

National Assembly for Wales

Greenhouse Gas Emissions in Wales July 2011

This research paper includes data up to 2008 and updates and replaces a previous research paper titled Carbon Dioxide Emissions in Wales.

It provides a short synopsis of the policy framework guiding action on greenhouse gas emissions. The paper examines total greenhouse gas emissions, carbon dioxide and methane emissions at a national level, and compares Welsh emissions with those of other countries internationally. Also included is information on the per capita carbon dioxide emissions for each local authority in Wales.

Comparisons cannot be made with data in previous versions of this paper.

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Enquiry no: 11/0951

National Assembly for Wales

Greenhouse Gas Emissions in Wales
July 2011

Gareth Thomas

Paper number: 11/042

Research
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Summary

This paper updates and replaces a research paper titled Carbon Dioxide Emissions in Wales, published in December 2009, to include data up to 2008. Comparisons with previous publications cannot be made due to changes in the sources and methodologies used.

In 2008, Wales emitted 49.5 Mega tonnes (Mt) of greenhouse gases; this accounted for a 9.9 per cent reduction in emissions below the 1990 base year. To reach the 2020 target of reducing greenhouse gas emissions by 34 per cent below the 1990 base year, emissions will need to be reduced by a further 24.1 percentage points in twelve years.

Of the EU-27, the UN Framework Convention on Climate Change (UNFCCC) Annex 1 Parties and the UK devolved administrations (accounting for 43 countries), Wales was ranked as having the 22nd largest reduction in greenhouse gas emissions since the base year. The UK was ranked 16th. Of the same countries, Wales was ranked as having the 6th highest greenhouse gas emissions per capita, while the UK was ranked 18th.

In 2008, Wales emitted 42 Mega tonnes (Mt) of carbon dioxide; this accounted for a 2.6 per cent reduction in emissions below the 1990 base year. To reach the 2010 target of reducing carbon dioxide emissions by 20 per cent below the 1990 base year, emissions will need to be reduced by a further 17.4 percentage points in two years. The largest emitter of carbon dioxide emissions in Wales was the Corus Steelworks in Port Talbot, emitting 5.3 Mt of carbon dioxide in 2009.

Of the EU-27, the UNFCCC Annex 1 Parties and the UK devolved administrations (accounting for 42 countries), Wales was ranked as having the 23rd largest reduction in carbon dioxide emissions since the base year. The UK was ranked 20th. Of these countries, Wales was ranked as having the 6th highest carbon dioxide emissions per capita, while the UK was ranked 16th.

Using 'end user' measurements, Neath Port Talbot had the highest carbon dioxide emissions of local authorities in Wales in 2008, while Merthyr Tydfil had the lowest. Carbon dioxide emissions per capita were lowest in the South Wales Valleys, Mid-Wales and some parts of North Wales.

In 2008, Wales emitted 7.9 Mega tonnes (Mt) of methane; this accounted for a 44.5 per cent reduction in emissions below the 1990 base year. Of the EU-27, the UNFCCC Annex 1 Parties and the UK devolved administrations (accounting for 44 countries), Wales was ranked as having the 8th largest reduction in methane emissions since the base year. The UK was ranked 3rd. Of these countries, Wales was ranked as having the 12th highest methane emissions per capita, while the UK was ranked 30th.

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1. Introduction

The earth's climate has been varying for millions of years, with some natural variation being natural and expected. However, recent, rapid increases in pollution are thought to have changed the composition of both the atmosphere and the oceans, leading to an increase in the amount of heat retained within the planetary circulation systems. There is compelling scientific evidence that the activities of humankind are responsible for changing the climate of the planet; this human-induced change is what is usually referred to as 'climate change', although it should be noted that there is not universal agreement that this is the case.

The United Nations Intergovernmental Panel on Climate Change (IPCC) [Working Group I](#) concluded in their Fourth Assessment that:

...most of the observed increase in global average temperature since the mid-20th century is very likely (>90 per cent probability of occurrence) to result from the observed increase in human caused greenhouse gases.¹

This paper concentrates on human caused greenhouse gas emissions, providing analysis of the recent changes in emissions in Wales and makes comparisons with global emissions and other UK countries.

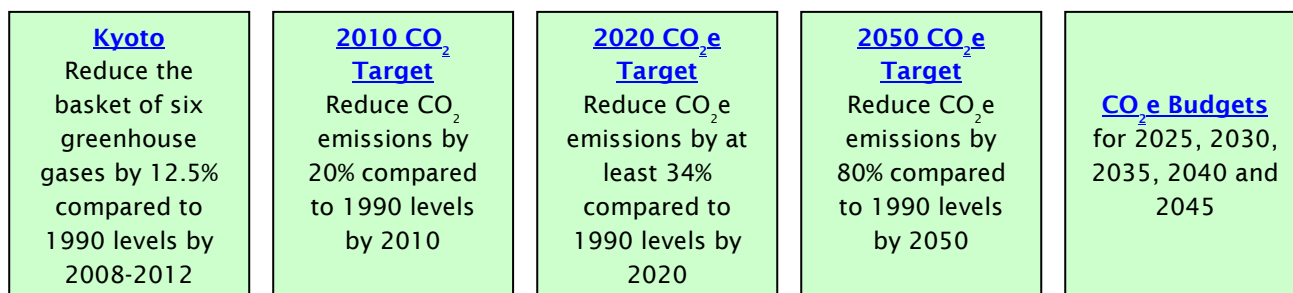
Emissions of carbon dioxide are the most significant human caused greenhouse gas. In addition to total greenhouse gas emissions, this paper therefore looks at carbon dioxide emissions, and also considers recent changes in methane emissions.

¹ United Nations Intergovernmental Panel on Climate Change, [Climate Change 2007 : Synthesis Report](#), page39 [accessed 7 April 2011]

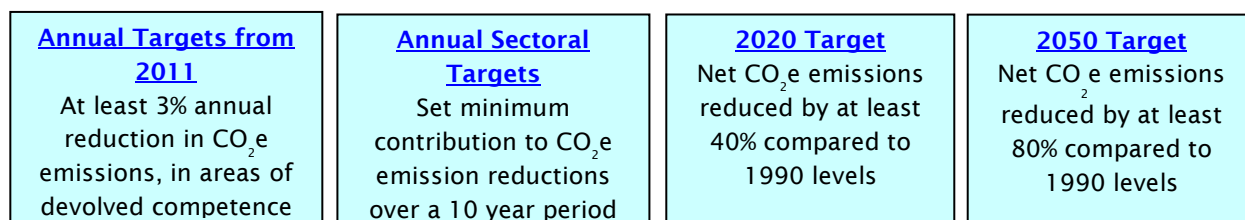
2. Policies and Targets

The following diagram provides an overview of the targets the UK Government and the Welsh Government have set to reduce the emissions of greenhouse gases, especially carbon dioxide, over the next century. To obtain further information on the targets, click on the links within each box.

UK Targets



Wales Targets



Scotland Targets

2010: Reduce CO₂e below 2009 national budget by 2010
2011-2019: CO₂e emissions to be lower than preceding year
2020: Net CO₂e emissions reduced by 42% compared to baseline
2020-2050: CO₂e emissions to be at least 3% lower than preceding year
2050: Net CO₂e emissions reduced by 80% compared to baseline

Northern Ireland Targets

2025: Reduce emissions of all GHGs (CO₂e) by 25% on baseline levels
2050: Net CO₂e emissions reduced by 80% compared to baseline

Source: [AEA Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page 3 (September 2010) and Welsh Government, [Climate Change Strategy for Wales](#) page 34 (October 2010) for Welsh targets.

Note: CO₂e is carbon dioxide equivalent emissions from greenhouse gases (GHGs).

2.1. *International policy*

The UN Framework Convention on Climate Change (UNFCCC)² sets an overall framework for intergovernmental efforts to tackle climate change, with the objective of stabilising greenhouse gas emissions in the atmosphere and reducing the human impact on the climate system.³ It recognises that the climate system is a shared resource whose stability can be affected by emissions of carbon dioxide and other greenhouse gases. The Convention has been ratified by 194 countries⁴, and one regional economic integration organisation (the EU), and entered into force on 21 March 1994.

The Kyoto Protocol⁵ is the protocol to the UNFCCC which entered into force on 16 February 2005; 192 Parties and one regional organisation (the EU) have ratified the Protocol to date.⁶ The Protocol's major feature is mandatory targets on greenhouse gas emissions, whereas the UNFCCC encouraged countries to stabilise greenhouse gas emissions. These targets range from -8 per cent to +10 per cent of 1990 (base year) emissions levels, 'with the view to reducing their overall emissions of such gases by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012'. The European Union participated in both the UNFCCC and the Kyoto Protocol on behalf of its Member States. The EU countries have a target to reduce emissions by 8 per cent, and the UK has agreed to reduce its emissions to at least 12.5 per cent lower than the base year levels.⁷

The world's nations met at the sixteenth conference of the UNFCCC in Cancun, Mexico between 29 November and 10 December 2010, and agreed to establish a Green Climate Fund which provides funds to developing nations to protect them against the impacts of climate change and to support low-carbon development.⁸ It was also recognised that between 50 and 80 per cent of actions to tackle climate change will need to be delivered below member state level.⁹ The next UNFCCC conference will be in Durban, South Africa between 28 November and 9 December 2011.¹⁰ The Kyoto agreement runs until 2012, and negotiations on a follow-up agreement have been taking place at UNFCCC conferences over previous years.

² United Nations: [United Nations Framework Convention on Climate Change](#) [accessed 6 April 2011]

³ AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page 1 (September 2010) [accessed 6 April 2011]

⁴ The number of [countries](#) that have ratified the convention as of 6 April 2011 [accessed 6 April 2011]

⁵ United Nations: [Kyoto Protocol to the United Nations Framework Convention on Climate Change](#), 1998 [accessed 6 April 2011]

⁶ The number of [Parties](#) to have ratified the protocol as of 6 April 2011 [accessed 6 April 2011]

⁷ DECC, [The UK Climate Change Programme Annual Report to Parliament](#), page 9, (July 2008) [accessed 6 April 2011]

⁸ Welsh Government, Jane Davidson (Minister for Environment, Sustainability and Housing), [Minister for Environment welcomes historic Cancun climate deal](#), 14 December 2010 [accessed 6 April 2011]

⁹ Welsh Government, Jane Davidson (Minister for Environment, Sustainability and Housing), [Cancun Climate Change Summit](#), Cabinet (Written) Statement, 23 December 2010 [accessed 6 April 2011]

¹⁰ United Nations, [United Nations Framework Convention on Climate Change Calendar 2011](#) [accessed 6 April 2011]

2.2. European Policy

The [European Climate Change Programme](#) was launched in June 2000, with the goal of identifying and developing all the necessary elements of an EU strategy to implement the Kyoto Protocol. The second phase of the programme commenced in October 2005. The EU has wide jurisdiction over environmental matters to influence climate change, the most relevant of which are:

- The EU has an objective of limiting global temperature increase to less than 2°C compared to pre-industrial levels, and has offered to increase its emissions reduction to 30 per cent by 2020, should other major emitting nations agree to take further action in a global agreement. Until an agreement is concluded, the EU's target is a 20 per cent reduction, including targets to improve energy efficiency by 20 per cent by 2020¹¹, and to increase the share of renewable energy to 20 per cent by 2020. The EU is also aiming to reduce domestic emissions by 80-95 per cent by 2050, as agreed at its Environment Council in November 2009.¹²
- Aviation will be included in the EU Emissions Trading Scheme from January 2012.¹³

2.3. UK policy

The UK's first Climate Change Programme, in 2000, set a domestic goal to cut the UK's emissions of carbon dioxide by 20 per cent below 1990 levels by 2010.¹⁴ In March 2006 the then UK Labour Government published its new Climate Change Programme¹⁵ which set out its policies and priorities for action on climate change, both across the UK and internationally.

The *Climate Change Act 2008*¹⁶ provides a legal framework to reduce future greenhouse gas emissions by 80 per cent compared to 1990 levels by 2050, with a reduction in emissions of at least 34 per cent compared to 1990 levels by 2020.¹⁷ It established a system of '[carbon budgeting](#)' every five years, during which time greenhouse gas emissions must be within predetermined limits. In addition, the Act also established the [Committee on Climate Change](#), an independent body which advises the UK Government and reports to Parliament annually on progress towards targets and budgets.

¹¹ European Union, [What is the EU doing on climate change](#), [accessed 6 April 2011]

¹² European Union, [Roadmap for moving to a low-carbon economy in 2050](#) [accessed 7 April 2011]

¹³ European union, [Emissions Trading System \(EU ETS\)](#), accessed 6 April 2011]

¹⁴ Department of Energy and Climate Change, [Climate Change: The UK Programme, Summary](#), page 3, November 2000 [accessed 7 April 2011]

¹⁵ Department of Energy and Climate Change, [UK Climate Change Programme](#), March 2006 [accessed 7 April 2011]

¹⁶ [Climate Change Act 2008](#) (chapter 27) [accessed 7 April 2011]

¹⁷ Department of Energy and Climate Change webpage, [Climate Change Act 2008](#) [accessed 7 April 2011]

In May 2011 it was announced that the UK Government is proposing a 50 per cent cut in greenhouse gas emissions for the carbon budget for 2023 to 2027, in line with advice it received from the Committee on Climate Change. This budget is required to be set in law by the end of June 2011.¹⁸

2.4. *Wales policy*

The previous Welsh Government's [Climate Change Strategy for Wales](#), published in October 2010, provided details of how Wales will aim to meet its target for 3 per cent annual reductions in carbon equivalent emissions from 2011 'in areas of devolved competence'¹⁹, and to achieve at least a 40 per cent reduction in greenhouse gas emissions by 2020.

The Climate Change Commission for Wales first met in December 2007, and is an independent advisory body which helps to develop policy, and works towards creating a consensus on climate change.²⁰ The Commission is made up of stakeholders from businesses, the public sector, environmental organisations, the voluntary sector and representatives of the four major Welsh political parties.²¹ The Commission worked alongside the Welsh Government to develop and approve the *Climate Change Strategy for Wales*.²² The strategy sets out how and where the Welsh Government will act to reduce greenhouse emissions, and how they intend to work with partners such as the UK Government, businesses, organisations and communities. Targets are also set out for specific sectors such as transport, business, agriculture and land use, waste, residents and the public sector.²³

The *Climate Change Strategy* is supplemented by two delivery plans; the *Emissions Reduction Delivery Plan*²⁴, which provides information on the policies and programmes that the Welsh Government believes will enable it to meet its annual 3 per cent reduction in carbon emissions in devolved areas, and the *Adaptation Delivery Plan*²⁵ which gives details of actions aimed at increasing Wales' resilience to climate change.

