CHAPTER 14:

DIFFERENCES IN NATIONAL CIRCUMSTANCES

The Climate Change Act requires that when advising on carbon budgets the Committee should take into account 'differences in circumstances between England, Wales, Scotland and Northern Ireland'. This chapter responds to the requirement under the Act, and sets out our analysis of carbon budgets as these relate to the national authorities within the UK[1]. It therefore covers Wales, Scotland and Northern Ireland. It does not focus on England or regions within England[2].

We focus on two aspects of carbon budgets:

- Firstly, we provide a high level assessment of potential for reducing emissions in Wales, Scotland and Northern Ireland. This assessment covers emissions relating to buildings and industry, road transport, power generation and non-CO_2 greenhouse gases.

- Secondly, we consider wider impacts of carbon budgets, particularly as these relate to competitiveness and fuel poverty, and how these impacts are likely to vary by nation.

The main messages in the chapter are as follows:

- Allowing for differences in circumstances, there are significant opportunities for abatement in Wales, Scotland and Northern Ireland.

- National authorities have an important role to play in unlocking the abatement potential, given the balance of devolved and reserved powers.

- Though there are potentially adverse impacts of carbon budgets (e.g. an increase in fuel poverty), these can and should be mitigated by appropriate policy design.

The Committee has carried out an initial analysis, which does not at this stage involve developing indicative carbon budgets for Wales, Scotland and Northern Ireland. Further work would be required to underpin any national carbon budgets and climate strategies.

We set out the analysis that underpins these messages in five sections:

1. Emissions trends and projections

2. Opportunities for emissions reductions

3. Economic impacts of carbon budgets

4. Fuel poverty impacts of carbon budgets

5. Next steps in developing the evidence base.

1 In the Climate Change Act, national authorities are: the Secretary of State, Scottish Ministers, Welsh Ministers and the relevant department in Northern Ireland.
2 Hereafter we use 'nations' and 'national' when referring collectively to England, Wales, Scotland and Northern Ireland.

