

Research note: Greenhouse Gas Emissions

August 2014

Introduction

This research note provides a summary of total greenhouse gas emissions using the latest figures from 2012. It examines total greenhouse gas emissions at Welsh and UK level over time and progress towards targets, using the by source and end-user approaches. The latest figures show that in 2012 Wales saw a 5% increase in greenhouse gas emissions by source since 2011, the largest percentage increase of the UK nations. It also saw a 2% decrease in emissions using the end-user approach, the only one of the UK nation to see such a decrease.

The Greenhouse Gases

There are six direct greenhouse gases which are included in the inventories used to record greenhouse gas emissions. These are Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons and Sulphur Hexafluoride. **Each greenhouse gas has a different global warming potential** and are summarised below in table 1.

Table 1: Global Warming Potential of the six greenhouse gases on a 100 year horizon¹

Greenhouse Gas	Global Warming Potential (t CO ₂ Equivalent/ t gas)
Carbon Dioxide	1
Methane	21
Nitrous Oxide	310
Hydrofluorocarbons	140-11700
Perfluorocarbons	6500-9200
Sulphur	23900

Using Methane as an example from table 1, it demonstrates that 1 tonne of Methane released into the atmosphere, will trap the equivalent amount of heat as 21 tonnes of Carbon Dioxide over a 100 year period. This is known as a gas's **warming potential**, which is why there are six direct GHG's included in the inventory, even though their emissions are not as abundant as CO₂ which makes up about 85% of greenhouse gas emissions².

¹ AEA, **Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland**: 1990-2012, page 5, July 2014.

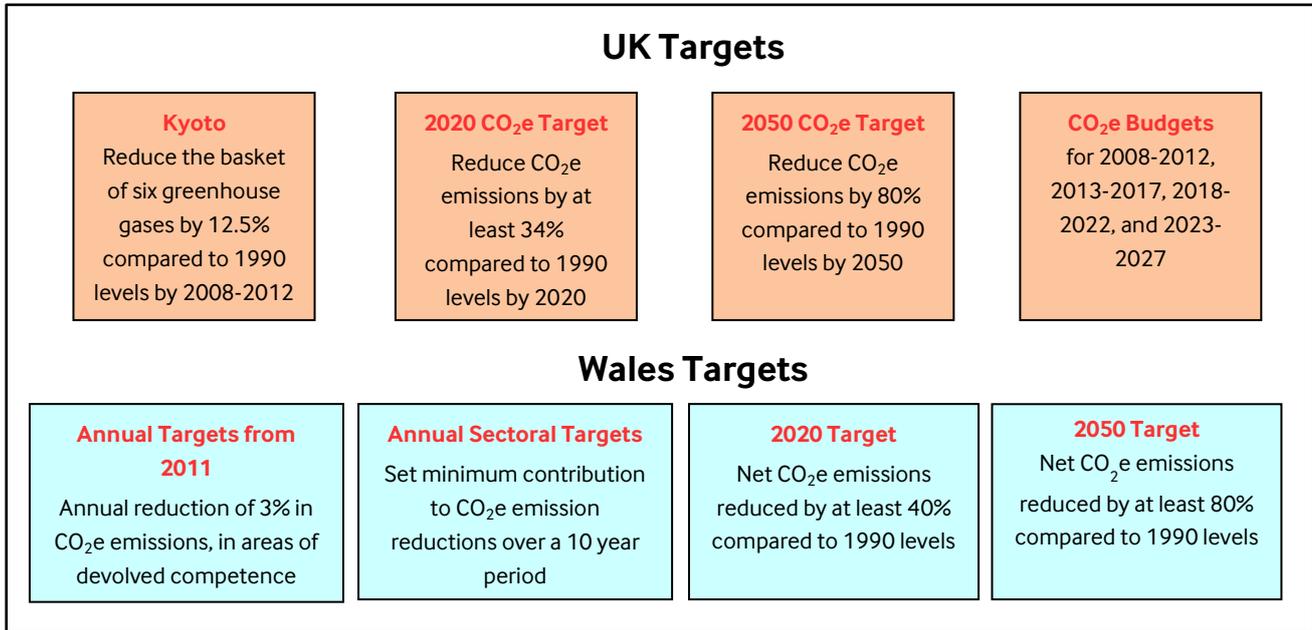
² NAEI, **Overview of greenhouse gases**, Accessed 17 July 2014.



