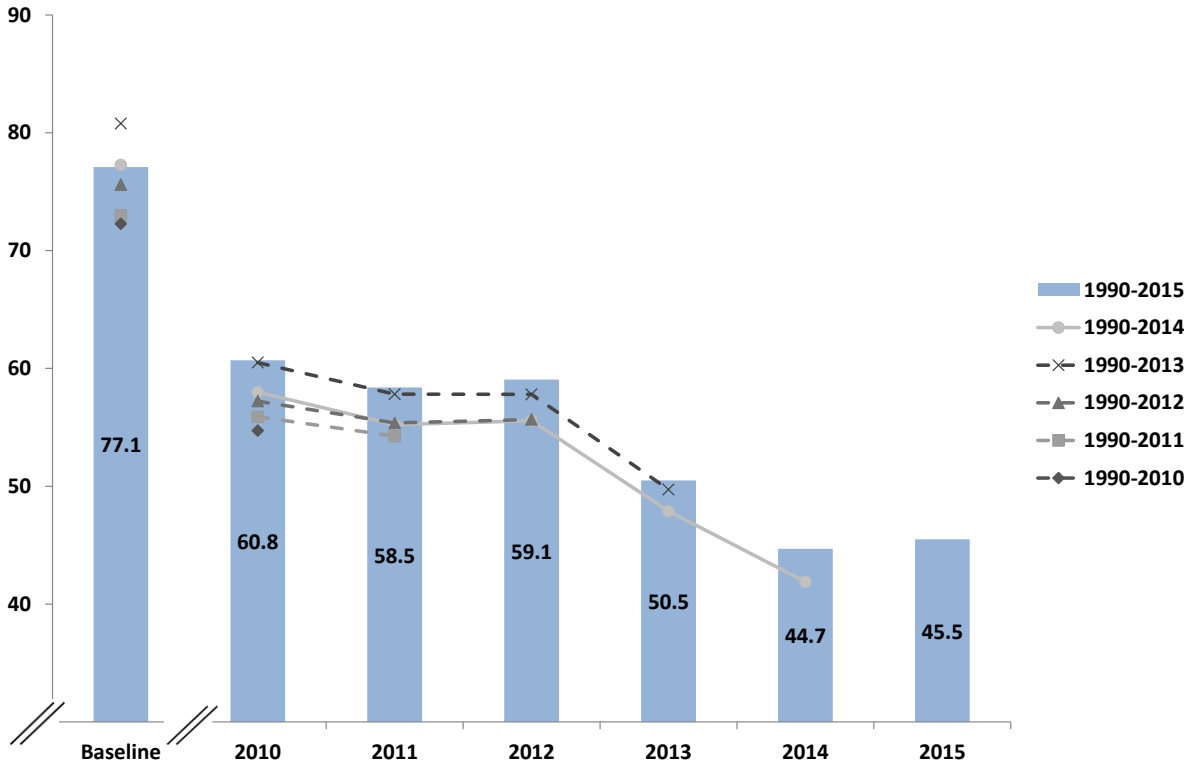
Table 10. Revisions to Cumulative Amounts in Preceding Target Years. All Values in tCO_2e

TARGET YEAR	Cumulative Amount previously reported	Revision required	Revised Cumulative Amount (G)	Net Scottish Emissions Account for the Target Year (H)	New Cumulative Amount (G + H)
2010	Not Applicable	Not Applicable	Not Applicable	54,713,907	54,713,907
2011	54,713,907	+1,178,969	55,892,876	54,251,910	110,144,787
2012	110,144,787	+2,441,212	112,585,998	55,665,180	168,251,178
2013	168,251,178	+7,845,364	176,096,542	49,724,807	225,821,349
2014	225,821,349	-9,171,741	216,649,608	41,885,736	258,535,344
2015	258,535,344	+15,035,663	273,571,007	45,504,443	319,075,450

[32] http://www.gov.scot/Topics/Environment/climatechange/meetingemissionstargets/reportingonprogress
[33] Figures may not sum due to rounding.
[34] http://www.gov.scot/Publications/2016/10/7938
[35] http://www.gov.scot/Publications/2017/06/9254

Chart 2 shows the impact of successive revisions to the inventory on the Net Scottish Emissions Accounts for the each of the Target Years from 2010 to 2014. It also shows the Net Scottish Emissions Account in 2015.