Under the *Climate Change Act 2008*, the Welsh Government is required to report to the National Assembly for Wales on its climate change objectives, policies and priorities. The *Climate Change Strategy* and the two delivery plans were submitted by the Welsh Government to the Assembly as the first report under

¹⁸ The UK Secretary of State for Energy and Climate Change (Chris Huhne) [HC Deb 17 May 2011 c176-7](#) [accessed 23 May 2011]

¹⁹ Welsh Government: [Climate Change Strategy for Wales](#) page 34, (October 2010) [accessed 7 April 2011]

²⁰ Welsh Government, [Climate Change Commission and subgroups](#) [accessed 7 April 2011]

²¹ Welsh Government, [Climate Change Commission for Wales](#) [accessed 7 April 2011]

²² Welsh Government, [Climate Change Strategy for Wales](#) page 5, (October 2010) [accessed 7 April 2011]

²³ *Ibid.* p38

²⁴ Welsh Government, [Delivery plan for Emission reduction](#) (October 2010) [accessed 7 April 2011]

²⁵ Welsh Government, [Adaptation Delivery Plan](#) (October 2010)

these requirements. The next report will be made in 2012, and future reports will be made annually.²⁶

3. Measuring Greenhouse Gas Emissions

There are two main approaches to calculating greenhouse gas emissions:

- **Production approach:** calculating emissions according to where emissions are produced. This is relatively easy to calculate and allocate to national accounts, however, it does not account for products that are made elsewhere and imported. This methodology is used by the [UNFCCC](#), and the AEA national figures have also been used to enable comparisons between the devolved nations and UNFCCC Annex 1 Parties²⁷ regarding total greenhouse gas emissions, carbon dioxide emissions and methane emissions.
- **Consumption or end user approach:** calculating emissions according to where the product of those emissions is consumed. This accounts for all the emissions associated with the consumption of materials, goods and energy, rather than those associated with the geographical location of where production takes place. I.e. accounting for all greenhouse gas emissions for which Wales' residents are responsible, not those that simply arise from within Wales. "End user" data for carbon dioxide emissions by local authority has been published by AEA²⁸ and figures for the Welsh local authorities are included in section 3.3.

The difference between the two approaches gives an indication of the extent to which the products, produced in Wales, are remaining in Wales or being exported to other countries. **In this paper, the national and international figures (in sections 3.1 and 3.2) use the production approach, while the local authority emissions data (section 3.3) uses the end user definition.**

3.1. National Emissions

This section compares the available data on total net greenhouse gas emissions in Wales, and other UK countries, with the targets outlined in the previous chapter. It then goes on to look at carbon dioxide emissions and methane emissions in Wales and the other UK countries.

3.1.1. Total net greenhouse gas emissions

Wales has performed inconsistently in reducing greenhouse gas emissions over the past 18 years. In 2008, total net emissions of greenhouse gases in Wales

²⁶ Welsh Government, [Climate Change Strategy for Wales](#) page 29, (October 2010) [accessed 7 April 2011]

²⁷ [Annex 1 Parties](#) include the industrialised countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States. [accessed 11 April 2011]

²⁸ AEA, [Local and Regional CO2 Emissions Estimates for 2005-2008 for the UK](#), (November 2010) [accessed 11 April 2011]

were 49.5 Mega tonnes (Mt), 9.9 per cent lower than the base year (1990 or 1995)²⁹, although there was a rise of 4 percentage points between 2007 and 2008. In comparison with the other UK countries in 2008, Wales has reduced its emissions (below the 1990 or 1995 base year) by 9.9 per cent, which is 9.6 percentage points less than the UK average, as shown in table 1. Scotland has had the largest reduction in emissions, of 21.3 per cent.

Total greenhouse gas emissions are made up of six gases; carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.³⁰

Table 1: Greenhouse gas emissions and percentage change from base year (1990 or 1995)^(a), Wales and the UK^(b), 1995 to 2008 (Mt CO₂ e)

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	55.0	..	614.4	..	68.2	..	25.0	..	777.8	..
1995	51.3	..	551.4	..	65.7	..	24.7	..	713.1	..
1998	53.1	-3.4	539.9	-12.1	65.1	-4.6	24.1	-3.8	703.1	-9.6
1999	54.1	-1.5	510.4	-16.9	61.1	-10.5	24.1	-3.5	670.2	-13.8
2000	55.9	1.7	509.7	-17.0	63.4	-7.1	23.6	-5.6	672.0	-13.6
2001	52.7	-4.2	516.1	-16.0	62.6	-8.2	23.9	-4.6	675.4	-13.2
2002	46.0	-16.4	506.5	-17.6	59.0	-13.6	21.8	-12.8	653.6	-16.0
2003	47.0	-14.4	512.5	-16.6	58.7	-14.0	21.7	-13.0	659.3	-15.2
2004	50.6	-8.0	508.7	-17.2	56.4	-17.4	21.7	-13.1	656.7	-15.6
2005	49.4	-10.1	506.2	-17.6	55.6	-18.5	22.8	-9.0	652.6	-16.1
2006	50.5	-8.1	497.9	-19.0	59.2	-13.3	23.3	-6.7	647.6	-16.7
2007	47.3	-13.9	495.5	-19.4	55.3	-18.9	22.3	-10.9	637.9	-18.0
2008	49.5	-9.9	484.5	-21.1	53.7	-21.3	22.2	-11.2	626.0	-19.5

Source: AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), (September 2010)

..= not applicable

Notes:

- The base years for carbon dioxide, methane and nitrous oxide emissions are 1990. The base years for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride are 1995. AEA has calculated the base year figure for total greenhouse gas emissions based on the figures for the corresponding base years.
- Data includes Crown Dependencies but excludes Overseas Territories – emissions from Crown Dependencies are allocated to England.

Emissions from offshore sources are not allocated to any of the countries within the UK, but are instead recorded in an ‘unallocated’ inventory category.

Unallocated total net greenhouse gas emissions accounted for 1.8 per cent (16.1Mt) of the UK’s emissions in 2008, a small decrease from 2.0 per cent in

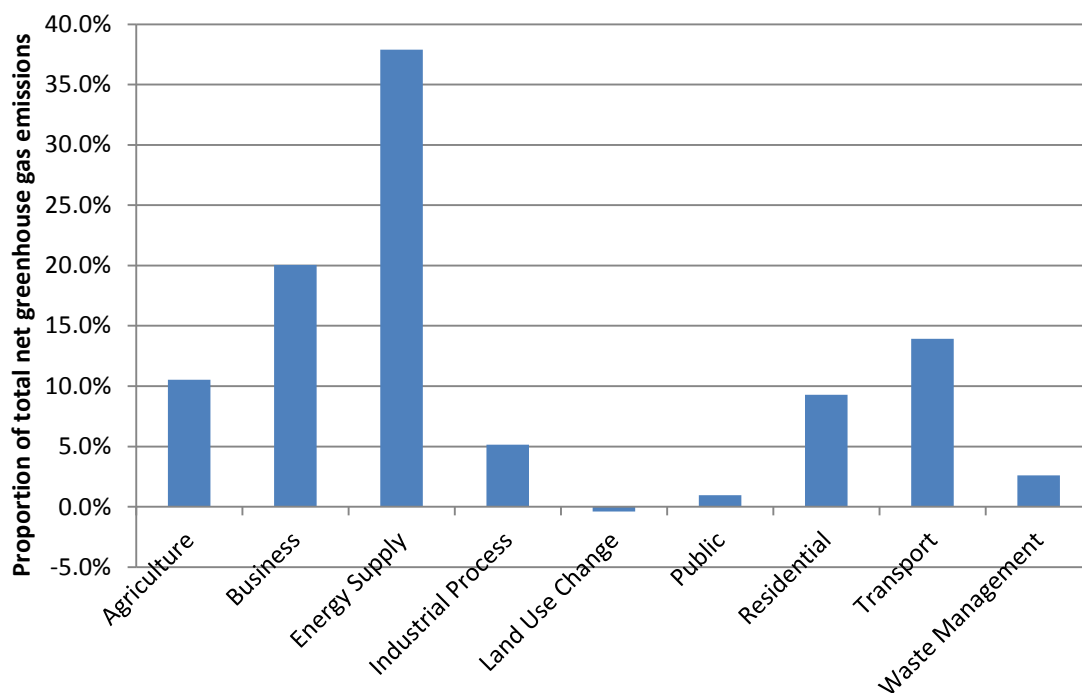
²⁹ AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page v, (September 2010) [accessed 11 April 2011]

³⁰ Ibid. page v

1990.³¹ There are no ‘unallocated’ emissions for hydrofluorocarbons, perfluorocarbons or sulphur hexafluoride.

The major sources of greenhouse gas emissions in Wales are power stations and combustion from the iron and steel sector, which produce large amounts of carbon dioxide; enteric fermentation in cattle and sheep, which produce large amounts of methane, and agricultural soil, which produces large amounts of nitrous oxide.³² Figure 1 below shows total net greenhouse gas emissions in Wales by sector in 2008. It can be seen that the energy supply sector produced most total net greenhouse gas emissions in 2008, producing 38 per cent of all total net greenhouse gas emissions. Business produced 20 per cent, while transport and agriculture each produced between 10 and 15 per cent of total net greenhouse gas emissions in Wales in 2008.

Figure 1: Total net greenhouse gas emissions in Wales by sector, 2008



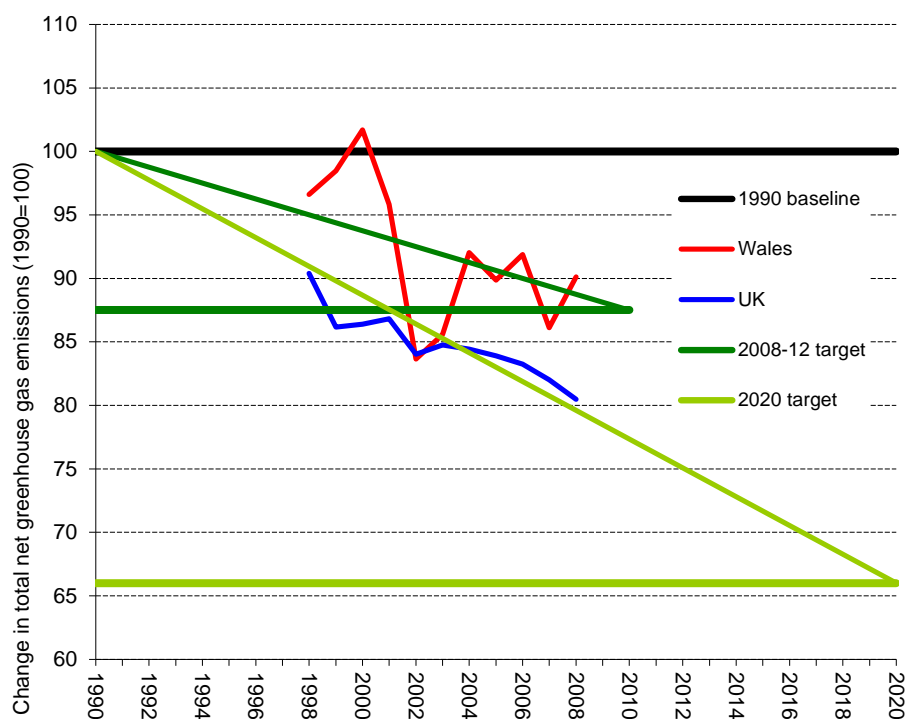
Source: AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), (September 2010) and Research Service calculations - data is available in Annex A of this research paper.

Figure 2 shows the inconsistent trend of greenhouse gas emissions in Wales in comparison with the UK trend and the trend lines to achieve the 2020 target of reducing total net greenhouse gas emissions by 34 per cent below the 1990 base year. It also shows the 2008-12 Kyoto Protocol target of the UK reducing greenhouse gas emissions by 12.5 per cent.

³¹ AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page 60, (September 2010) [accessed 11 April 2011]

³² Ibid. page 35

Figure 2: Change in total net greenhouse gas emissions from 1990 to 2008, Wales and UK



Source: AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), (September 2010)

(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.

(b) Different methodologies have been used from previous AEA publications; therefore comparisons cannot be made with previous papers.

3.1.2. Carbon dioxide emissions

Carbon dioxide accounts for approximately 85 per cent of total net greenhouse gas emissions in the UK.³³ Wales has performed inconsistently in reducing carbon dioxide emissions over the past 18 years. In 2008, total emissions of carbon dioxide were 42Mt, representing a 2.6 per cent decrease from the base year (1990)³⁴, although there was an increase of 6 percentage points between 2007 and 2008. In comparison with the other UK countries in 2008, Wales has reduced its emissions (below the 1990 base year) by 7.5 percentage points less than the UK average, as shown in table 2. Scotland has had the largest reduction in emissions, of 16.8 per cent.

³³ AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page ix, (September 2010) [accessed 11 April 2011]

³⁴ Ibid. page 35

Due to updated emissions data and changes to methodologies it is not possible to compare these figures with previous Research Service papers or previous AEA inventory publications.

Table 2: Carbon dioxide emissions^(a) and percentage change from base year (1990), Wales and the UK^(b), 1990 to 2008 (Mt CO₂)

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	43.1	..	467.3	..	50.6	..	17.3	..	591.4	..
1995	40.6	-5.9	426.3	-8.8	49.5	-2.1	17.2	-1.0	551.5	-6.7
1998	42.8	-0.8	423.8	-9.3	49.8	-1.4	16.5	-5.0	551.8	-6.7
1999	44.1	2.3	415.2	-11.1	46.7	-7.6	16.7	-3.8	541.4	-8.5
2000	46.3	7.3	419.5	-10.2	49.4	-2.2	16.5	-4.5	549.6	-7.1
2001	43.7	1.2	432.8	-7.4	49.4	-2.2	16.9	-2.5	561.3	-5.1
2002	37.3	-13.6	426.0	-8.8	46.2	-8.6	15.3	-11.4	543.7	-8.1
2003	38.6	-10.6	437.1	-6.5	46.6	-7.9	15.4	-10.9	555.5	-6.1
2004	42.2	-2.2	435.1	-6.9	44.4	-12.2	15.5	-10.4	555.1	-6.1
2005	40.8	-5.4	434.1	-7.1	43.6	-13.7	16.6	-4.4	552.6	-6.6
2006	42.2	-2.2	427.9	-8.4	47.2	-6.6	17.2	-1.0	550.1	-7.0
2007	39.4	-8.6	426.8	-8.7	43.6	-13.8	16.2	-6.6	542.2	-8.3
2008	42.0	-2.6	416.3	-10.9	42.1	-16.8	16.2	-6.7	531.5	-10.1

Source: AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), (September 2010)

Notes:

- (a) Different methodologies have been used from previous AEA publications, therefore comparisons cannot be made with previous papers.
- (b) Data includes Crown Dependencies but excludes Overseas Territories – emissions from Crown Dependencies are allocated to England.