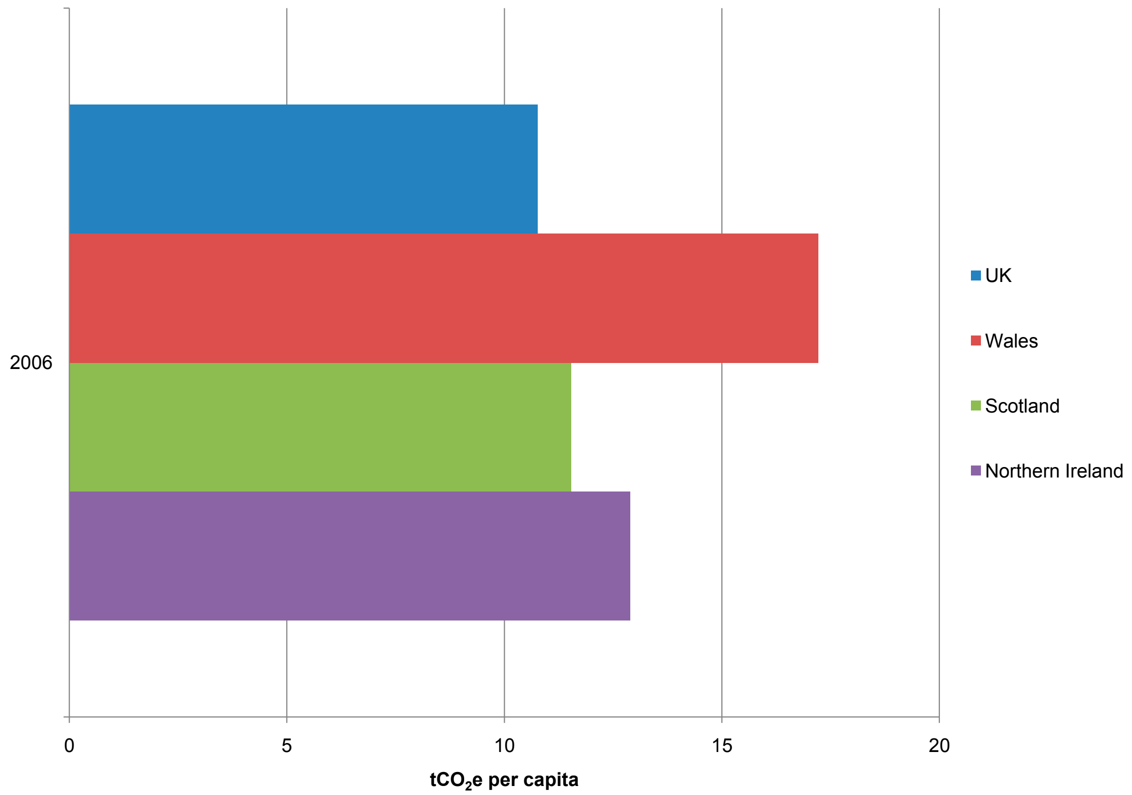
1. EMISSIONS TRENDS AND PROJECTIONS IN WALES, SCOTLAND AND NORTHERN IRELAND

Emissions shares and per capita emissions: The UK's greenhouse gas (GHG) inventory is disaggregated to the level of England, Wales, Scotland and Northern Ireland. In 2006, emissions shares of Wales, Scotland and Northern Ireland were higher than population shares; this was most pronounced in Wales, but each of the three nations has relatively high GHG emissions per capita (Figure 14.1).

Part of this variation can be explained in terms of the power sector: for example, if power generation emissions are excluded, Scotland's per capita emissions fall below the UK average (Figure 14.2). Power does not, however, explain all of the difference in national per capita emissions, which is driven in part by other sectors (Figure 14.3):

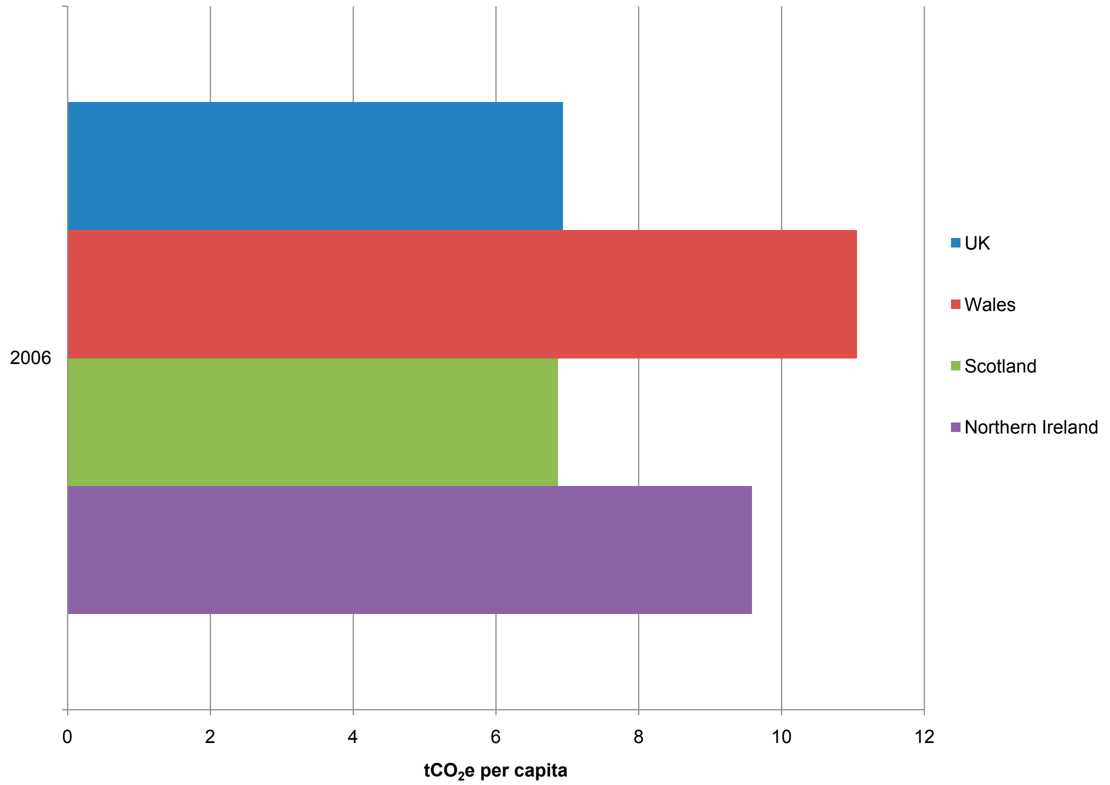
- Transport, where Northern Ireland in particular has relatively high transport emissions due to high levels of rural driving.
- Business, where emissions are relatively high in Wales given the energy-intensive industries (e.g. iron and steel, refining) located there.
- Residential, where emissions are higher than the UK average in Wales, Scotland and Northern Ireland due to a greater proportion of homes being off the mains gas grid and therefore reliant on more carbon-intensive fuels for heating.
- Agriculture, where emissions are relatively high in Wales, Scotland and Northern Ireland due to the sector's relatively large contribution to their economies.
- Land use, land use change and forestry (LULUCF), where sink impacts are greatest in Scotland.