Greenhouse gas emission targets

Figure 1 provides an overview of the targets the UK Government and the Welsh Government have set to reduce greenhouse gas emissions up to 2050. The Carbon Dioxide Equivalent (CO₂e) is a measure used to calculate emissions for greenhouse gases, as it expresses them in terms of CO₂ based on their relative global warming potential as shown in Table 1.

Figure 1: UK and Welsh Government greenhouse gas emission reduction targets up to 2050



Source: AEA, **Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2012**, page 4, July 2014; and Welsh Government, **Climate Change Strategy for Wales**, page 34, October 2010 for Welsh targets.

Kyoto Protocol Target

In reference to the six greenhouse gases covered under the Kyoto Protocol, the UK achieved its 2008-2012 CO₂e budget target with a reduction of 22.5% against the 1990 base year levels, although the figures for this period will not be finalised until 2015.



Greenhouse Gas Emissions

Progress towards the targets outlined in this research note are measured using the by source approach. The source approach calculates emissions by country and sector according to where the emissions are produced.

- In 2012, total net greenhouse emissions in Wales were 45.8 mega tonnes (Mt), showing an increase of 2.2Mt between 2011 and 2012, an increase of 5%. The AEA³ report states that this increase is predominately driven by the increase in global fuel prices causing a shift from natural gas back to coal, which has higher carbon content per unit of energy and has consequently increased emissions⁴.
- In 2012 emissions in Wales were 18% lower than the base year (1990 or 1995)⁵.
- In comparison to the other UK nations, Wales has reduced its emissions by **8.5** percentage points less than the UK average since the base year. Scotland and England have had larger percentage reductions in emissions than Wales, while Northern Ireland's reduction has been lower.

Table 2: Greenhouse gas emissions and percentage change from base year (1990 or 1995), Wales and the UK, 1995 to 2012 (Mt CO₂e)

Year	Wales		England		Scotland		Northern Ireland		United Kingdom	
	Emissions (Mt)	Percentage change from base year	Emissions (Mt)	Percentage change from base year	Emissions (Mt)	Percentage change from base year	Emissions (Mt)	Percentage change from base year	Emissions (Mt)	Percentage change from base year
Base Year	55.8	..	611.7	..	73.1	..	25.0	..	780.3	..
1995	52.3	..	554.0	..	72.8	..	25.7	..	724.6	..
1998	53.8	-3.6	545.6	-10.8	71.2	-2.6	25.2	1.0	718.3	-8.0
1999	55.4	-0.7	516.7	-15.5	67.7	-7.3	25.5	2.0	687.1	-11.9
2000	57.3	2.7	515.0	-15.8	69.7	-4.6	25.1	0.4	687.8	-11.9
2001	54.1	-3.1	522.8	-14.5	69.0	-5.5	25.5	1.9	692.4	-11.3
2002	47.2	-15.5	515.6	-15.7	65.0	-11.0	23.2	-7.0	672.9	-13.8
2003	48.4	-13.3	522.6	-14.6	64.6	-11.6	23.2	-7.2	679.3	-13.0
2004	52.0	-6.8	518.4	-15.3	62.0	-15.1	22.9	-8.2	675.3	-13.5
2005	49.9	-10.6	515.2	-15.8	60.5	-17.2	23.7	-5.1	668.8	-14.3
2006	51.6	-7.5	507.7	-17.0	63.8	-12.7	24.0	-4.0	665.4	-14.7
2007	48.6	-13.0	507.0	-17.1	59.2	-18.9	22.6	-9.4	655.4	-16.0
2008	49.9	-10.6	489.5	-20.0	57.1	-21.8	22.4	-10.2	635.9	-18.5
2009	43.5	-22.1	447.9	-26.8	53.4	-26.9	20.8	-16.9	582.5	-25.3
2010	46.7	-16.4	457.0	-25.3	55.8	-23.6	21.7	-13.1	598.0	-23.4
2011	43.6	-21.8	425.7	-30.4	49.9	-31.7	20.5	-17.8	554.9	-28.9
2012	45.8	-17.9	441.8	-27.8	50.5	-30.8	21.0	-16.0	573.5	-26.5

Source: AEA, **Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2012: Devolved Administration GHG Pivot Tables**, July 2014 and Research Service Calculations

Note: Emissions from international aviation and shipping are excluded from the figures for Scotland so that they are comparable with the figures for other devolved nations, which do not include these emissions. This has also been done in the AEA report.

³ AEA are a global sustainability consultancy who produce annual reports on greenhouse gas emissions in England, Scotland, Wales and Northern Ireland for the UK Government and devolved administrations.