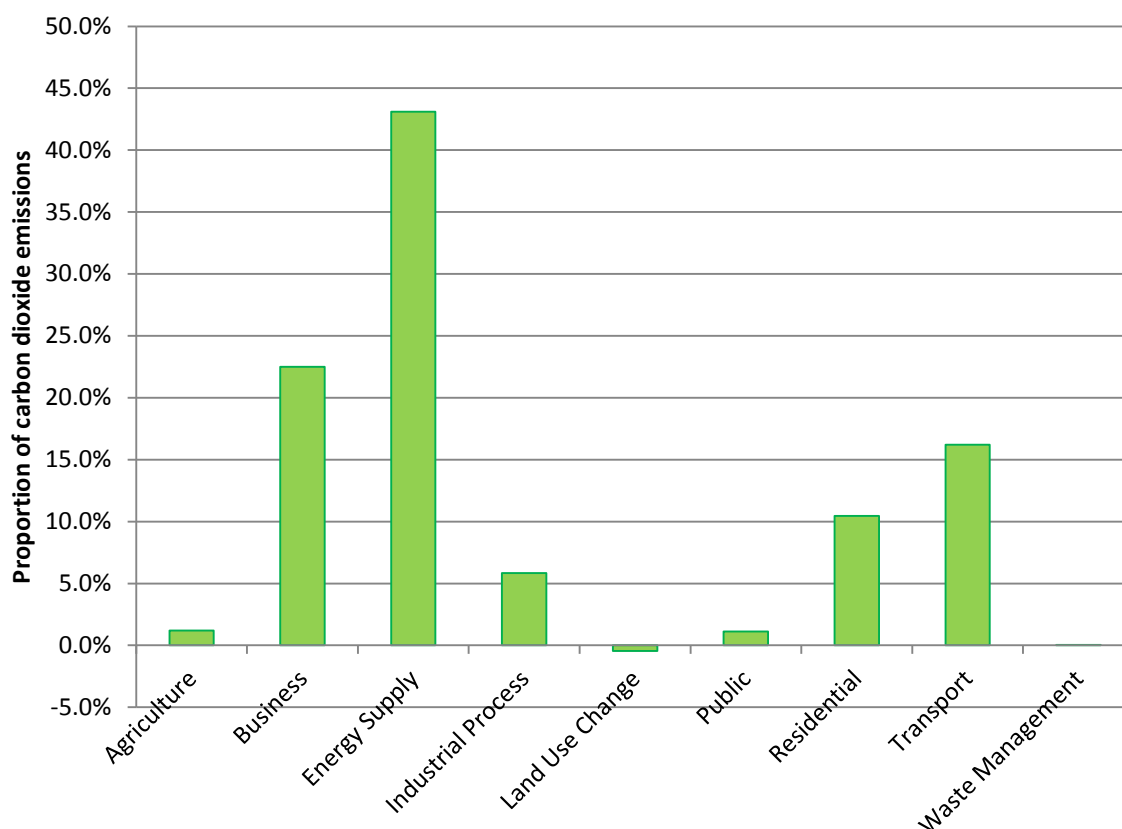
Emissions from offshore sources are not allocated to any of the countries within the UK, but are instead recorded in an ‘unallocated’ inventory category.

Unallocated carbon dioxide emissions accounted for 2.8 per cent (15.0Mt) of the UK’s emissions in 2008, an increase of 13.6 per cent since 1990.³⁵

It can be seen from figure 3 that the energy supply sector produced 43 per cent of all carbon dioxide emissions in Wales in 2008, which was the largest proportion of all sectors. Business produced 23 per cent, and transport produced 16 per cent of all carbon dioxide emissions in Wales during 2008.

³⁵ AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page 60, (September 2010) [accessed 11 April 2011]

Figure 3: Carbon dioxide emissions in Wales by sector, 2008



Source: Source: AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), (September 2010) and Research Service calculations – data is available in Annex A of this research paper.

It is estimated that electricity generation contributed 35 per cent of total Welsh carbon dioxide emissions in 2008, which is slightly higher than the UK proportion of 32.5 per cent. Emissions from electricity generation have increased by 30.5 per cent between 1990 and 2008, compared with a fall of 15.3 per cent in UK emissions. However, it should be noted that annual generation figures have fluctuated significantly over this period, including a rise of 30 per cent in power station emissions between 2007 and 2008 due to Aberthaw Power Station re-opening following its plant shutdown during 2007 to retro fit two units with Flue Gas Desulphurisation abatement.³⁶

Wales is a net exporter of electricity i.e. it exports more than it uses. Data indicates that in 2008 10,064 GWh of electricity, just over 26 per cent of all power generated in Wales, was exported to England. Again, the re-opening of Aberthaw was a major factor in this.

³⁶ AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page 36 (September 2010)

The Environment Agency has provided details of the top 11 carbon dioxide emitters in the EU Emissions Trading Scheme (EUETS) in Wales from 2005 to 2009, and also of the sector of the emitters.

Table 3: Top 11 carbon dioxide emitters in the EUETS in Wales, 2005-09 (Mt CO₂)

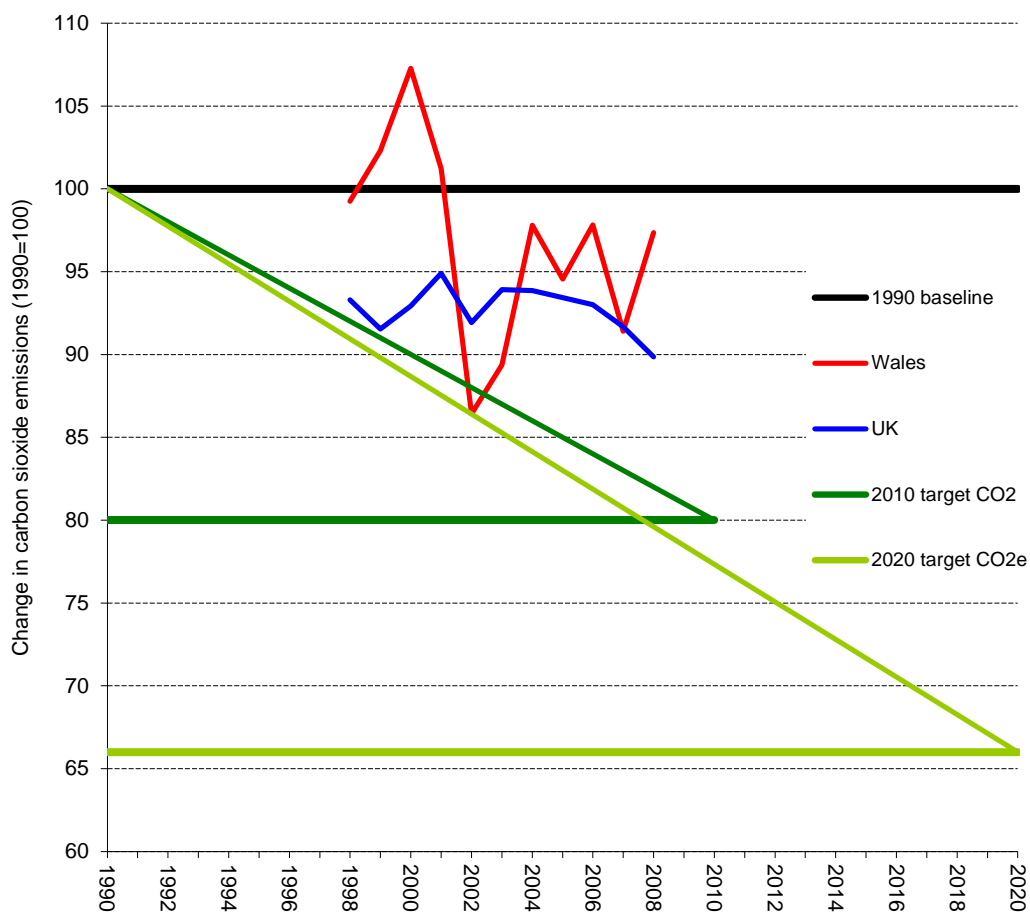
Site		2005	2006	2007	2008	2009
Port Talbot Steelworks	Industry	6.1	6.6	7.1	6.9	5.3
Aberthaw Power Station	Electricity Generation	5.3	7.3	4.2*	7.0	5.0
Connahs Quay Power Station	Electricity Generation	3.4	3.2	3.4	3.3	3.2
Chevron Limited - Pembroke	Industry	2.3	2.3	2.5	2.2	2.5
Deeside Power Station	Electricity Generation	1.0	0.6	0.9	1.2	1.2
Murco Petroleum Ltd - Milford Haven	Industry	1.0	1.2	1.2	1.1	1.1
Uskmouth Power Station	Electricity Generation	1.0	0.9	0.6	1.3	0.7
Barry Power Station	Electricity Generation	0.3	0.2	0.4	0.5	0.5
Shotton Combined Heat Power Station	Electricity Generation	0.5	0.5	0.5	0.5	0.4
Baglan Power Station	Electricity Generation	1.1	1.1	1.4	0.7	0.3
Padeswood Works	Industry	0.3	0.6	0.6	0.5	0.3

Source: Environment Agency

* Reduction at Aberthaw was the result of a temporary reduction in capacity.

Figure 4 shows the inconsistent trend of carbon dioxide emissions in Wales in comparison with the UK trend and the trend lines to achieve the 2010 target of reducing carbon dioxide emissions by 20 per cent below the 1990 base year. It also shows the 2020 Kyoto Protocol target of the UK reducing greenhouse gas emissions by 34 per cent.

Figure 4: Change in carbon dioxide emissions from 1990 to 2008, Wales and UK



Source: AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), (September 2010)

(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.

(b) Different methodologies have been used from previous AEA publications; therefore comparisons cannot be made with previous papers.

3.1.3. Methane emissions

Wales has consistently reduced methane emissions over the past 18 years. In 2008, methane emissions in Wales were 4.4Mt, 44.5 per cent lower than the base year (1990)³⁷, and 2.4 percentage points lower than in 2007. In comparison with

³⁷ AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page 35 (September 2010)

the other UK countries in 2008, Wales has reduced its emissions (below the 1990 base year) by 8.9 percentage points less than the UK average, as shown in table 4, although it has reduced its emissions by more percentage points than Scotland and Northern Ireland. England has had the largest reduction in emissions, of 57.3 per cent.

Table 4: Methane emissions and percentage change from base year (1990), Wales and the UK^(a), 1990 to 2008 (Mt CO₂e)

Year	Wales		England		Scotland		Northern Ireland		United Kingdom	
	Emissions (Mt)	Percentage change since base year	Emissions (Mt)	Percentage change since base year	Emissions (Mt)	Percentage change since base year	Emissions (Mt)	Percentage change since base year	Emissions (Mt)	Percentage change since base year
1990	7.9	..	79.0	..	11.0	..	4.4	..	104.1	..
1995	6.8	-13.8	68.0	-13.9	10.2	-7.5	4.1	-5.8	90.9	-12.7
1998	6.2	-21.6	58.1	-26.5	9.2	-17.0	4.0	-9.5	79.0	-24.2
1999	6.0	-24.0	54.2	-31.4	8.5	-23.4	3.8	-13.7	73.8	-29.1
2000	5.7	-27.3	50.6	-36.0	8.1	-26.6	3.6	-17.4	69.3	-33.5
2001	5.2	-33.4	46.0	-41.8	7.3	-33.5	3.5	-20.6	63.3	-39.3
2002	5.1	-35.8	43.8	-44.5	6.9	-37.9	3.4	-22.6	60.2	-42.2
2003	4.8	-38.6	38.8	-50.8	6.2	-43.6	3.3	-24.9	54.3	-47.9
2004	4.8	-38.7	37.2	-53.0	6.2	-43.9	3.3	-25.6	52.6	-49.5
2005	4.9	-37.6	36.0	-54.5	6.3	-43.3	3.3	-23.6	51.4	-50.7
2006	4.8	-39.3	35.2	-55.5	6.3	-43.0	3.3	-24.5	50.4	-51.6
2007	4.6	-42.1	33.9	-57.0	6.3	-43.3	3.4	-23.5	49.1	-52.8
2008	4.4	-44.5	33.7	-57.3	6.3	-43.1	3.3	-23.8	48.6	-53.4

Source: AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), (September 2010)

Note:

- (a) Data includes Crown Dependencies but excludes Overseas Territories – emissions from Crown Dependencies are allocated to England.

Enteric fermentation³⁸ from cattle is the largest source of methane emissions in Wales, providing 31 per cent of all methane emissions in Wales in 2008, and fermentation from sheep is also a significant source of methane emissions. In the energy sector, fugitive emissions from fuels such as leaks from the natural gas supply network are a further source of methane emissions, accounting for 12.5 per cent of all methane emissions in Wales in 2008.³⁹

3.2. International emissions

Comparisons of greenhouse gas emissions with those of other countries can be interesting for reference purposes. As explained in section 2.1, the Kyoto protocol includes individual targets of reducing greenhouse emissions between -8 per cent and +10 per cent of 1990 emissions by 2008-12. Information on assigned amounts for individual nations is available in [Annex B to the Kyoto](#)

³⁸ The United Nations Intergovernmental Panel on Climate Change (IPCC) states that: "Methane is produced in herbivores as a byproduct of enteric fermentation, a digestive process by which carbohydrates are broken down by micro-organisms into simple molecules for absorption into the bloodstream...ruminant livestock (e.g. cattle, sheep) are major sources of methane."

UNIPCC, [IPCC Guidelines for National Greenhouse Gas Inventories](#) (page 10.24), February 2009 [accessed 23 May 2011]

³⁹ AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page 36, (September 2010) [accessed 11 April 2011]

[protocol](#). Figures are provided in this publication for total net greenhouse gas emissions, carbon dioxide emissions and methane emissions.

Full lists of total net greenhouse gas emissions, carbon dioxide emissions and methane emissions for the Annex 1 Parties, EU-27 and UK countries in 2008 are provided in Annexes A to C of this paper.

It is important to note that due to updated emissions data and changes to methodologies it is not possible to compare the carbon dioxide emissions figures with previous Research Service papers or previous UNFCCC publications.