Figure 14.1 Per capita GHG emissions – UK, Wales, Scotland and Northern Ireland, 2006



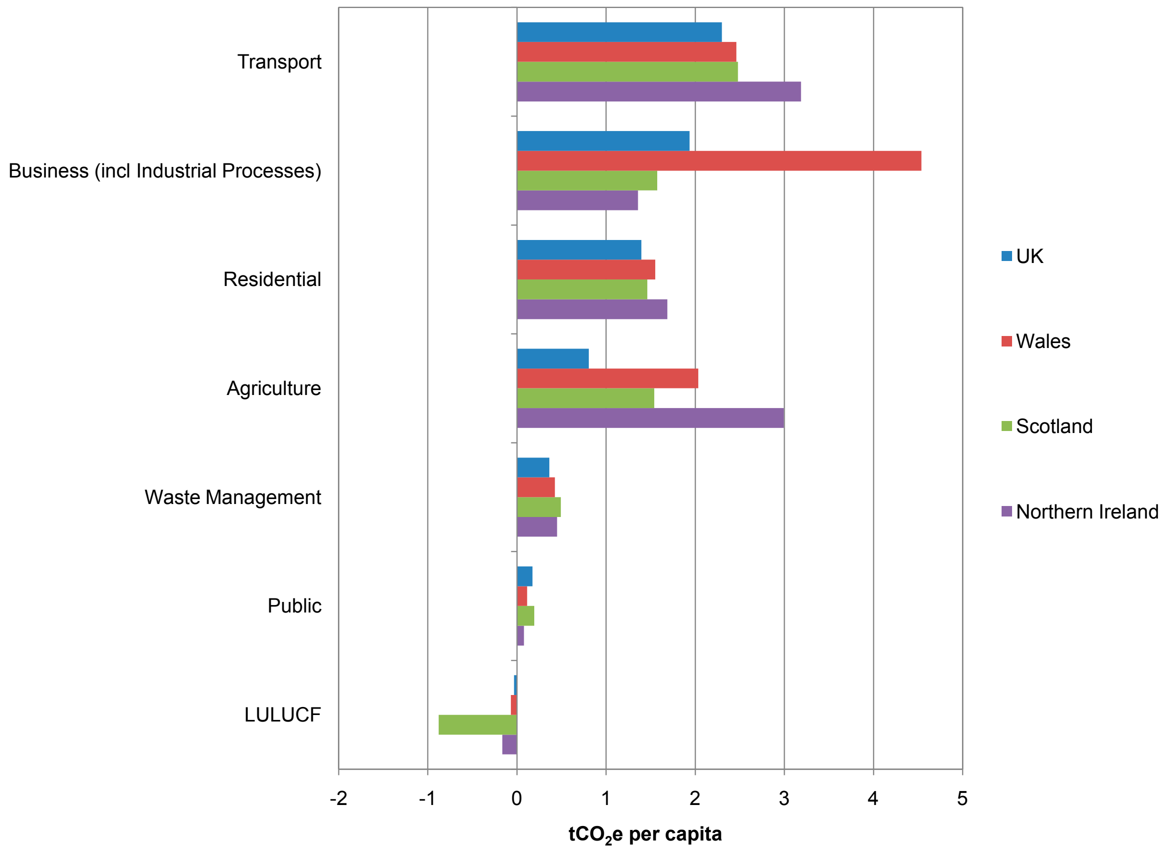
Source: National Atmospheric Emissions Inventory (NAEI) (2008) and Government Actuary's Department (GAD)

Figure 14.2 Per capita GHG emissions, excluding power – UK, Wales, Scotland and Northern Ireland, 2006



Source: NAEI (2008) and GAD

Figure 14.3 Per capita GHG emissions, by sector – UK, Wales, Scotland and Northern Ireland, 2006