⁴ AEA Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2012, page 60, July 2014.

⁵ Under the Kyoto Protocol, Annex 1 parties are able to use the 1990 or 1995 as the base year for emissions of hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride, and a number of parties, including the United Kingdom and devolved nations, use 1995.

Figures 2 and 3 show the trend of greenhouse gas emissions in Wales in comparison with the UK trend. The trend lines represent the Welsh and UK Government targets by 2020, thus allowing for progress towards those targets to be shown. It can be seen from figures 2 and 3 that:

- To reach the Welsh Government’s 2020 target of reducing greenhouse gas emissions by 40% below the base year, emissions in Wales will need to be reduced by a further 22.1 percentage points over the next eight years.

To reach the UK Government’s 2020 target of reducing greenhouse gas emissions by 34% below the base year, emissions across the UK will need to be reduced by a further 7.5 percentage points over the next eight years. For Welsh greenhouse emissions to reduce by an equivalent amount needed to achieve the UK target, they will need to be reduced by a further 16.1 percentage points over the next eight years.

Figure 2: Trends in total net greenhouse gas emissions against Welsh Government 2020 target from 1990 to 2012, (against base year) Wales (a)

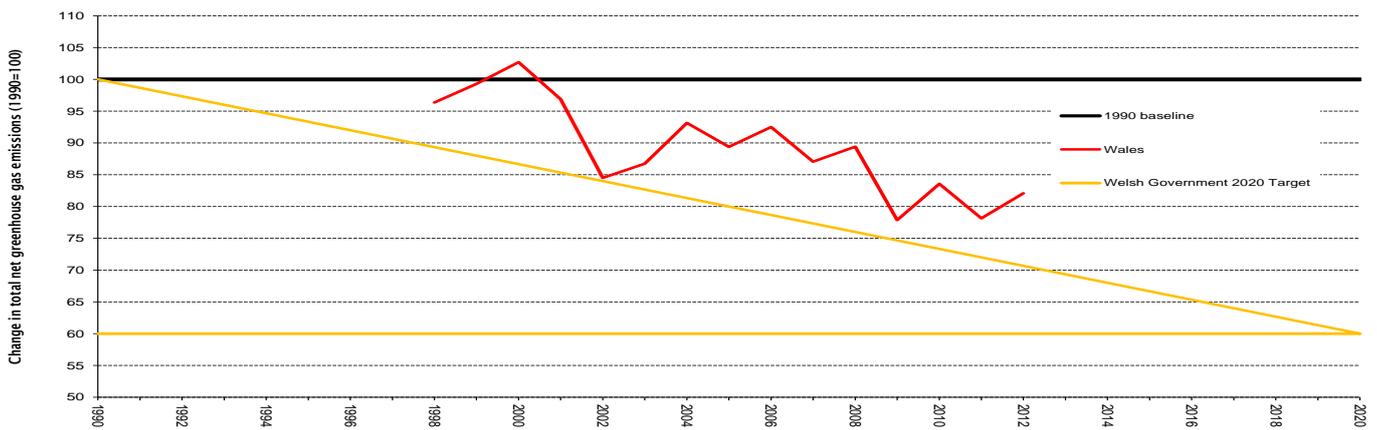
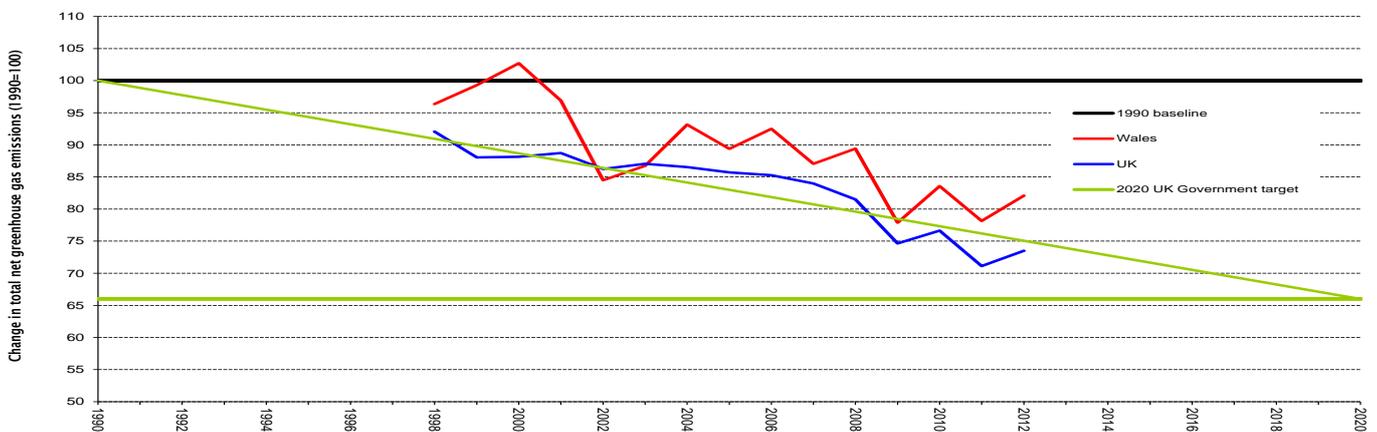