3.2.1. Total net greenhouse gas emissions

The UNFCCC figures for total net greenhouse gas emissions cover the six main greenhouse gases outlined in section 3.1.1. Figure 5 below shows the percentage change of total net greenhouse gas emissions between the base year (1990 or 1995) and 2008 for all of the UNFCCC Annex 1⁴⁰ Parties,⁴¹ the EU-27⁴² and the four UK countries.⁴³

Of the 43 countries⁴⁴ included in figure 5, 16 have increased their total net greenhouse gas emissions since 1990, while 27 have reduced their emissions. The largest increase was in Turkey, increasing by over 100 per cent. The largest decreases in emissions were in Lithuania and Estonia, both declining by nearly 70 per cent.

In terms of the largest reductions of total net greenhouse gas emissions of the 43 countries included in figure 5, Wales is ranked 22nd, Scotland 14th, England 15th and Northern Ireland 21st. Under the Kyoto Protocol, Annex 1 parties are able to use 1995 as the base year for emissions of hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, and a number of parties do, including the United Kingdom and devolved nations.⁴⁵

⁴⁰ [Annex 1 Parties](#) include the industrialised countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States. [accessed 11 April 2011]

⁴¹ The graph excludes Latvia even though it is part of the UNFCCC Annex 1 Parties as it had negative emissions in 2008. Total net greenhouse gas emissions in Latvia have declined from 8,059Gg to -16,972Gg, a decrease of 311 per cent.

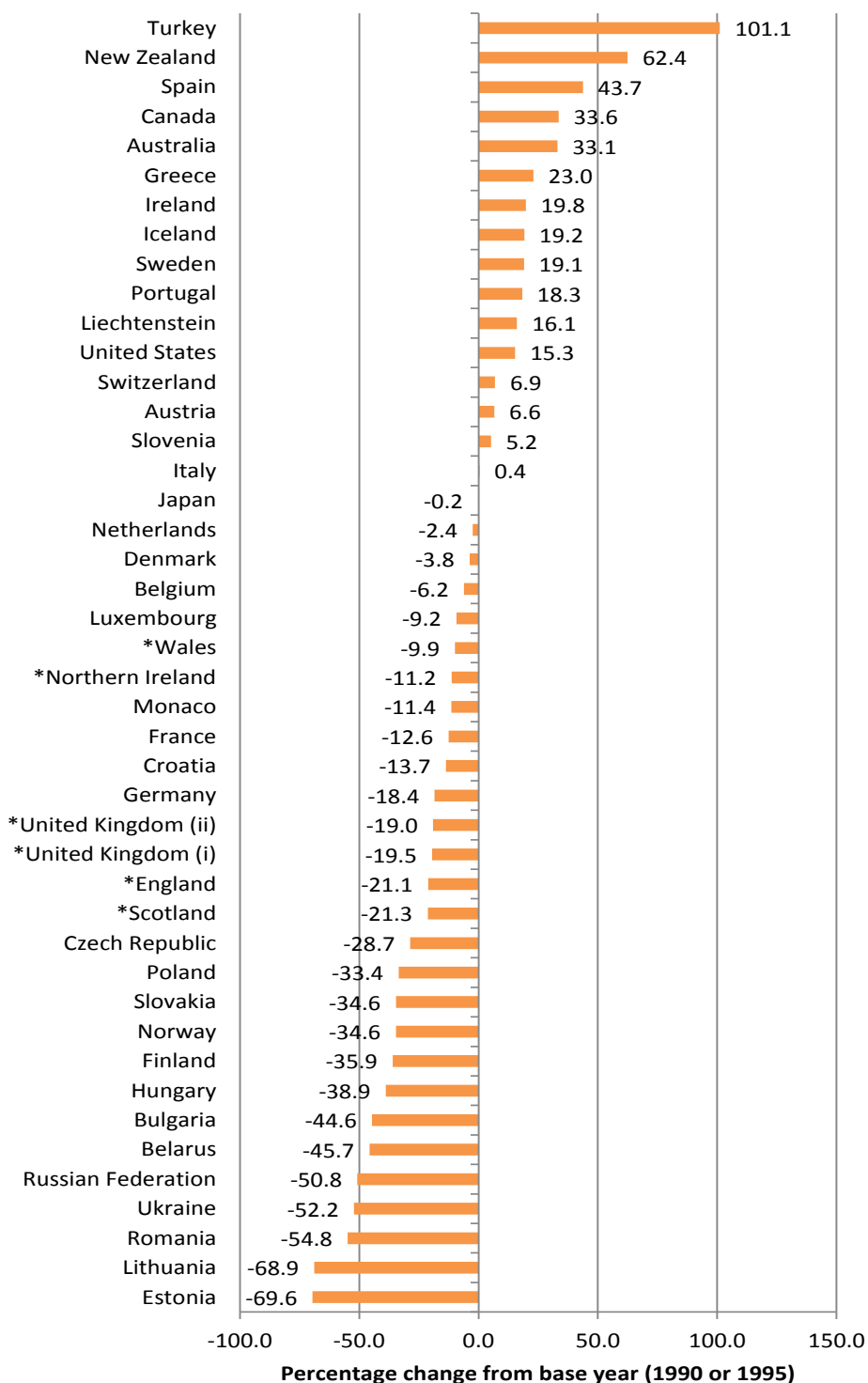
⁴² Data was not available from the UNFCCC for Cyprus and Malta.

⁴³ The UK countries are highlighted with a * on the graph

⁴⁴ Including all four UK countries and "UK (ii)" emissions (not "UK (i)").

⁴⁵ UNFCCC, [Kyoto Protocol Base Year Data](#) [accessed 14 April 2011]

Figure 5: Percentage change from the base year (1990 or 1995) of total net greenhouse gas emissions, by Country^(a), including LULUCF^(b), 2008 (Gg⁴⁶)



Source: UNFCCC, [National Greenhouse Gas Inventory Data for the period 1990-2008](#) and AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), (September 2010) – data is available in Annex B of this research paper.

⁴⁶ One Gigagramme (Gg) equates to one thousand tonnes, or one kilotonnes (kt) (UK data is recorded in kt).

Notes:

(a) The graph excludes Latvia even though it is part of the UNFCCC Annex 1 Parties as it had negative emissions in 2008. Total net greenhouse gas emissions in Latvia have declined from 8,059Gg to -16,972Gg.

(b) LULUCF is land use, land use change and forestry.

UK (i) figure does not match those published in table 1; here the figure includes all unallocated emissions, Crown Dependencies and Overseas Territories which have joined the UK's instruments of ratification to the UNFCCC and the Kyoto Protocol.

UK (ii) only includes unallocated emissions and Crown Dependencies. These match the figures provided in table 1, (the figure for England also includes Crown Dependencies).

Countries with large populations and large economies tend to have the largest emissions. Due to this, focusing only on absolute emission levels gives a partial understanding of global greenhouse gas emissions. Examining total net greenhouse gas emissions per capita provides further explanation as to how emissions are distributed.⁴⁷ Total net greenhouse gas emissions per capita is the total net amount of greenhouse gases emitted by a country, divided by the population of the country.⁴⁸

Figure 6 presents the total net greenhouse gas emissions (net emissions/removals) per capita for each of the EU-27,⁴⁹ the UNFCCC Annex 1 Parties⁵⁰ and the four UK countries.⁵¹ Data for UK countries have been calculated using total net greenhouse gas emissions published in the AEA 2010 publication,⁵² divided by the [mid-2008 population estimates](#) for each country.

The total net greenhouse gas emissions per capita shown in figure 6 have been **calculated by the Research Service**, by dividing total net greenhouse gas emissions for each country by their population. **Caution** should be used when **making comparisons** with other data sources as methodologies are likely to differ. In addition, **care** should be taken when **comparing the UK devolved administration** figures with **international figures** as the methods used to calculate total net greenhouse gas emissions are also likely to vary slightly.

The total net greenhouse gas emissions per capita for the UK countries in 2008 were:

⁴⁷ World Resources Institute, [Navigating the numbers, Greenhouse gas data and international climate policy](#), page 21, 2005 [accessed 14 April 2011]

⁴⁸ DBERR, [Energy – its impact on the environment and society](#), Annex 5A page 3, July 2006 [accessed 14 April 2011]

⁴⁹ Data for Cyprus and Monaco are not available and due to the negative levels of greenhouse gas emissions in Latvia it has also been excluded (see footnote 42).

⁵⁰ [Annex 1 Parties](#) include the industrialised countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States. [accessed 11 April 2011]

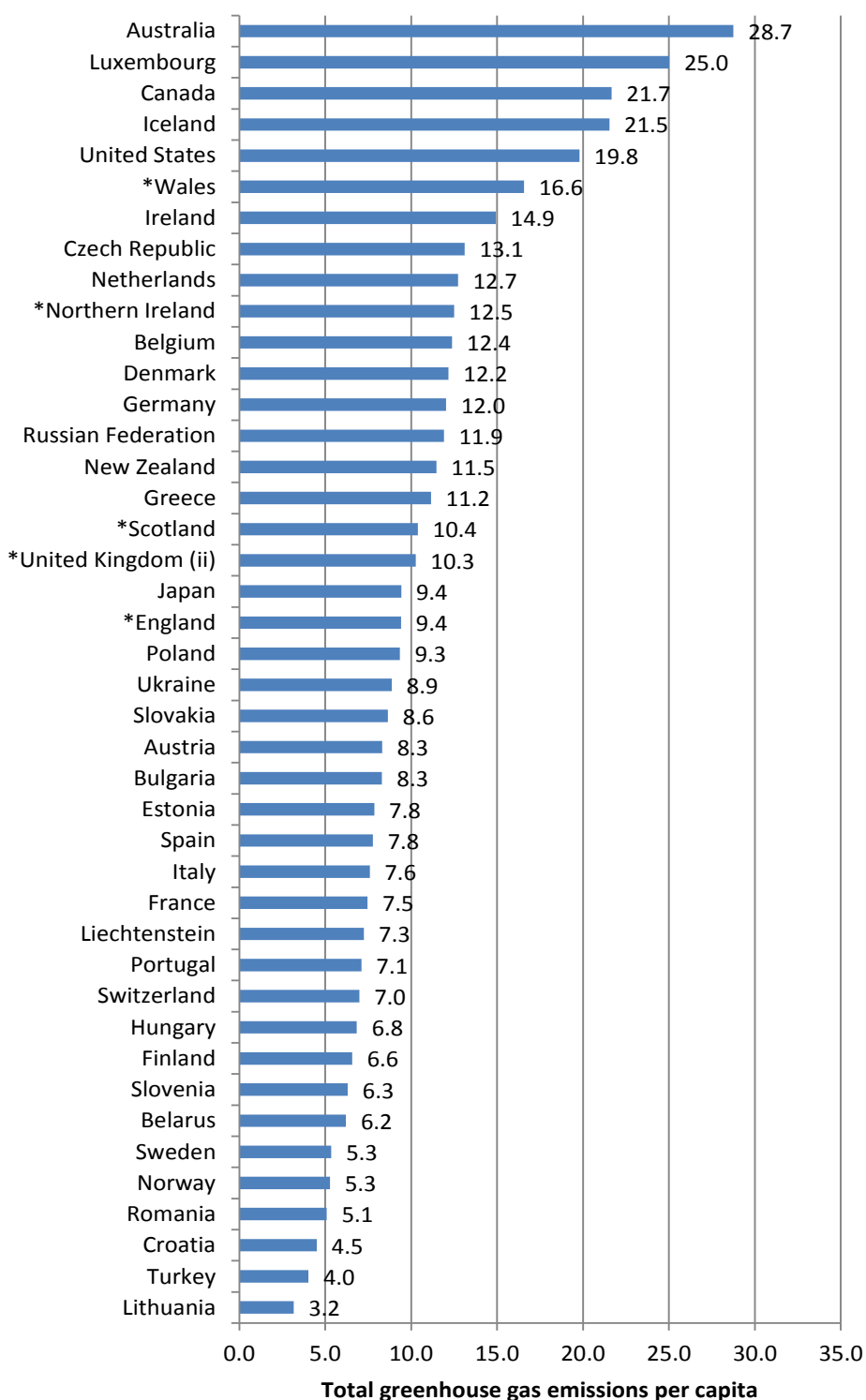
⁵¹ The UK countries are highlighted with a * on the graph

⁵² AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page xi (September 2010) [accessed 11 April 2011]

- Wales 16.6 tonnes per capita
- Northern Ireland 12.5 tonnes per capita
- Scotland 10.4 tonnes per capita
- England 9.4 tonnes per capita

Of the 42 countries included in figure 6, Wales had the 6th highest total net greenhouse gas emissions per capita in 2008. Australia had the highest, while Lithuania had the lowest. The UK was ranked 18th highest.

Figure 6: Total net greenhouse gas emissions per capita, 2008 (Gg⁵³ per thousand capita)^(a)



Source: UNFCCC, [National Greenhouse Gas Inventory Data for the period 1990-2008](#), [UN Demographic Year Book 2008](#) (table 5) AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), [Mid-2008 population estimates](#) and Research Service calculations – data is available in Annex B of this research paper.

⁵³ One Gigagramme (Gg) equates to one thousand tonnes, or one kilotonnes (kt) (UK data is recorded in kt).

Notes:

* denotes UK Countries

(a) The graph excludes Latvia even though it is part of the UNFCCC Annex 1 Parties as it had negative emissions in 2008. Total net greenhouse gas emissions in Latvia have declined from 8,059Gg to -16,972Gg. Monaco is also excluded as population data is not available.

(b) UK (ii) UK data is emissions from UK and Crown Dependencies, but population data used is only for the UK (the figure for England includes Crown Dependencies, see table 1).

3.2.2. Carbon dioxide emissions

It is also possible to calculate percentage changes for carbon dioxide emissions between the 1990 base year and 2008 for all of the UNFCCC Annex 1⁵⁴ Parties,⁵⁵ the EU-27⁵⁶ and the four UK countries.⁵⁷ Figure 7 below sets out these changes.

Of the 42 countries⁵⁸ included in figure 7, 18 have increased their total carbon dioxide emissions since 1990, while 23 have reduced their emissions, and one country's emissions have remained the same. The largest increase was in Turkey, increasing by over 100 per cent. The largest decreases in emissions were in Lithuania and Estonia, both declining by over 70 per cent.

In terms of the largest reductions of carbon dioxide emissions of the 42 countries included in figure 7, Wales is ranked 23rd, Scotland 14th, England 18th and Northern Ireland 22nd.