Source: NAEI (2008) and GAD

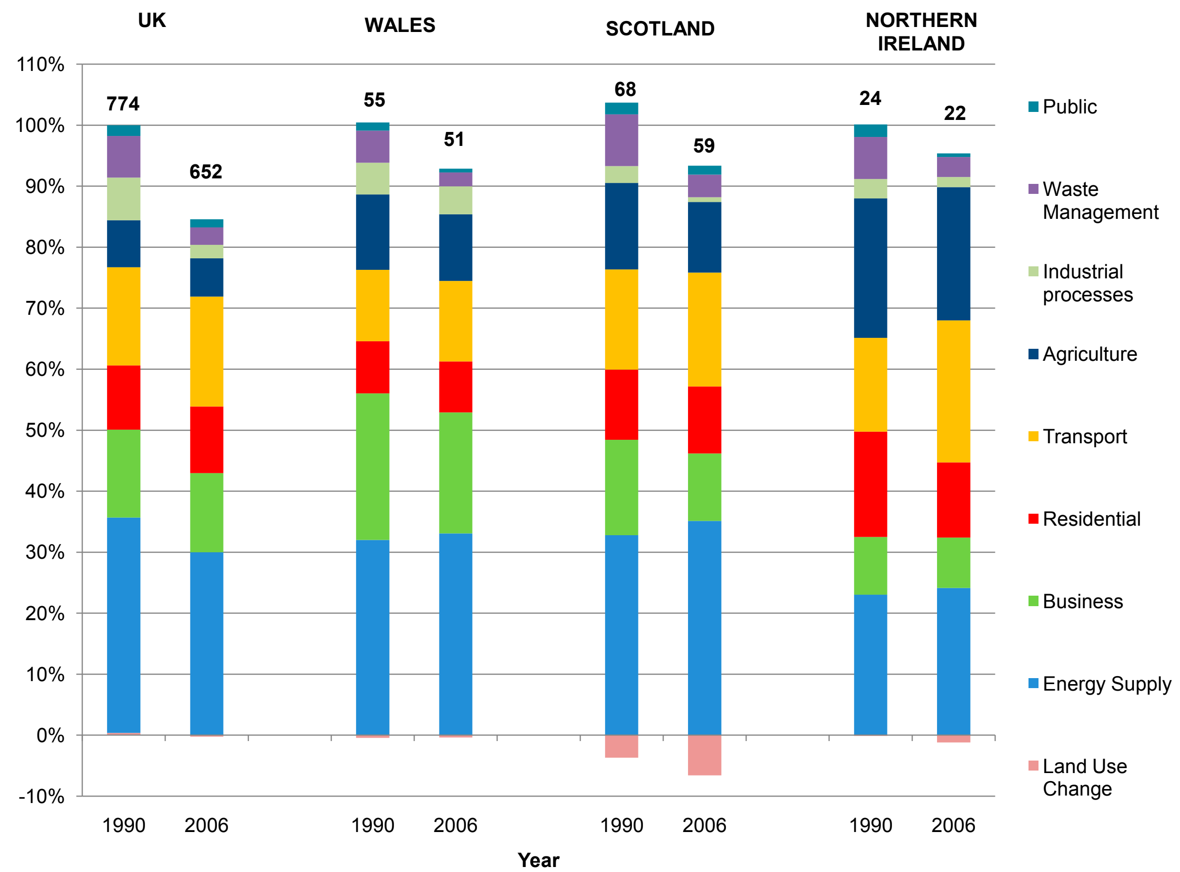
Emissions trends: Each of the nations has contributed to the UK's 16% GHG emissions reduction over the period 1990-2006 (Figure 14.4):

- Wales, Scotland and Northern Ireland have each reduced GHG emissions from agriculture, waste management, business, industrial processes, residential and public sectors. In agriculture, emissions reductions were achieved due to reduced livestock numbers (except in Northern Ireland where they have increased) and more efficient fertiliser application. Emissions reductions were also achieved due to energy efficiency improvements in buildings and industry, and the changing composition of industrial output (e.g. closure of a large steelworks in Scotland).

- Emissions from transport have increased in Wales, Scotland and Northern Ireland as they have done for the UK as a whole, due to increased demand for road and air travel. This trend is particularly marked in Northern Ireland where emissions from transport have increased by almost 50% between 1990 and 2006.

- Emissions from power generation in Wales, Scotland and Northern Ireland have increased over the period, whereas for the UK as a whole they have fallen by 15%. This is in part due to the fuel mix used to generate electricity in each nation (e.g. one or two coal plants dominate power emissions), and also because each of the nations exports electricity.