Chart 2. Impact of successive revisions to the inventory on the Net Scottish Emissions Accounts for each of the Target Years from 2010 to 2014, and the Net Scottish Emissions Account in 2015. Values in $MtCO_2e$



The fixed annual targets for 2010-2027 were set on the basis of the 1990-2008 inventory, which was the latest inventory available at the time. This estimated baseline emissions to have been 70.201 $MtCO_2e$ and the 2020 target was set at 40.717 $MtCO_2e$, which equated to a 42 per cent reduction in line with the level of the 2020 interim target set by the Act. Successive revisions means that the reductions required to meet each of the fixed annual targets are now significantly greater than was envisaged when the targets were set. So, for example, to reach the 2020 annual target now equates to a 47.2 per cent reduction in emissions (Table 11).

Table 11. Annual Targets for the period 2010-2027

Year	Targets (in tCO_2e)	Percentage reduction against 1990 baseline when targets were set - using the 1990-2008 inventory	Percentage reduction against 1990 baseline – based on latest (1990-2015) inventory
2010	53,652,000	-23.6%	-30.4%
2011	53,404,000	-23.9%	-30.7%
2012	53,226,000	-24.2%	-31.0%
2013	47,976,000	-31.7%	-37.8%
2014	46,958,000	-33.1%	-39.1%
2015	45,928,000	-34.6%	-40.4%
2016	44,933,000	-36.0%	-41.7%
2017	43,946,000	-37.4%	-43.0%
2018	42,966,000	-38.8%	-44.3%
2019	41,976,000	-40.2%	-45.6%
2020 (year of interim target)	**40,717,000**	**-42.0%**	**-47.2%**
2021	39,495,000	-43.7%	-48.8%
2022	38,310,000	-45.4%	-50.3%
2023	37,161,000	-47.1%	-51.8%
2024	35,787,000	-49.0%	-53.6%
2025	34,117,000	-51.4%	-55.7%
2026	32,446,000	-53.8%	-57.9%
2027	30,777,000	-56.2%	-60.1%

Part 4 – Scottish electricity consumption and generation

Requirements of the Act

Section 34 of the Act requires that the report must:

- state the amount of Scottish gross electricity consumption for the target year (subsection (4)(a)).
- state the amount of Scottish electricity generation for the target year (subsection (4)(b)).
- state the average greenhouse gas emissions per megawatt hour of electricity generated in Scotland in the target year (subsection (4)(c)).
- state the average greenhouse gas emissions per megawatt hour, and the estimated lifetime cumulative emissions, of any new electricity generation capacity greater than 50 megawatts approved in Scotland in the target year (subsection (4)(d)).

This part of the report also fulfills the requirements of Section 38 of the Act. This requires a report in respect of each year in the period 2010-2050 that, in so far as reasonably practicable, sets out the impact on net Scottish emissions during that year resulting from the exercise by the Scottish Ministers of the functions conferred on them by virtue of any enactment relating to electricity generation.

The amount of Scottish gross electricity consumption

In 2015, gross electricity consumption in Scotland was 36,410 GWh[36].

The amount of Scottish electricity generation

In 2015, Scottish electricity generation was 51,200 GWh[37]

The average greenhouse gas emissions per megawatt hour of electricity generated in Scotland

In 2015, the average greenhouse gas emissions per megawatt hour of electricity generated is 151 gCO_2e / kWh.

Note: There are various ways of estimating the average greenhouse gas emissions per megawatt hour of electricity generated in Scotland. In reports prior to the 2014 annual target report (published in October 2016), this calculation used data from the Scottish Pollutant Release Inventory (SPRI) which is collated by SEPA. From the 2014 annual target report, the Scottish greenhouse gas inventory is used for this calculation as it is the basis upon which Scotland's headline greenhouse gas statistics are estimated, and as such is consistent with other emissions data which are contained within this report. The methods used to compile the greenhouse gas inventory are consistent with international guidance on national inventory reporting from the Intergovernmental Panel on Climate Change (IPCC).

[36] Published by the Department for Business, Energy & Industrial Strategy (BEIS). The data are available at: https://www.gov.uk/government/statistics/energy-trends-december-2016-special-feature-article-electricity-generation-and-supply-figures-for-scotland-wales-northern-ireland-and-england-2. Gross consumption is *calculated by subtracting net exports from the total generation figure.*

[37] Ibid.