⁵⁴ [Annex 1 Parties](#) include the industrialised countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States. [accessed 11 April 2011]

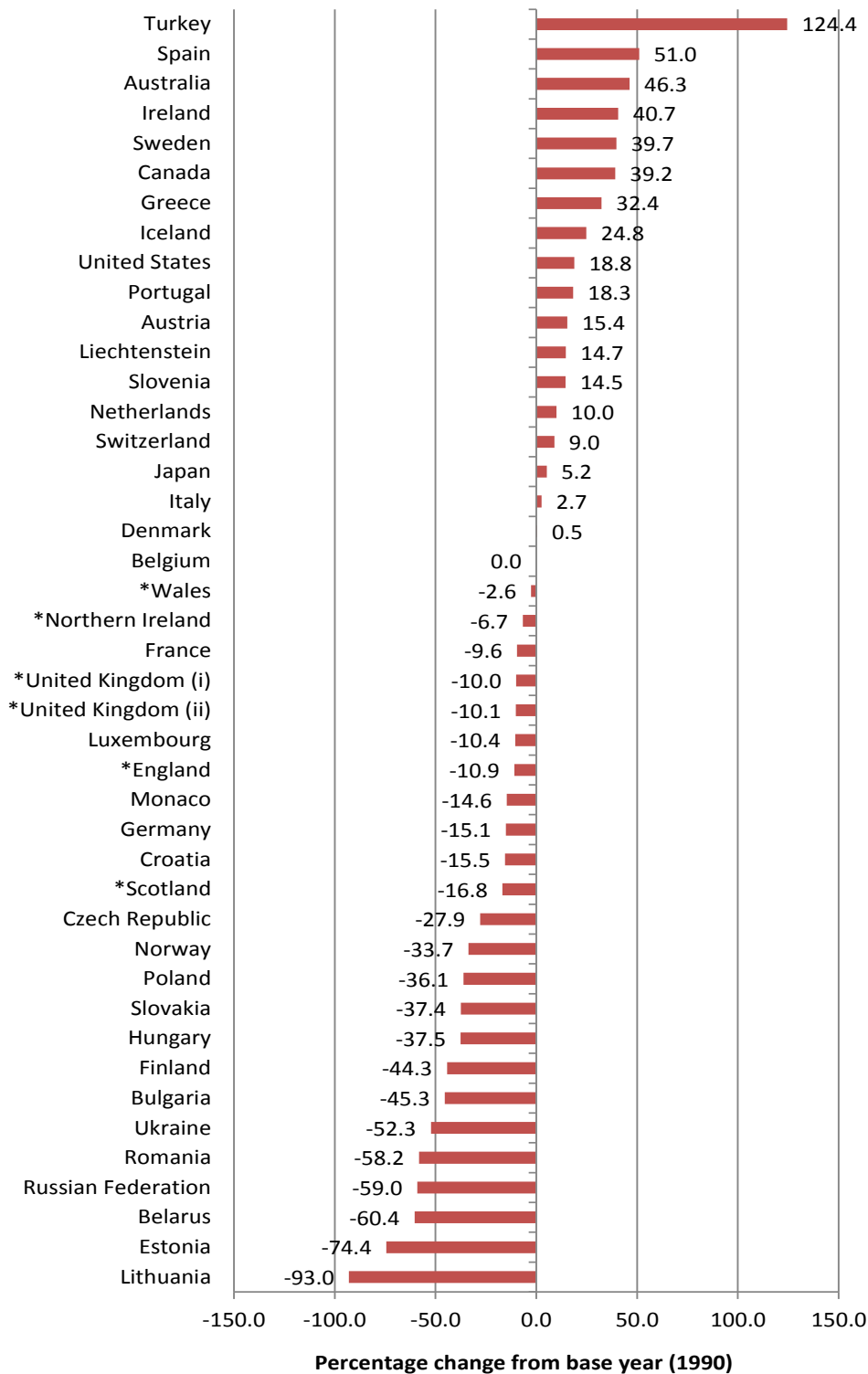
⁵⁵ The graph excludes Latvia even though it is part of the UNFCCC Annex 1 Parties as it had negative emissions in 2008. CO₂ emissions in Latvia have declined from 365 Gg to -20,748Gg, a decrease of 5,791 per cent. New Zealand is also excluded as it had negative emissions in 1990. Carbon dioxide emissions in New Zealand have risen from -6,226Gg to 4,269 Gg.

⁵⁶ Data was not available from the UNFCCC for Cyprus and Malta.

⁵⁷ The UK countries are highlighted with a * on the graph

⁵⁸ Including all four UK countries and "UK (i)" emissions (not "UK (ii)").

Figure 7: Percentage change from the base year (1990) of carbon dioxide emissions, by Country^(a), including LULUCF^(b), 2008 (Gg⁵⁹)



Source: UNFCCC, [National Greenhouse Gas Inventory Data for the period 1990-2008](#) and AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), (September 2010) - data available in Annex C of this research paper.

⁵⁹ One Gigagramme (Gg) equates to one thousand tonnes, or one kilotonnes (kt) (UK data is recorded in kt).

Notes:

(a) The graph excludes Latvia even though it is part of the UNFCCC Annex 1 Parties as it had negative emissions in 2008. Carbon dioxide emissions in Latvia have declined from 365Gg to -20,748Gg. New Zealand is also excluded as it had negative emissions in 1990. Carbon dioxide emissions in New Zealand have risen from -6,226Gg to 4,269 Gg.

(b) LULUCF is land use, land use change and forestry.

UK (i) figure does not match those published in table 2; here the figure includes all unallocated emissions, Crown Dependencies and Overseas Territories which have joined the UK's instruments of ratification to the UNFCCC and the Kyoto Protocol.

UK (ii) only includes unallocated emissions and Crown Dependencies. These match the figures provided in table 2, (the figure for England also includes Crown Dependencies).

Figure 8 presents the carbon dioxide emissions (net emissions/removals) per capita for each of the EU-27,⁶⁰ the UNFCCC Annex 1 Parties,⁶¹ and the four UK countries.⁶² Data for UK countries have been calculated using carbon dioxide emissions published in the AEA 2010 publication,⁶³ divided by the [mid-2008 population estimates](#) for each country.

The carbon dioxide emissions per capita shown in figure 8 have been **calculated by the Research Service**, by dividing the carbon dioxide emissions for each country by their population. **Caution** should be used when **making comparisons** with other data sources as methodologies are likely to differ. In addition, **care** should be taken when **comparing the UK devolved administration** figures with **international figures** as the methods used to calculate carbon dioxide emissions are also likely to vary slightly. **Figures are not comparable with those in previous Research Service publications.**

The carbon dioxide emissions per capita for the UK countries in 2008 were:

- Wales 14.0 tonnes per capita
- Northern Ireland 9.1 tonnes per capita
- Scotland 8.1 tonnes per capita
- England 8.1 tonnes per capita

Of the 42 countries included in figure 8, Wales had the 6th highest carbon dioxide emissions per capita in 2008. Luxembourg had the highest, while Lithuania had the lowest. The UK was ranked 16th highest.

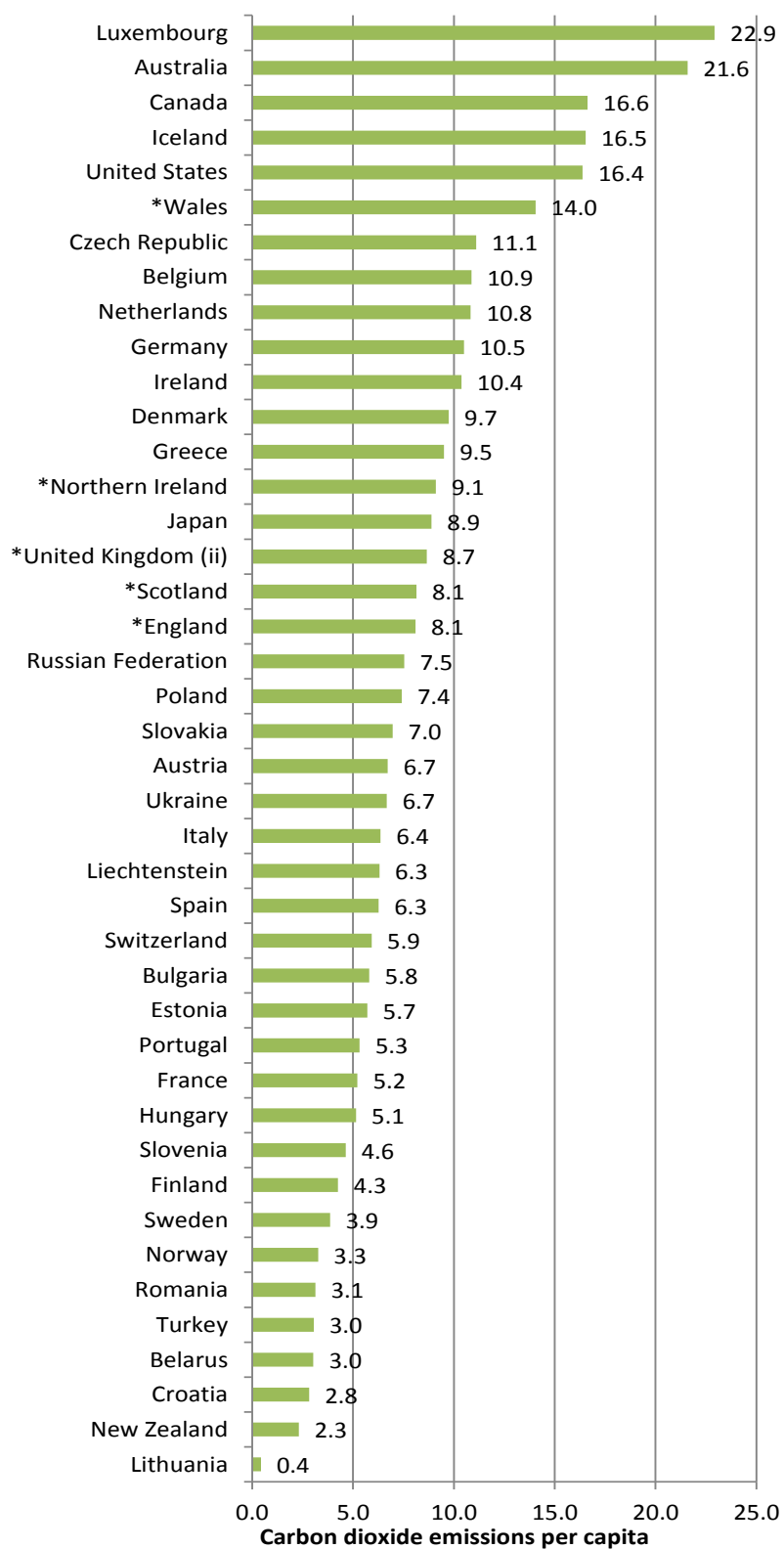
⁶⁰ Data for Cyprus and Monaco are not available and due to the negative levels of carbon dioxide emissions in Latvia it has also been excluded (see footnote 53).

⁶¹ [Annex 1 Parties](#) include the industrialised countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States. [accessed 11 April 2011]

⁶² The UK countries are highlighted with a * on the graph

⁶³ [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page xi (September 2010) [accessed 11 April 2011]

Figure 8: Carbon dioxide emissions per capita, 2008 (Gg⁴⁶ per thousand capita)^{(a)(b)}



Source: UNFCCC, [National Greenhouse Gas Inventory Data for the period 1990-2008](#), [UN Demographic Year Book 2008](#) (table 5) AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), [Mid-2008 population estimates](#) and Research Service calculations – data is available in Annex C of this research paper.

Notes:

* denotes UK Countries

(a) The graph excludes Latvia even though it is part of the UNFCCC Annex 1 Parties as it had negative emissions in 2008. Carbon dioxide emissions in Latvia have declined from 365Gg to -20,748Gg. Monaco is also excluded as population data is not available.

(b) UK (ii) UK data is emissions from UK and Crown Dependencies, but population data used is only for the UK (the emissions figure for England includes Crown Dependencies, see table 2).

3.2.3. Methane emissions

It is also possible to calculate percentage changes for methane emissions between the 1990 base year and 2008 for all of the UNFCCC Annex 1⁶⁴ Parties, the EU-27⁶⁵ and the four UK countries.⁶⁶ Figure 9 below sets out these changes.

Of the 44 countries⁶⁷ included in figure 9, eight have increased their total methane emissions since 1990, while 36 have reduced their emissions. The largest increase was in Turkey, increasing by over 60 per cent. The largest decreases in emissions were in England, the United Kingdom, Germany and Ukraine, all with emissions declining by over 50 per cent.

In terms of the largest reductions of methane emissions of the 44 countries included in figure 9, Wales is ranked 8th, Scotland 9th, England 1st and Northern Ireland 21st.

⁶⁴ [Annex 1 Parties](#) include the industrialised countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States. [accessed 11 April 2011]

⁶⁵ Data was not available from the UNFCCC for Cyprus and Malta.

⁶⁶ The UK countries are highlighted with a * on the graph

⁶⁷ Including all four UK countries and "UK (ii)" emissions (not "UK (i)").

Figure 9: Percentage change from the base year (1990) of methane emissions, by Country, including LULUCF^(a), 2008 (Gg⁶⁸)



Source: UNFCCC, [National Greenhouse Gas Inventory Data for the period 1990-2008](#) and AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), (September 2010) – data is available in Annex D of this research paper.

⁶⁸ One Gigagramme (Gg) equates to one thousand tonnes, or one kilotonnes (kt) (U data is recorded in kt).

Notes:

(a) LULUCF is land use, land use change and forestry.

UK (i) figure does not match those published in table 1; here the figure includes all unallocated emissions, Crown Dependencies and Overseas Territories which have joined the UK's instruments of ratification to the UNFCCC and the Kyoto Protocol.

UK (ii) only includes unallocated emissions and Crown Dependencies. These match the figures provided in table 4, (the figure for England also includes Crown Dependencies).

Figure 10 presents the methane emissions (net emissions/removals) per capita for each of the EU-27,⁶⁹ the UNFCCC Annex 1 Parties and the four UK countries.⁷⁰ Data for UK countries have been calculated using methane emissions published in the AEA 2010 publication,⁷¹ divided by the [mid-2008 population estimates](#) for each country.

The methane emissions per capita shown in figure 10 have been **calculated by the Research Service**, by dividing methane emissions for each country by their population. **Caution** should be used when **making comparisons** with other data sources as methodologies are likely to differ. In addition, **care** should be taken when **comparing the UK devolved administration** figures with **international figures** as the methods used to calculate methane emissions are also likely to vary slightly.