Figure 14.4 Contribution to total GHG emissions, by sector – UK, Wales, Scotland and Northern Ireland, 1990 and 2006 (relative to 1990)



Source: NAEI (2008)
Note: Total net GHG emissions appear in bold ($MtCO_2e$)

Reference emissions projections: We now set out our reference projections for Wales, Scotland and Northern Ireland. These are based on the same assumptions as the UK reference emissions projections as set out in Chapter 3: *The first three budgets*. However, it should be noted there is greater uncertainty in the disaggregated emissions projections and it has not been possible to achieve complete coverage of all emissions sources[3].

In order to project CO_2 emissions from energy at the national level, we have used a number of models:

- For residential and industry and services CO_2 emissions, we have used the Department for Energy and Climate Change (DECC) Energy Model. In disaggregating the DECC Energy Model outputs, we have assumed that national emissions projections follow the UK trend, and applied this to nation-specific data on fuel consumption, whilst accounting for forecast trends in the number of households and economic circumstances in each nation.

- For road transport CO_2 emissions, we have used the Department for Transport (DfT) National Transport Model (NTM), which provides road transport projections for Wales and Scotland[4].

- For non-energy CO_2 emissions due to LULUCF, we have used nation-specific projections published by the Centre for Ecology and Hydrology (CEH).

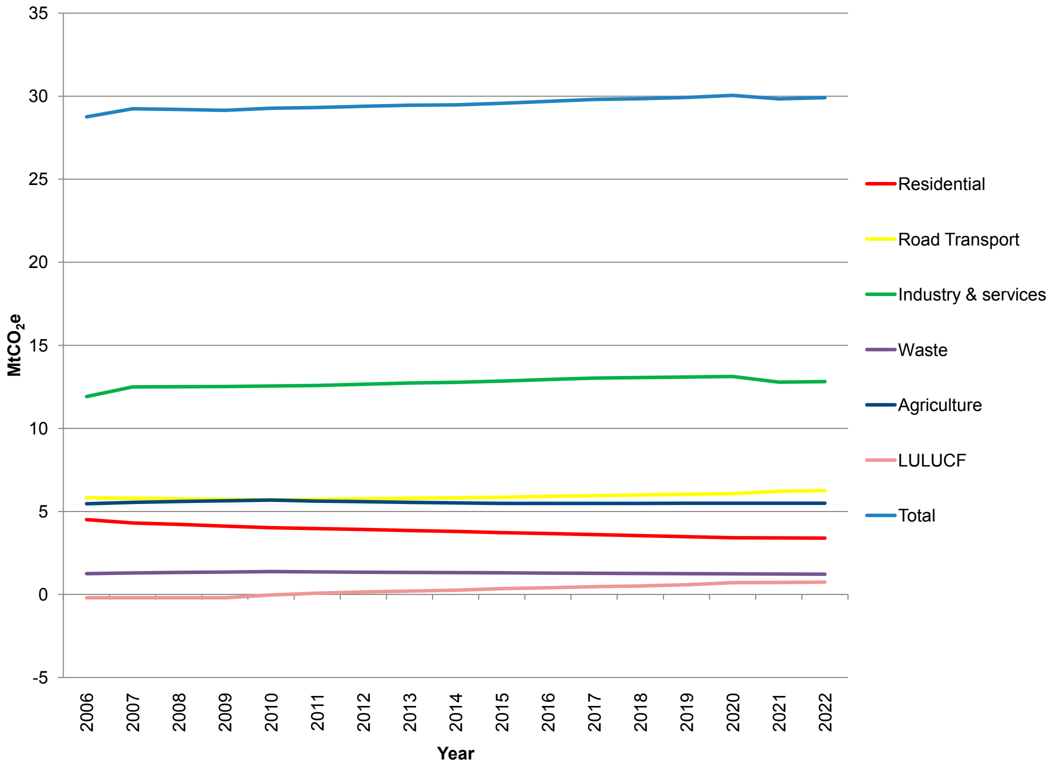
- For non-CO_2 gases, we have used Defra's projections (see Chapter 9: *Non-CO_2 greenhouse gases*), which are produced for Wales, Scotland and Northern Ireland.

Our indicative reference emissions projections (using the DECC Energy model and NTM outputs) for the period 2006-2022 suggest that GHG emissions from these source sectors in Wales, Scotland and Northern Ireland are forecast to rise by 4%, 7% and 1% respectively (Figures 14.5.a-c).