The average greenhouse gas emissions per kilowatt hour of electricity generated in Scotland is calculated using the following formula:

$$\textit{Emissions Intensity from Electricity} = \frac{\textit{Total emissions from Electricity Generation}}{\textit{Total Output}}$$

Total emissions from Electricity Generation are obtained from the Energy Supply Sector ("Public Electricity & Heat Production" subsector) of the Scottish Greenhouse Gas Inventory 1990-2015[38]. This gives a figure of 7.71 $MtCO_2e$ in 2015. The total output figure is taken from the amount of Scottish electricity generation for the target year, which is shown above (51,200 GWh).

Table 12 shows the emissions intensity of electricity generated in Scotland using data from the Scottish greenhouse gas inventory for the years 2010 to 2015.

Table 12. Greenhouse Gas Emissions Intensity of Electricity Generated in Scotland (gCO_2e/kWh), 2010 to 2015

Year	Total Emissions ($MtCO_2e$)	Total Output (GWh)[39]	Emissions Intensity (gCO_2e/kWh)
2010	15.84	49,867	318
2011	12.12	51,170	237
2012	12.82	50,520	254
2013	11.44	52,963	216
2014	9.81	49,944	196
2015	7.71	51,200	151

Estimated lifetime cumulative emissions of new electricity generation capacity greater than 50MW approved in 2015

Due to longer-term uncertainties in the electricity market it is not possible to estimate lifetime cumulative emissions of new electricity generation capacity.

Emissions impacts are assessed at a GB level, reflecting the fact that the system is operated as a GB wide wholesale electricity market. Our approach is therefore to set out what the impact from any new electricity generation capacity consented by Scottish Ministers under section 36 of the Electricity Act 1989 in the "target year" has on overall GB system wide carbon emissions. The approach includes the impact of all new electricity generation capacity irrespective of scale, which may include extensions to existing installations that take the cumulative capacity over 50MW, and assumes that all consented plants become operational prior to 2022[40]. The results specify the estimated impact on emissions in that year.

[38] http://www.gov.scot/Publications/2017/06/9254

[39] Extracted from Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2004 to 2015 available at https://www.gov.uk/government/statistics/energy-trends-december-2016-special-feature-article-electricity-generation-and-supply-figures-for-scotland-wales-northern-ireland-and-england-2.

[40] 2022 is chosen as it is considered plausible for generation consented in 2015 to become operational by this date. The results assume that all projects are operating for the full calendar year.

In 2015, seven projects in Scotland were consented by Scottish Ministers after consideration under section 36 of the Electricity Act 1989. Of these, six related to onshore wind projects (totalling 231 MW) and one to an offshore wind project (30 MW).

Results of modelling suggest that these consented projects, should they become operational, could reduce GB system wide carbon emissions by an estimated 0.24 $MtCO_2$ in the year 2022. Emissions impacts of these projects are measurable at a GB level, as this is the level at which decisions from the model are made.

Impact on net Scottish emissions resulting from exercise of electricity generation related functions

Section 38 of the Act requires a report on the impact on emissions resulting from the exercise of electricity generation related functions. The report must, in so far as reasonably practicable, set out the impact on net Scottish emissions during that year resulting from the exercise by Scottish Ministers of the functions conferred on them by virtue of any enactment relating to electricity generation.

In 2015, seven projects[41] in Scotland were consented after consideration under section 36 of the Electricity Act 1989, with a further two projects licensed by Marine Scotland (in addition to those licensed under section 36). These additional projects were both tidal devices (totalling 10.5 MW).

As explained above, calculating the impact of consenting decisions is a complex task. The modelling results suggest that the consented projects, should they become operational, could reduce GB system wide carbon emissions by an estimated 0.25 $MtCO_2$ in the year 2022.

[41] Statistics on the number of consented projects in 2015 have come from Marine Scotland and Scottish Government Energy Consents and Deployment Unit.

Other information

Under Section 34(9) of the Climate Change (Scotland) Act 2009, this report may contain such other information as the Scottish Ministers consider appropriate and, in particular, may state the amount of Scottish electricity generation from each source for the target year.

Table 13 below shows Scottish electricity generation by fuel for 2015.