Figure 3: Trends in total net greenhouse gas emissions against UK Government 2020 target from 1990 to 2012, (against base year) Wales and UK (a)



Source for both graphs: AEA, **Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2012: Devolved Administration GHG Pivot Tables**, July 2014 and Research Service Calculations

a) For figures prior to 1998, data is only available for 1990 and 1995; therefore these years have not been included on the trend lines.

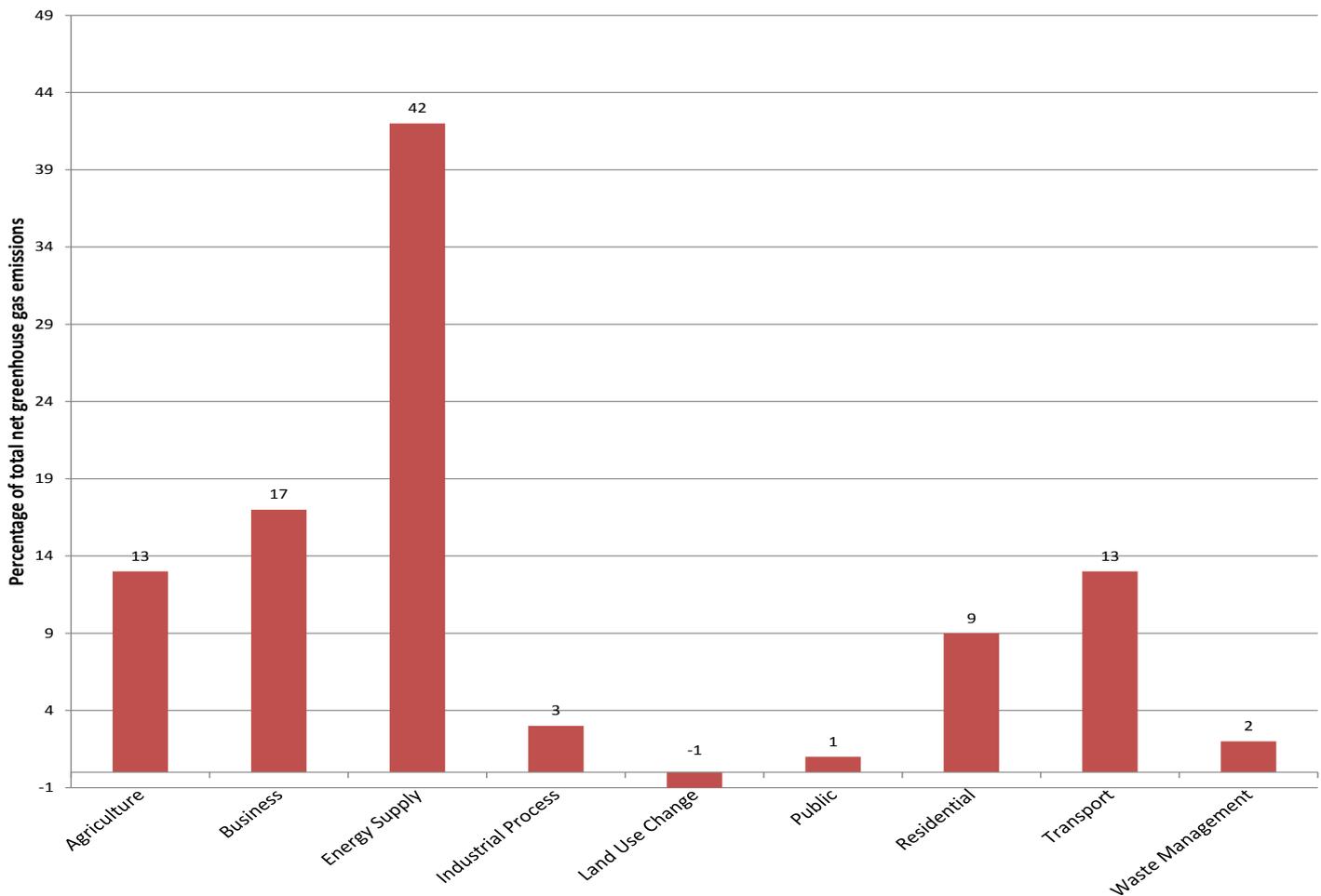


Greenhouse Gas Emissions by sector in Wales

Figure 4 shows total net greenhouse gas emissions in Wales in 2012 broken down by sector.

- In 2012 the energy supply sector produced the most greenhouse gas emissions of any sector, 42% of all Welsh greenhouse gas emissions.
- Other sectors which produced over 10% of Welsh greenhouse gas emissions in 2012 were business, transport and agriculture.
- Land use change in 2012 acted as a greenhouse gas sink, meaning that it absorbed more GHG than it released. There are therefore negative GHG emissions as a result of land use change.

Figure 4: Total net greenhouse gas emissions by sector, 2012 (per cent)



Source: AEA, **Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2012: Devolved Administration GHG Pivot Tables**, July 2014 and Research Service Calculations

Greenhouse Gas Emissions using the 'end-user' approach

The end user approach calculates emissions according to where the product of those emissions is consumed. This accounts for all the emissions associated with the consumption of energy, rather than those associated with the geographical location of where energy production takes place. Non-energy production emissions are still counted at the place of production. The figures shown below exclude exports outside the UK.

Table 3: End-user greenhouse gas emissions excluding exports and percentage change from base year (1990 or 1995), Wales and the other UK countries, 1990 to 2011 (Mt CO₂e)

Year	Wales		England		Scotland		Northern Ireland		United Kingdom	