3 Reference emissions projections include industry and services, road transport, residential, waste (non-CO_2 only), agriculture and LULUCF sectors. They do not cover emissions from power generation, industrial processes, refineries, offshore and air, water and rail transport sectors.

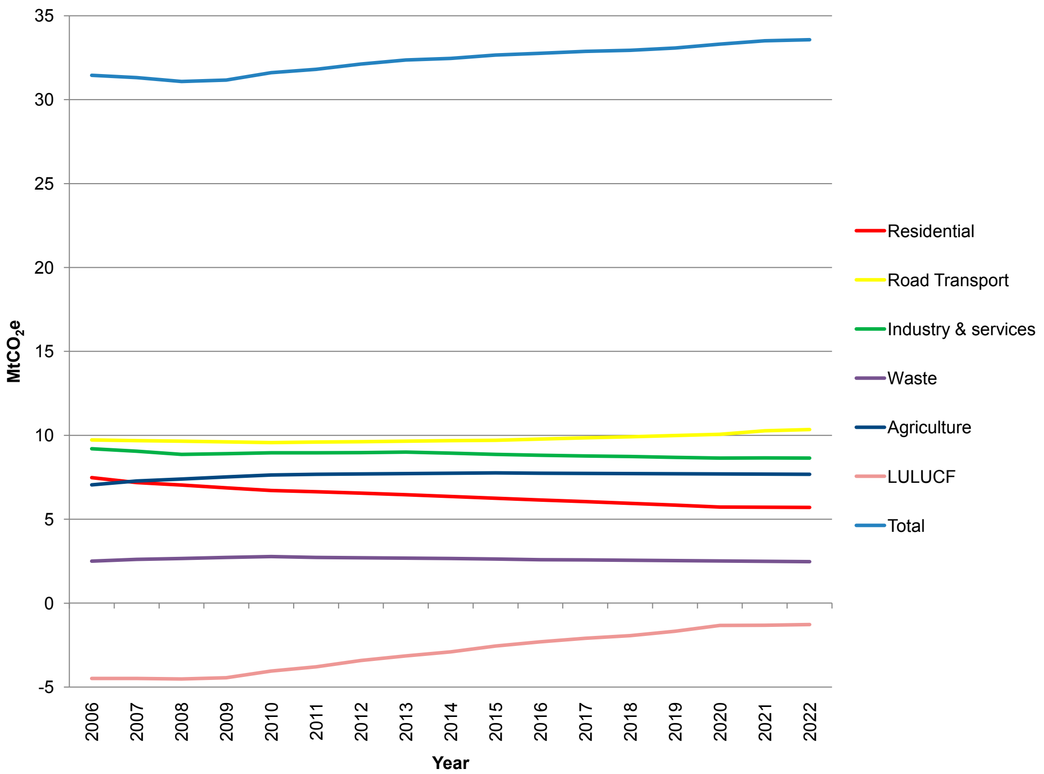
4 An estimate has been derived for Northern Ireland, in line with current road transport fuel consumption. We have assumed that Northern Ireland road transport emissions follow the same trend as the average for Great Britain.