Table 13. Generation of electricity by fuel in Scotland (GWh)[42]	
Coal	8,306
Oil	836
Gas	1,913
Nuclear	17,763
Thermal renewables	1,861
Other thermal	207
Hydro natural flow	5,757
Hydro Pumped Storage	523
Non thermal renewables	14,009
Wastes	25
Total	51,200

[42] Published by the Department for Business, Energy & Industrial Strategy (BEIS). The data are available at: https://www.gov.uk/government/statistics/energy-trends-december-2016-special-feature-article-electricity-generation-and-supply-figures-for-scotland-wales-northern-ireland-and-england-2

Annex
Accounting For The EU Emissions Trading System (EU ETS)

Introduction

This annex outlines the calculation of adjusted emissions to take account of trading in the EU Emissions Trading System (EU ETS).

What is the EU ETS?

The EU ETS is a 'cap and trade' system. A limit (cap) is placed on the overall volume of emissions from participants in the system. Within the cap, organisations receive or buy emissions allowances which they can trade (1 emissions allowance equals 1 tCO_2e). Each year, an organisation must surrender enough allowances to cover its emissions. The cap is reduced over time so that by 2020, the volume of emissions permitted within the system will be 21 per cent lower than in 2005. The reducing cap, alongside the financial considerations of trading emissions allowances, incentivises organisations within the system to find the most cost effective way of reducing their emissions. The EU ETS operates as a number of Phases. Phase III began on 1 January 2013 and will operate until 31 December 2020.

In the greenhouse gas inventory, source emissions can be categorised into traded and non-traded. Traded emissions capture those that come from installations covered by the EU ETS, whereas non-traded emissions are those which do not fall within the scope of the EU ETS. The emissions from some sectors, such as the residential sector, are completely non-traded whereas emissions from other sectors, such as energy supply, business and industrial process emissions are a combination of traded and non-traded. For the years 2012 to 2015, CO_2 emissions from domestic and international aviation are classified as being within the traded sector.

What does this mean for the NSEA?

The figure for source emissions is comprised of emissions from both the non-traded and traded sectors. The figure for the NSEA is comprised of emissions from the non-traded sector and a value for Scotland's share of the notional EU ETS cap. The amount of emissions from the non-traded sector remains the same for both the source emissions and the NSEA.

The EU ETS element of the NSEA is calculated by replacing the number of emissions allowances surrendered from Scottish installations in a given year with Scotland's notional share of the overall EU ETS cap. This involves taking the difference between Scotland's notional share of the overall EU ETS cap and the number of emissions allowances surrendered from Scottish installations in a given year. This difference is then added to net Scottish emissions to get the NSEA.

The NSEA is referred to as "adjusted emissions", as they are adjusted to take into account trading within the EU ETS and the purchase of other credits. As no units were credited to the NSEA in 2015 as a result of the purchase by Ministers of international carbon units, this adjustment takes the form of a 4-step process.

Calculation of adjusted emissions for 2015

STEP 1
Take the Scottish greenhouse gas emissions from Scottish greenhouse gas inventory (for 2015, it is 48.051 $MtCO_2e$). This figure is comprised of:

- traded emissions units surrendered - sourced from Scottish Environment Protection Agency (SEPA) for fixed installations (15.132 $MtCO_2e$)
- an imputed estimate of surrendered CO_2 emissions from domestic aviation (0.507 $MtCO_2e$) and international aviation (1.303 $MtCO_2e$) - sourced from the Scottish Greenhouse Gas Inventory for 1990 to 2015
- non-traded emissions from sources such as residential emissions (31.110 $MtCO_2e$)

STEP 2
Remove an amount relating to surrendered emissions from fixed installations and an estimate of surrendered emissions from domestic and international aviation. This amounts to 15.132 $MtCO_2e$ + 0.507 $MtCO_2e$ + 1.303 $MtCO_2e$ = 16.941 $MtCO_2e$.

STEP 3
Add on the value of the EU ETS cap which is outlined within The Carbon Accounting Scheme (Scotland) Amendment Regulations 2017[43]. The cap reflects an estimate of the Scottish share of the European wide EU ETS cap that is used for emissions accounting.

The Scottish EU ETS cap for 2015 is 14.394 $MtCO_2e$, and is made up of 3 components, as shown in the table below. A methodological paper, *Determining a Scottish EU ETS cap for 2015*[44], documents the calculations that determine how a notional emissions cap has been calculated.