The methane emissions per capita for the UK countries in 2008 were:

- Wales 1.5 tonnes per capita
- Northern Ireland 1.9 tonnes per capita
- Scotland 1.2 tonnes per capita
- England 0.7 tonnes per capita

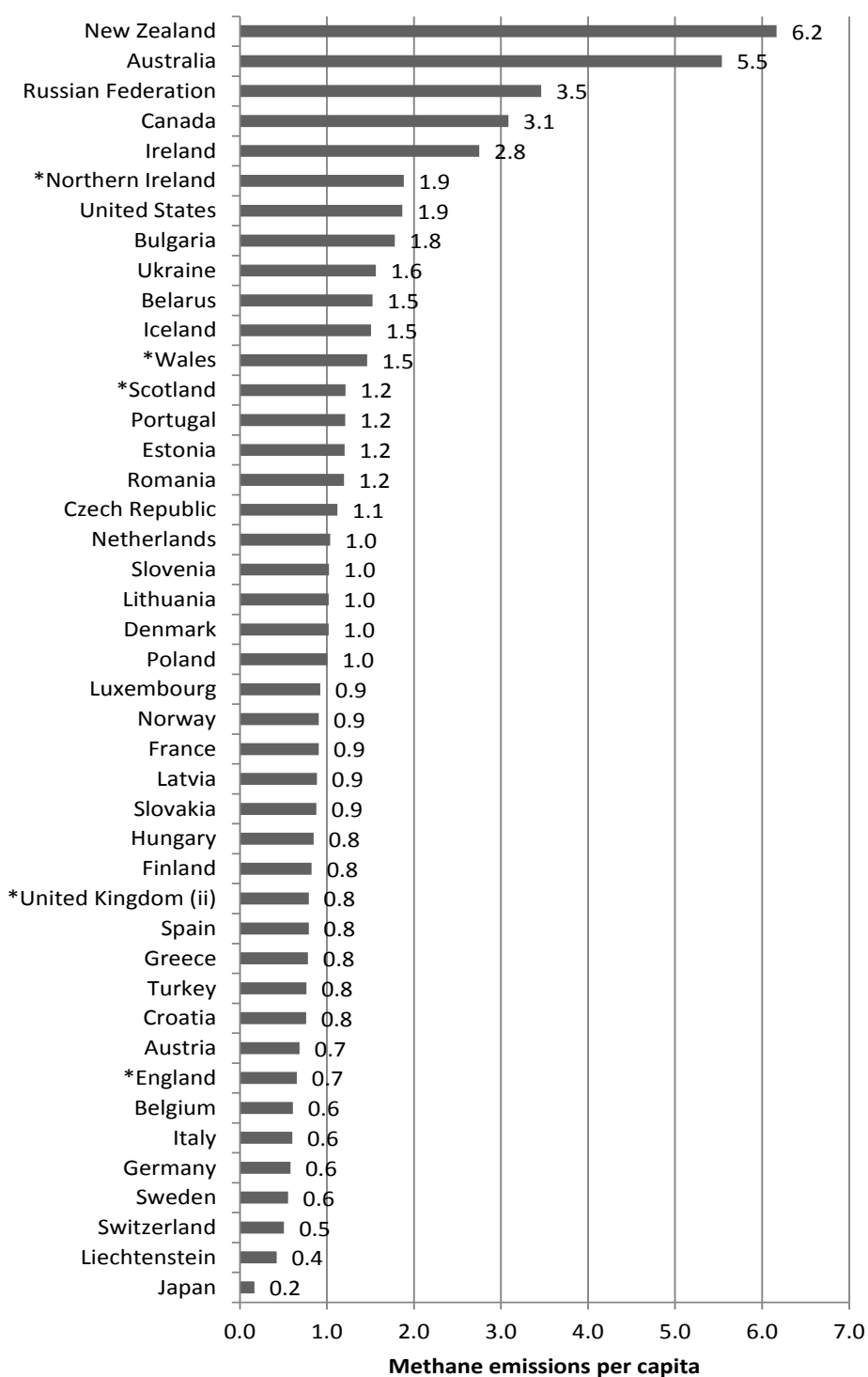
Of the 43 countries included in figure 10, Wales had the 12th highest methane emissions per capita in 2008. New Zealand had the highest, while Japan had the lowest. The UK was ranked 30th highest.

⁶⁹ Data for Cyprus and Monaco are not available.

⁷⁰ The UK countries are highlighted with a * on the graph

⁷¹ AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), page xi (September 2010) [accessed 11 April 2011]

Figure 10: Methane emissions per capita, 2008 (Gg⁷² per thousand capita)^(a)



Source: UNFCCC, [National Greenhouse Gas Inventory Data for the period 1990-2008](#), [UN Demographic Year Book 2008](#) (table 5) AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), [Mid-2008 population estimates](#) and Research Service calculations – data is available in Annex D of this research paper.

⁷² One Gigagramme (Gg) equates to one thousand tonnes, or one kilotonnes (kt) (U data is recorded in kt).

Notes:

* denotes UK Countries

- (a) UK (ii) UK data is emissions from UK and Crown Dependencies, but population data used is only for the UK (the emissions figure for England includes Crown Dependencies, see table 4).
- (b) Monaco has been excluded as population data is not available.

3.3. Local authority emissions

Figures at a local authority level are available for carbon dioxide emissions.

The principal methodology for allocating emissions to local authorities allocates emissions on an “end user” basis. This means that emissions are distributed according to the point of energy consumption or the point of emission if non-energy related. Emissions from the production of goods are assigned to where the production takes place (i.e. emissions from exported goods are included).

The values arising from this methodology give an idea of geographical use, rather than production, so it is useful in informing about emissions from use of energy in local authority areas. Detailed carbon dioxide emissions for 2008 by sector, and local authority are shown in table 5. Figures were first collected by the DECC in 2005. Figure 11 shows the percentage change in total carbon dioxide emissions between 2005 and 2008, by local authority.

As a result of the ‘end user’ methodology used, the total emissions figure (32.4 Mt CO₂) in table 5 **does not match** the inventoried all-Wales total (42.0 Mt CO₂ in table 2), which is based on the ‘production’ approach. The information is therefore more useful to compare between the local authorities in Wales, rather than a definitive value of emissions.

Table 5: Carbon dioxide emissions by sector and local authority, 2008 (kt CO₂)

Local Authority	Industry & Commercial	Domestic	Road Transport	LULUCF (b)	Total	Welsh rank /22 (of total emissions)	UK rank /434 (of total emissions)
Isle of Anglesey	371	223	138	46	778	16	284
Gwynedd	282	355	289	-110	816	15	261
Conwy	187	297	278	-19	743	17	293
Denbighshire	213	250	205	0	669	18	323
Flintshire	1,541	467	407	2	2,418	3	27
Wrexham	845	342	229	3	1,419	8	97
Powys	390	421	350	-200	961	13	212
Ceredigion	217	235	163	14	629	20	339
Pembrokeshire	556	359	244	56	1,215	10	135
Carmarthenshire	606	535	454	39	1,634	5	77
Swansea	615	573	399	15	1,603	6	79
Neath Port Talbot	7,214	342	303	-10	7,849	1	3
Bridgend	562	321	305	16	1,204	11	137
Vale of Glamorgan	854	299	239	24	1,416	9	98
Cardiff	1,024	718	694	6	2,443	2	25
Rhondda Cynon Taf	545	562	475	-17	1,564	7	84
Merthyr Tydfil	141	144	92	1	379	22	409
Caerphilly	387	415	263	0	1,064	12	169
Blaenau Gwent	205	176	83	0	464	21	393
Torfaen	299	209	147	-1	654	19	332
Monmouthshire	266	239	365	-27	842	14	255
Newport	858	320	471	0	1,649	4	74
Wales	18,180	7,800	6,594	-161	32,413

Source: DECC, [2008 local authority carbon dioxide emissions](#) (full dataset) and Research Service calculations.

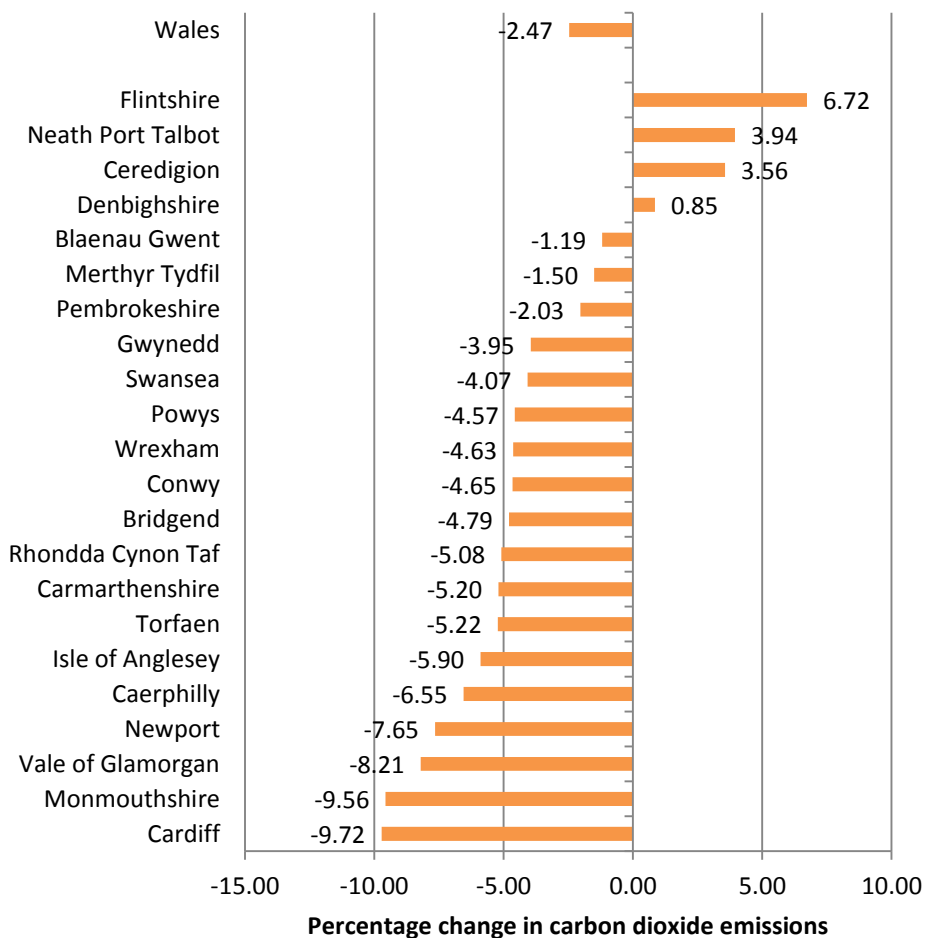
(a) Different methodologies have been used from previous AEA publications; therefore comparisons cannot be made with previous papers.

(b) LULUCF – Land use, land use change and forestry.

The following observations can be made from table 5 and figure 11:

- The local authority with the highest carbon dioxide emissions in 2008 was Neath Port Talbot (the main contributor to this is the Port Talbot Steelworks), while Flintshire had the largest increase in carbon dioxide emissions between 2005 and 2008;
- Industrial and commercial emissions accounted for 56 per cent of all carbon dioxide emissions in Wales in 2008;
- Only four Welsh local authorities increased their carbon dioxide emissions between 2005 and 2008, while 18 reduced theirs. Cardiff reduced their emissions by the most (9.7 per cent); and
- Of the 434 local authorities in the UK, Neath Port Talbot had the third highest emissions in 2008. Merthyr Tydfil (with the lowest emissions in Wales) had the 26th lowest carbon dioxide emissions of UK local authorities.

Figure 11: Percentage change in carbon dioxide emissions between 2005 and 2008, by local authority



Source: DECC, [2008 local authority carbon dioxide emissions](#) (full dataset) and Research Service calculations
 (a) Different methodologies have been used from previous AEA publications, therefore comparisons cannot be made with previous papers.

Per capita emissions provide an indication of the level of emissions in comparison with the population size of a local authority. Table 6 provides carbon dioxide emissions per capita in 2008 by sector, while figure 12 highlights the geographical differences of the total emissions per capita. Per capita emissions as a result of domestic activity⁷³ provide an indication of energy efficiency at a local authority level.

The following observations can be made from table 6 and figures 12 to 15:

- The highest emissions per capita were in Neath Port Talbot (57.1 tonnes per capita), while Caerphilly had the lowest (6.2 tonnes per capita). (The main contributor to the high Neath Port Talbot figure is the Corus steelworks in Port Talbot).
- The contribution of the Corus steelworks to the Neath Port Talbot figure is also reflected in its industry and commercial carbon dioxide emissions, which at 52.4 tonnes per capita are the highest in Wales. Conwy had the lowest industrial and commercial emissions, 1.7 tonnes per capita.
- There is little difference between domestic carbon dioxide emissions across Wales, ranging from 2.2 to 3.2 tonnes per capita. Cardiff had the lowest domestic emissions, while the Isle of Anglesey, Gwynedd and Powys had the highest.
- Monmouthshire had the highest road transport emissions per capita, at 4.2 tonnes per capita, while Blaenau Gwent had the lowest, 1.2 tonnes per capita.
- Emissions per capita from LULUCF highlight the areas with the most carbon dioxide is being removed from the atmosphere, generally through forest growth. In Wales, Powys had the highest levels of carbon dioxide being removed from the atmosphere.