Figure 14.5.a Reference GHG emissions projections – Wales, 2006-2022



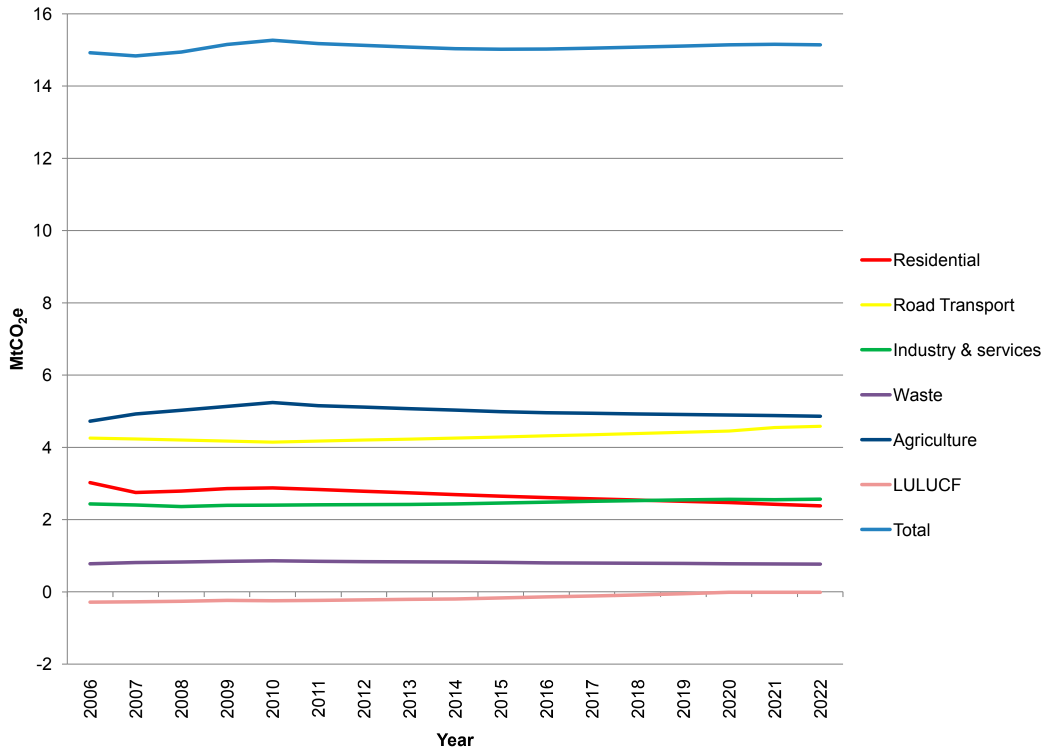
Source: CCC Calculations, DECC, DfT, CEH (2008) and Defra