Table 14. Total EU ETS cap for Scotland, 2015 - this is the "specified amount" for fixed installations, domestic aviation and international aviation - as outlined in The Carbon Accounting Scheme (Scotland) Amendment Regulations 2017

Component	**2015 Allocation tCO_2e**
Fixed Installation Cap	13,029,411
Domestic Aviation Cap	443,255
International Aviation Cap	921,758
Total 2015 Cap	14,394,424

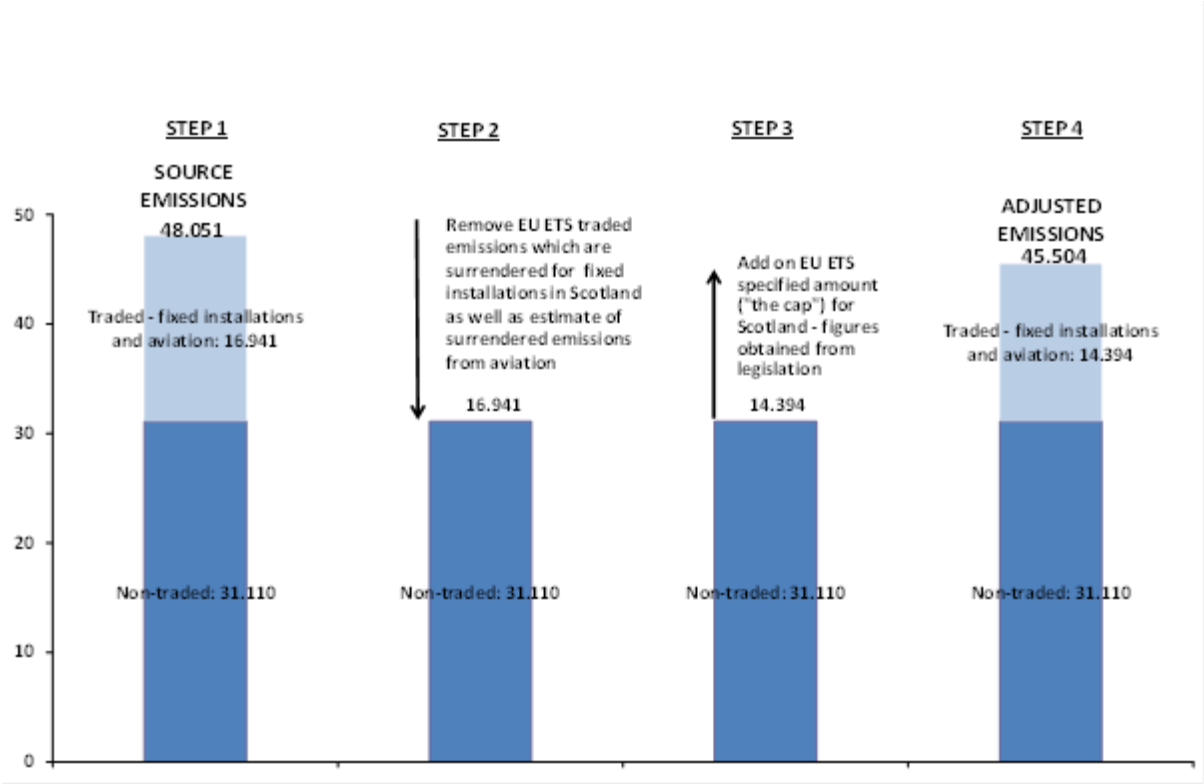
[43] http://www.legislation.gov.uk/ssi/2017/121/made
[44] http://www.gov.scot/Resource/0051/00514280.pdf

STEP 4

Adding on the value of the EU ETS cap gives a value of 45.504 $MtCO_2e$.

In 2015, the adjusted emissions which take account of trading in the EU ETS is 45.504 $MtCO_2e$. This is 2.547 $MtCO_2e$ lower than the value of estimated source emissions in 2014. Under the Climate Change (Scotland) Act 2009, a downward adjustment to source emissions is referred to as a credit to the Net Scottish Emissions Account. This means that 2,546,649 units have been credited to the Net Scottish Emissions Account in 2015.

Chart 3. Calculation of Adjusted Emissions for Trading in the EU Emissions Trading System (EU ETS), 2015. Values in $MtCO_2e$



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