⁷³ Carbon dioxide emissions from domestic activity include emission from domestic electricity, gas, oil and solid fuel use and emissions from domestic home and garden machinery.
DECC, [Local Authority CO2 emissions estimates 2008 : Methodology Summary](#), page 5, 16 September 2010 [accessed 11 April 2011]

Table 6: Carbon dioxide emissions per capita^(a), by sector in Wales, 2008 (tonnes per capita)

<u>Local Authority</u>	<u>Industry & Commercial</u>	<u>Domestic</u>	<u>Road Transport</u>	<u>LULUCF (b)</u>	<u>Total</u>
Isle of Anglesey	5.4	3.2	2.0	0.7	11.3
Gwynedd	2.4	3.2	2.4	-0.9	6.9
Conwy	1.7	2.7	2.5	-0.2	6.7
Denbighshire	2.2	2.6	2.1	0.0	6.9
Flintshire	10.3	3.1	2.7	0.0	16.1
Wrexham	6.4	2.6	1.7	0.0	10.7
Powys	3.0	3.2	2.7	-1.5	7.3
Ceredigion	2.8	3.1	2.1	0.2	8.2
Pembrokeshire	4.7	3.1	2.1	0.5	10.3
Carmarthenshire	3.4	3.0	2.5	0.2	9.0
Swansea	2.7	2.5	1.7	0.1	7.0
Neath Port Talbot	52.4	2.5	2.2	-0.1	57.1
Bridgend	4.2	2.4	2.3	0.1	9.0
Vale of Glamorgan	6.9	2.4	1.9	0.2	11.4
Cardiff	3.1	2.2	2.1	0.0	7.4
Rhondda Cynon Taf	2.3	2.4	2.0	-0.1	6.7
Merthyr Tydfil	2.5	2.6	1.7	0.0	6.8
Caerphilly	2.2	2.4	1.5	0.0	6.2
Blaenau Gwent	3.0	2.6	1.2	0.0	6.8
Torfaen	3.3	2.3	1.6	0.0	7.2
Monmouthshire	3.0	2.7	4.2	-0.3	9.6
Newport	6.1	2.3	3.4	0.0	11.8
Wales	6.1	2.6	2.2	-0.1	10.8

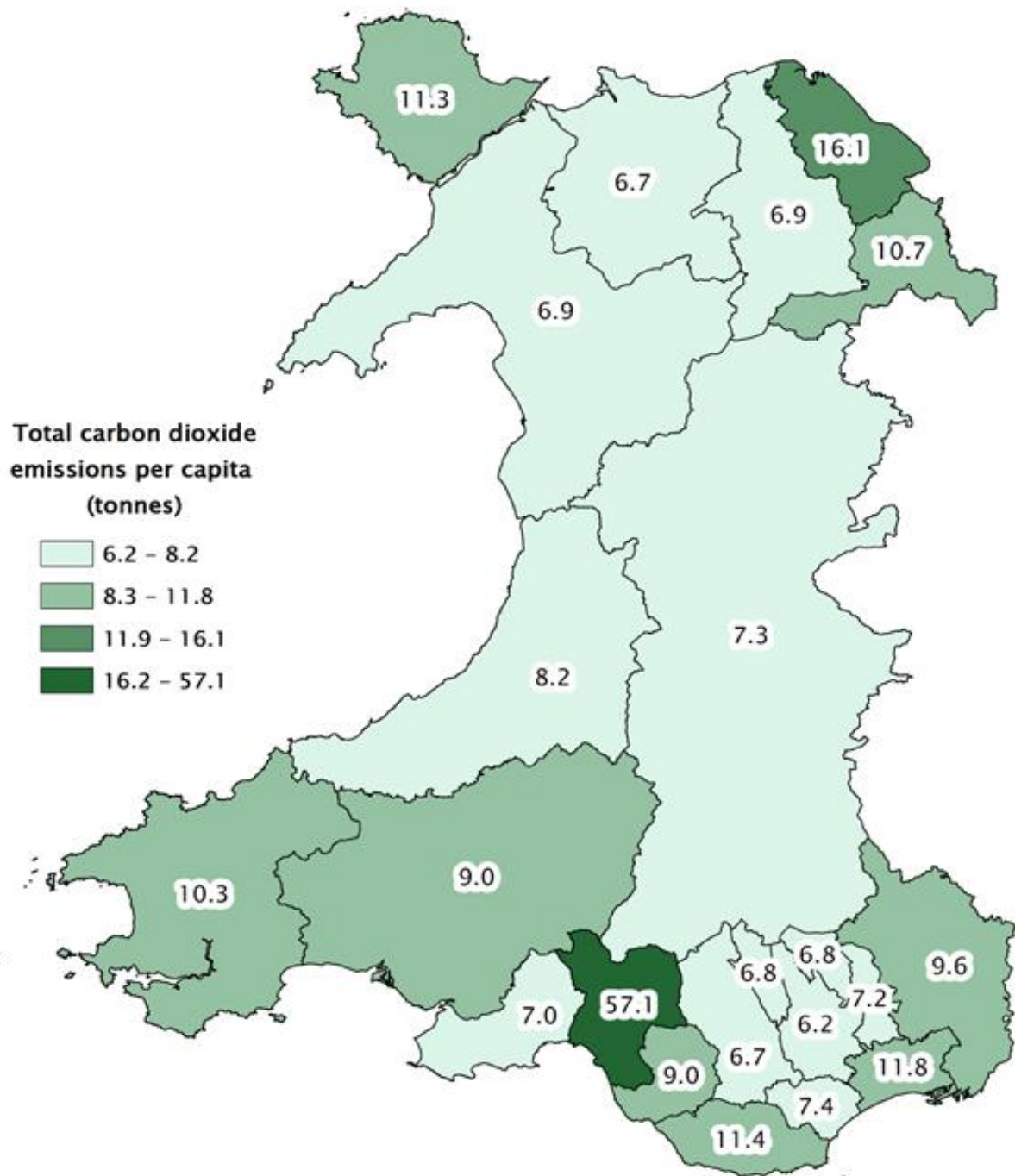
Source: DECC, [2008 local authority carbon dioxide emissions \(full dataset\)](#), Mid -2008 population estimates (StatsWales [table 016889](#)) and Research Service calculations

(a) Per capita emissions have been calculated using StatsWales population so does not match exactly those used in the DECC paper (which used rounded population data).

(b) LULUCF - Land use, land use change and forestry

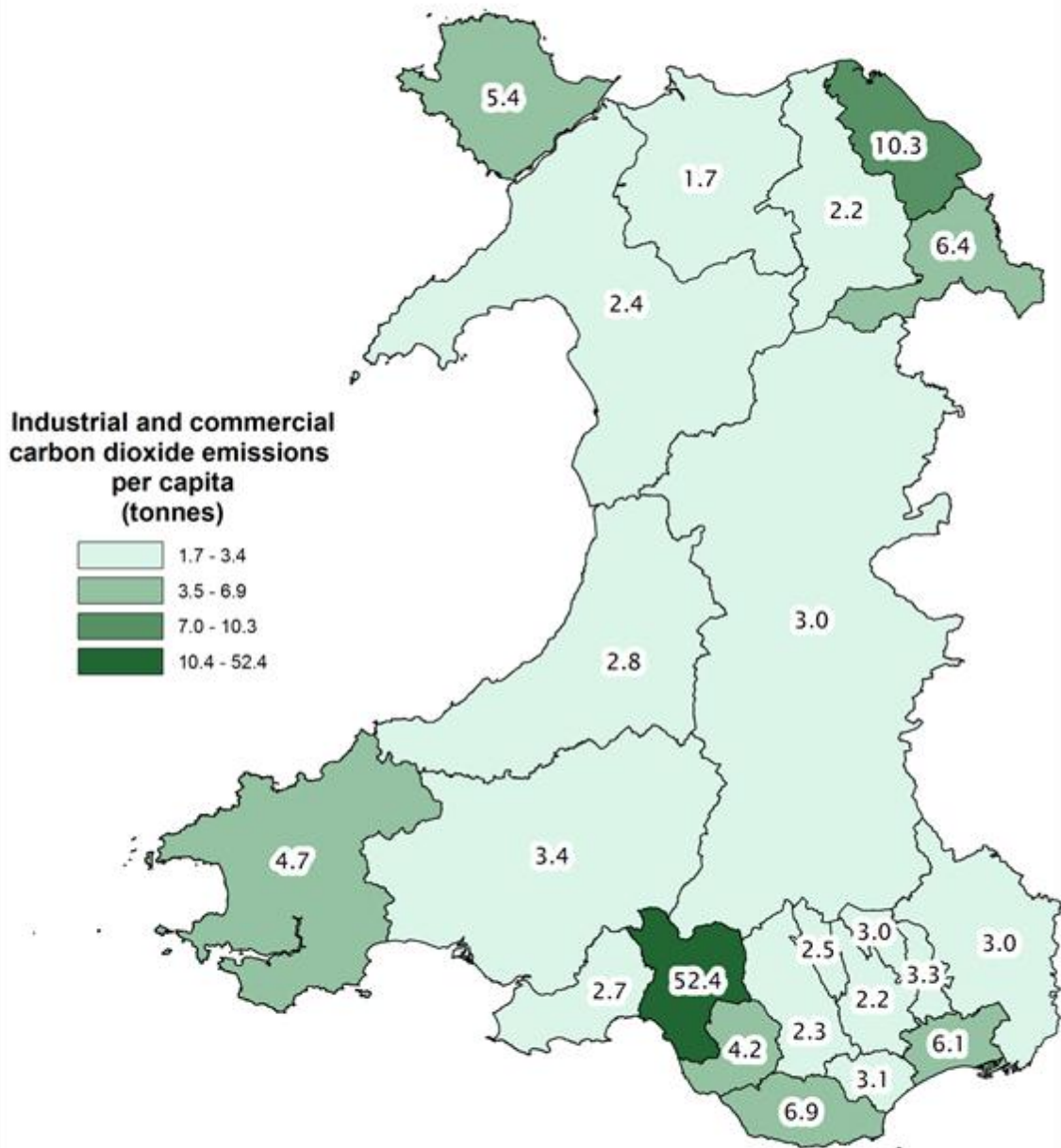
Note: Different methodologies have been used from previous AEA publications, therefore comparisons cannot be made with previous papers.

Figure 12: Total carbon dioxide emissions per capita, by Welsh local authority, 2008



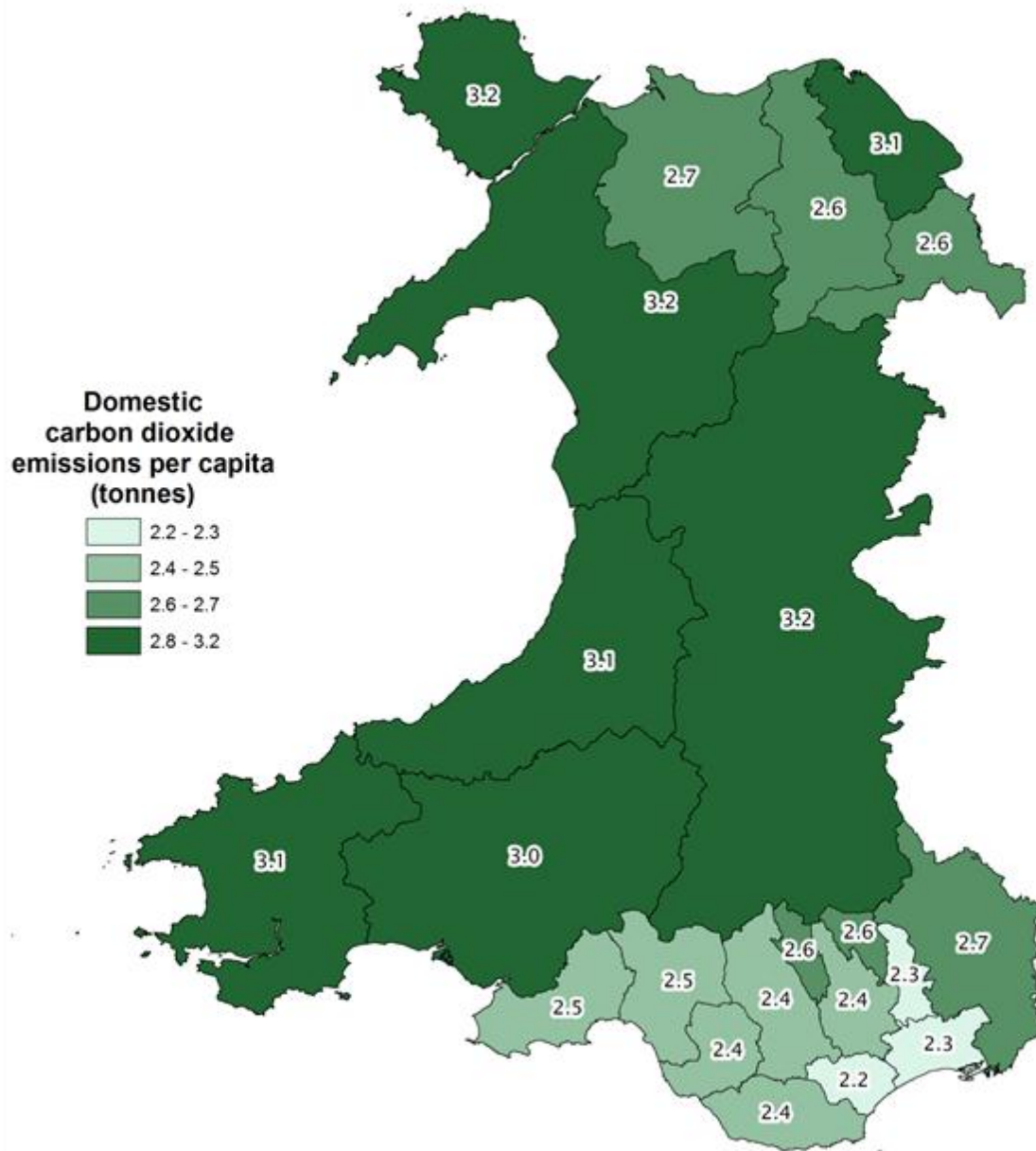
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Figure 13: Industrial and commercial carbon dioxide emissions per capita, by Welsh local authority, 2008