	Emissions (Mt)	Percentage change from base year	Emissions (Mt)	Percentage change from base year	Emissions (Mt)	Percentage change from base year	Emissions (Mt)	Percentage change from base year	Emissions (Mt)	Percentage change from base year
1990	56.6	..	616.2	..	78.5	..	25.8	..	777.1	..
2003	48.2	-14.8	544.3	-11.7	62.2	-20.7	24.6	-4.8	679.3	-12.6
2004	49.1	-13.3	540.2	-12.3	61.4	-21.7	24.6	-4.7	675.3	-13.1
2005	46.6	-17.6	535.9	-13.0	61.2	-22.0	25.0	-3.0	668.8	-13.9
2006	47.3	-16.4	532.6	-13.6	60.2	-23.3	25.3	-2.0	665.4	-14.4
2007	46.4	-18.0	526.0	-14.6	58.2	-25.8	24.8	-4.1	655.4	-15.7
2008	44.5	-21.3	510.0	-17.2	57.9	-26.2	23.5	-9.1	635.9	-18.2
2009	39.6	-30.0	466.5	-24.3	53.7	-31.6	22.8	-11.8	582.5	-25.0
2010	42.8	-24.3	477.1	-22.6	54.6	-30.4	23.5	-9.0	598.0	-23.0
2011	40.0	-29.3	441.6	-28.3	51.2	-34.7	22.1	-14.3	554.9	-28.6
2012	39.1	-31.0	459.8	-25.4	52.0	-33.7	22.7	-12.1	573.5	-26.2

Source: AEA, **Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2012: Devolved Administration GHG Pivot Tables**, July 2014 and Research Service Calculations

It can be seen from table 3 that:

- In 2012, end user greenhouse gas emissions in Wales were 39.1Mt, which is a decrease of 31.0% since 1990. Wales was the only one of the UK nations to see a fall in end-user emissions between 2011 and 2012.
- Since 1990, emissions in Wales using the end-user approach have decreased by a greater percentage than England and Northern Ireland, but less than Scotland.

Wales has lower end user emissions than source emissions. In 2012 end-user emissions were 14.6% lower than emissions measured using the source approach. This is due to Wales being a net exporter of electricity and refined oils to other parts of the UK.



Further information

For further information on **greenhouse gas emissions**, please contact **Gareth Thomas** (GarethDavid.Thomas@Wales.gov.uk), Research Service.

See also:

- AEA, **Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2012**
- Welsh Government, **Climate Change Strategy for Wales**
- Welsh Government, Climate Change Strategy for Wales: **2013 Climate Change Annual Report**

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