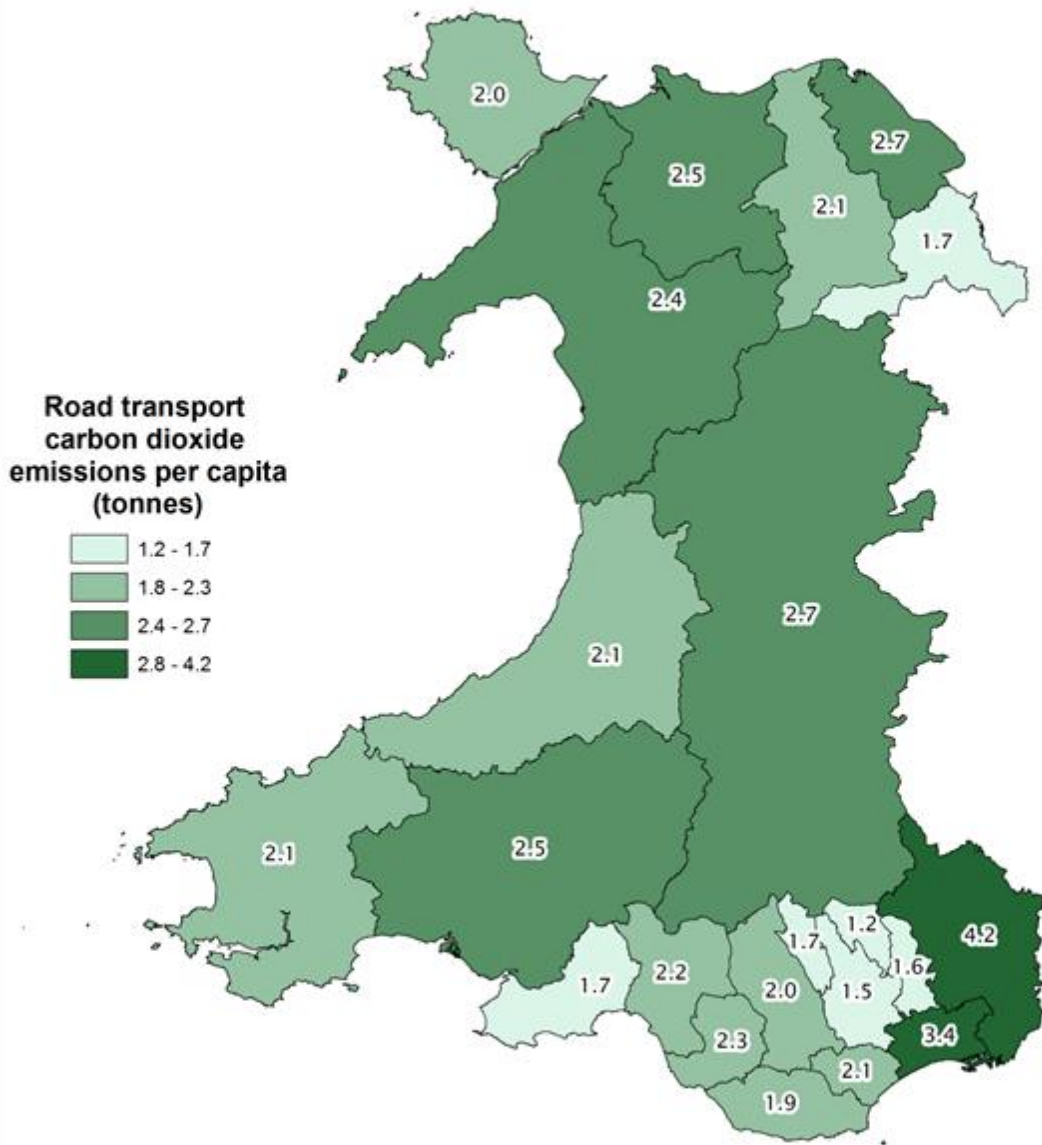
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Figure 14: Domestic carbon dioxide emissions per capita, by Welsh local authority, 2008



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Figure 15: Road transport carbon dioxide emissions per capita, by Welsh local authority, 2008



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4. Useful links and further information

The links below provide further information about the data sources in this paper and also contain links to further information about greenhouse gas emissions at an international, European, UK and Welsh level.

- [Climate Change Commission for Wales](#)
- Welsh Government website on [Climate Change](#)
- [The Department of Energy and Climate Change](#) (DECC)
- [Statistics about Climate Change](#), published by DECC
- [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 to 2008](#), published by AEA
- [2008 Local Authority Carbon Dioxide figures](#), published by DECC
- The UK Government's [UK Climate Projections](#)
- The UK Government's [Committee on Climate Change](#)
- [The Met Office Hadley Centre](#)
- [Tyndall Centre for Climate Change Research](#)
- [European Climate Change Programme](#)
- [UN Framework Convention on Climate Change](#)

Annex A: Total net greenhouse gas and carbon dioxide emissions in Wales in 2008, by sector

Sector	Total net greenhouse gas emissions (Mt)	Percentage of total net greenhouse gas emissions	Carbon dioxide emissions (Mt)	Percentage of carbon dioxide emissions
Agriculture	5.2	10.5	0.5	1.2
Business	9.9	20.1	9.4	22.5
Energy Supply	18.8	37.9	18.1	43.1
Industrial Process	2.5	5.1	2.5	5.8
Land use change	-0.2	-0.4	-0.2	-0.5
Public	0.5	0.9	0.5	1.1
Residential	4.6	9.3	4.4	10.5
Transport	6.9	13.9	6.8	16.2
Waste Management	1.3	2.6	0.0	0.0
Total	49.5	100.0	42.0	100.0

Source: AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), (September 2010)

Annex B: Total net greenhouse gas emissions, by country

Country	GHG emissions (Gg)		Mid-2008 population (thousands)	Percentage change from base year	CO2 per capita (g per capita)
	1990 (base year)	2008			
England	614,408	484,505	51,465	-21.1	9.4
Northern Ireland	24,995	22,186	1,775	-11.2	12.5
Scotland	68,222	53,707	5,169	-21.3	10.4
United Kingdom (i)	777,634	626,041	..	-19.5	..
United Kingdom (ii)	777,820	629,791	61,383	-19.0	10.3
Wales	54,952	49,526	2,990	-9.9	16.6
Australia	464,497	618,058	21,499	33.1	28.7
Austria	65,032	69,303	8,337	6.6	8.3
Belarus	110,584	60,078	9,681	-45.7	6.2
Belgium	140,648	131,978	10,667	-6.2	12.4
Bulgaria	114,261	63,284	7,623	-44.6	8.3
Canada	540,306	721,740	33,327	33.6	21.7
Croatia	23,148	19,977	4,435	-13.7	4.5
Czech Republic	191,559	136,655	10,430	-28.7	13.1
Denmark	69,402	66,789	5,489	-3.8	12.2
Estonia	34,562	10,524	1,341	-69.6	7.8
Finland	54,459	34,888	5,313	-35.9	6.6
France	531,401	464,442	62,277	-12.6	7.5
Germany	1,211,588	988,246	82,127	-18.4	12.0
Greece	101,872	125,316	11,237	23.0	11.2
Hungary	112,296	68,623	10,038	-38.9	6.8
Iceland	5,771	6,877	319	19.2	21.5
Ireland	55,059	65,969	4,422	19.8	14.9
Italy	452,292	454,187	59,832	0.4	7.6
Japan	1,205,317	1,203,076	127,704	-0.2	9.4
Latvia	8,059	-16,972	2,266	-310.6	-7.5
Liechtenstein	221	257	35	16.1	7.3
Lithuania	34,157	10,637	3,358	-68.9	3.2
Luxembourg	13,466	12,222	489	-9.2	25.0
Monaco	108	95	..	-11.4	..
Netherlands	214,604	209,363	16,446	-2.4	12.7
New Zealand	30,133	48,943	4,269	62.4	11.5
Norway	38,465	25,150	4,768	-34.6	5.3
Poland	535,336	356,375	38,116	-33.4	9.3
Portugal	63,763	75,424	10,622	18.3	7.1
Romania	242,321	109,501	21,504	-54.8	5.1
Russian Federation	3,438,975	1,690,974	141,956	-50.8	11.9
Slovakia	71,507	46,755	5,407	-34.6	8.6
Slovenia	12,121	12,753	2,023	5.2	6.3
Spain	246,299	353,969	45,593	43.7	7.8
Sweden	41,396	49,287	9,220	19.1	5.3
Switzerland	49,992	53,436	7,648	6.9	7.0
Turkey	142,159	285,922	71,079	101.1	4.0
Ukraine	859,586	411,257	46,373	-52.2	8.9
United States	5,217,347	6,016,408	304,060	15.3	19.8

Source: UNFCCC, [National Greenhouse Gas Inventory Data for the period 1990-2008](#), [UN Demographic Year Book 2008](#) (table 5) AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), [Mid-2008 population estimates](#) and Research Service calculations

Note:

- UK (ii) UK data is emissions from UK and Crown Dependencies, but population data used is only for the UK (the emissions figure for England includes Crown Dependencies, see table 1).
- One Gigagramme (Gg) equates to one thousand tonnes, or one kilotonnes (kt) (U data is recorded in kt).

Annex C: Carbon dioxide emissions, by country

Country	CO2 emissions (Gg)		Mid-2008 population (thousands)	Percentage change from base year	CO2 per capita (g per capita)
	1990 (base year)	2008			
England	467,274	416,325	51,465	-10.9	8.1
Northern Ireland	17,325	16,171	1,775	-6.7	9.1
Scotland	50,554	42,057	5,169	-16.8	8.1
United Kingdom (i)	594,071	534,731	..	-10.0	..
United Kingdom (ii)	591,449	531,503	61,383	-10.1	8.7
Wales	43,134	41,996	2,990	-2.6	14.0
Australia	317,190	464,036	21,499	46.3	21.6
Austria	48,497	55,974	8,337	15.4	6.7
Belarus	73,982	29,315	9,681	-60.4	3.0
Belgium	115,941	115,900	10,667	0.0	10.9
Bulgaria	80,966	44,248	7,623	-45.3	5.8
Canada	398,214	554,227	33,327	39.2	16.6
Croatia	14,815	12,521	4,435	-15.5	2.8
Czech Republic	160,575	115,818	10,430	-27.9	11.1
Denmark	53,235	53,498	5,489	0.5	9.7
Estonia	29,849	7,650	1,341	-74.4	5.7
Finland	40,516	22,585	5,313	-44.3	4.3
France	358,838	324,455	62,277	-9.6	5.2
Germany	1,016,438	862,488	82,127	-15.1	10.5
Greece	80,689	106,839	11,237	32.4	9.5
Hungary	82,659	51,652	10,038	-37.5	5.1
Iceland	4,228	5,278	319	24.8	16.5
Ireland	32,609	45,878	4,422	40.7	10.4
Italy	370,777	380,718	59,832	2.7	6.4
Japan	1,079,972	1,135,599	127,704	5.2	8.9
Latvia	365	-20,748	2,266	-5791.0	-9.2
Liechtenstein	195	224	35	14.7	6.3
Lithuania	20,503	1,440	3,358	-93.0	0.4
Luxembourg	12,503	11,203	489	-10.4	22.9
Monaco	105	90	..	-14.6	..
Netherlands	161,918	178,132	16,446	10.0	10.8
New Zealand	-6,226	9,844	4,269	-258.1	2.3
Norway	23,504	15,581	4,768	-33.7	3.3
Poland	441,832	282,375	38,116	-36.1	7.4
Portugal	47,784	56,546	10,622	18.3	5.3
Romania	160,876	67,289	21,504	-58.2	3.1
Russian Federation	2,612,573	1,070,391	141,956	-59.0	7.5
Slovakia	60,165	37,662	5,407	-37.4	7.0
Slovenia	8,181	9,366	2,023	14.5	4.6
Spain	189,214	285,721	45,593	51.0	6.3
Sweden	25,491	35,606	9,220	39.7	3.9
Switzerland	41,528	45,272	7,648	9.0	5.9
Turkey	96,492	216,544	71,079	124.4	3.0
Ukraine	647,810	309,272	46,373	-52.3	6.7
United States	4,191,418	4,980,855	304,060	18.8	16.4

Source: UNFCCC, [National Greenhouse Gas Inventory Data for the period 1990-2008](#), [UN Demographic Year Book 2008](#) (table 5) AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008](#), [Mid-2008 population estimates](#) and Research Service calculations

Note:

- UK (ii) UK data is emissions from UK and Crown Dependencies, but population data used is only for the UK (the emissions figure for England includes Crown Dependencies, see table 2).
- One Gigagramme (Gg) equates to one thousand tonnes, or one kilotonnes (kt) (U data is recorded in kt).

Annex D: Methane emissions, by country

Country	CH4 emissions (Gg)		Mid-2008 population (thousands)	Percentage change from base year	CH4 per capita (g per capita)
	1990 (base year)	2008			
England	78,988	33,690	51,465	-57.3	0.7
Northern Ireland	4,382	3,341	1,775	-23.8	1.9
Scotland	11,043	6,279	5,169	-43.1	1.2
United Kingdom (i)	104,143	48,570	..	-53.4	..
United Kingdom (ii)	104,601	48,926	61,383	-53.2	0.8
Wales	7,876	4,373	2,990	-44.5	1.5
Australia	120,786	119,026	21,499	-1.5	5.5
Austria	8,306	5,717	8,337	-31.2	0.7
Belarus	15,408	14,763	9,681	-4.2	1.5
Belgium	10,012	6,505	10,667	-35.0	0.6
Bulgaria	19,789	13,566	7,623	-31.4	1.8
Canada	77,739	102,838	33,327	32.3	3.1
Croatia	3,437	3,372	4,435	-1.9	0.8
Czech Republic	18,564	11,689	10,430	-37.0	1.1
Denmark	5,536	5,591	5,489	1.0	1.0
Estonia	2,728	1,613	1,341	-40.9	1.2
Finland	6,350	4,378	5,313	-31.0	0.8
France	67,163	56,350	62,277	-16.1	0.9
Germany	103,299	47,745	82,127	-53.8	0.6
Greece	9,785	8,802	11,237	-10.0	0.8
Hungary	11,887	8,501	10,038	-28.5	0.8
Iceland	447	481	319	7.7	1.5
Ireland	13,576	12,166	4,422	-10.4	2.8
Italy	41,710	36,022	59,832	-13.6	0.6
Japan	31,909	21,326	127,704	-33.2	0.2
Latvia	3,752	2,003	2,266	-46.6	0.9
Liechtenstein	13	15	35	11.6	0.4
Lithuania	6,360	3,429	3,358	-46.1	1.0
Luxembourg	469	451	489	-3.8	0.9
Monaco	0.65	0.58	..	-9.7	..
Netherlands	25,549	17,078	16,446	-33.2	1.0
New Zealand	25,930	26,316	4,269	1.5	6.2
Norway	4,657	4,320	4,768	-7.2	0.9
Poland	51,948	38,372	38,116	-26.1	1.0
Portugal	10,396	12,855	10,622	23.7	1.2
Romania	46,421	25,705	21,504	-44.6	1.2
Russian Federation	579,179	491,442	141,956	-15.1	3.5
Slovakia	4,826	4,750	5,407	-1.6	0.9
Slovenia	2,263	2,071	2,023	-8.5	1.0
Spain	26,464	36,064	45,593	36.3	0.8
Sweden	6,733	5,101	9,220	-24.2	0.6
Switzerland	4,676	3,877	7,648	-17.1	0.5
Turkey	33,498	54,295	71,079	62.1	0.8
Ukraine	152,248	72,401	46,373	-52.4	1.6
United States	613,388	567,632	304,060	-7.5	1.9

Source: UNFCCC, [National Greenhouse Gas Inventory Data for the period 1990-2008](#), [UN Demographic Year Book 2008](#) (table 5) AEA, [Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2008.](#), [Mid-2008 population estimates](#) and Research Service calculations

Note:

- UK (ii) UK data is emissions from UK and Crown Dependencies, but population data used is only for the UK (the emissions figure for England includes Crown Dependencies, see table 4).
- One Gigagramme (Gg) equates to one thousand tonnes, or one kilotonnes (kt) (U data is recorded in kt).