Figure 14.5.b Reference GHG emissions projections – Scotland, 2006-2022



Source: CCC calculations, DECC, DfT, CEH (2008) and Defra

Figure 14.5.c Reference GHG emissions projections – Northern Ireland, 2006-2022

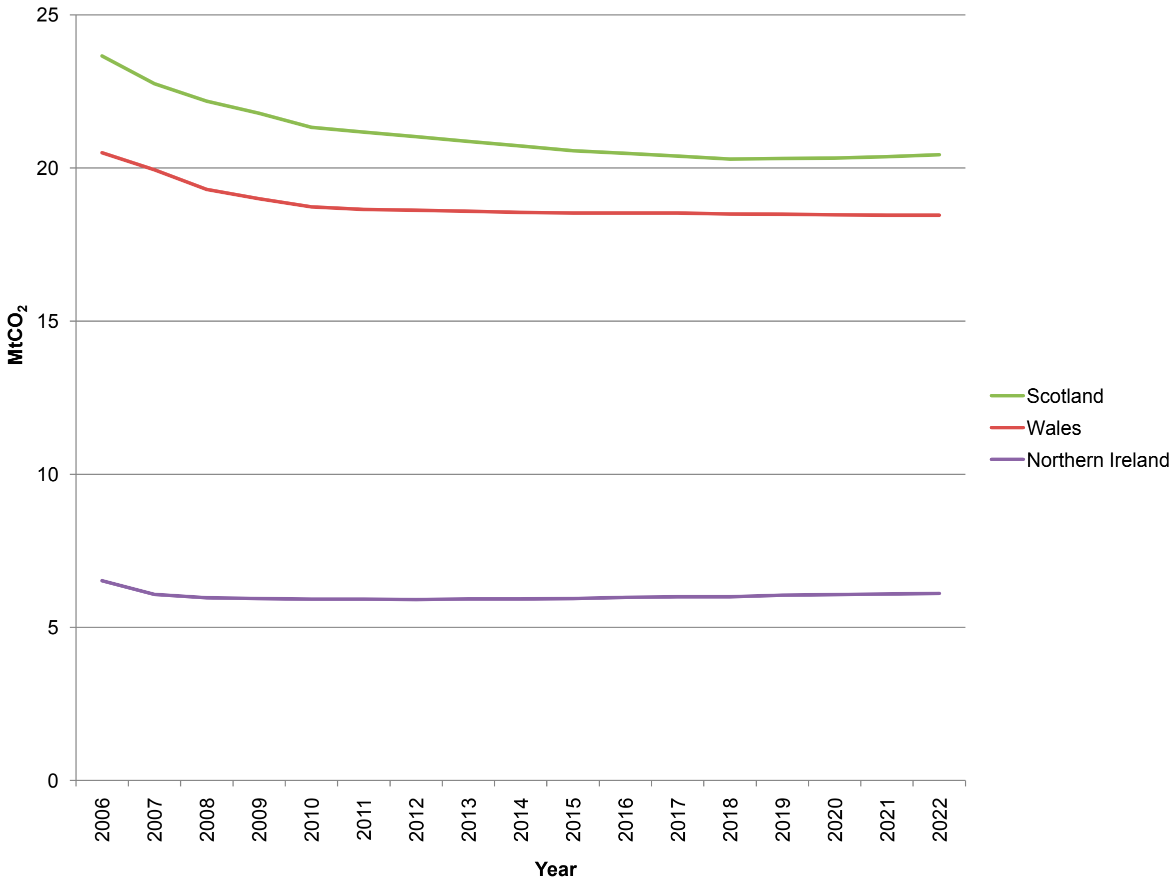


Source: CCC calculations, DECC, DfT, CEH (2008) and Defra
Note (Figures 14.5a-c): Total includes only those sectors listed and excludes emissions from power generation, refineries, offshore, industrial processes and rail, water and air transport.

- Total CO_2 emissions from energy sources (industry and services, road transport and residential) are projected to fall in both Scotland (–7%) and Northern Ireland (–3%), whilst emissions in Wales are projected to rise by 1%:
  - Emissions from residential buildings are expected to fall in each nation, driven by energy efficiency improvements, yet emissions in industry and service sectors rise in Wales and Northern Ireland due to forecast emissions growth in certain industries located there.
  - Road transport emissions are projected to grow in all nations due to sustained growth in demand for road transport.
- Net emissions from land use, land use change and forestry are projected to increase in each nation but especially in Scotland, due in part to the slower rate of forest planting in recent years.
- Total non-CO_2 emissions are projected to grow by between 1% and 7% in the period to 2022, driven by increased emissions in non-CO_2 greenhouse gases in industry and services, road transport and agriculture.

We have also analysed national outputs from the Cambridge Econometrics MDM-E3 model (see Chapter 3). For a set of the energy sectors considered above (industry, services, road transport and residential), these projections show different trends to the DECC/NTM results in some cases; overall CO_2 emissions projections fall in each nation by 6% to 14% between 2006 and 2022 (Figure 14.6). This highlights the sensitivity of nation-level projections to precise assumptions in the modelling approach.

Figure 14.6 Reference CO_2 emissions projections from Cambridge Econometrics – Wales, Scotland and Northern Ireland, 2006-2022



Source: Cambridge Econometrics modelling for CCC

2. OPPORTUNITIES FOR EMISSIONS REDUCTIONS IN WALES, SCOTLAND AND NORTHERN IRELAND

Reference emissions projections above do not include the full range of abatement options across the national economies. Whilst it has not been possible to undertake a thorough bottom-up analysis of abatement potential in each nation, we have carried out a high level disaggregation of the UK Marginal Abatement Cost Curve (MACC) analysis. To complement this approach, we have identified a number of factors that might further influence the scope and scale of abatement potential that have not been taken into account in the disaggregation, which will require further investigation. In addition, we discuss the capacity of national authorities to take action to deliver emissions savings.

The analysis in this section relates to four key areas of abatement potential:

(i) Power sector decarbonisation

(ii) Energy efficiency and new energy sources in buildings and industry

(iii) More efficient vehicles and new transport fuels

(iv) Emissions reductions in non-CO_2 greenhouse gases.

(i) Power sector decarbonisation

We set out scenarios for UK power sector decarbonisation over the first three budget periods in Chapter 5: *Decarbonising electricity generation*. These scenarios included moving away from a reference case with capacity additions based on conventional coal-fired generation. Instead, investment was assumed to flow to renewable generation backed up by gas-fired plant. Depending on the scenario, we also assumed some investment in nuclear new build. Finally, we assumed that there will be one coal-fired carbon capture and storage (CCS) demonstration plant, and that conventional coal-fired capacity could be added only on the expectation that this would be retrofitted with CCS in the 2020s.

We have not undertaken an analysis of where capacity might be added in the UK. Given our scenario-based approach at the UK level, it would not be appropriate to try to be definitive at the national level. At a high level, however, it is reasonable to assume that there will be opportunities for investment in low-carbon technologies in each of the nations of the UK, both because existing capacity is due to be retired, and because of renewable resource endowments, for example:

- There are planned capacity retirements in Scotland and Northern Ireland under the Large Combustion Plant Directive. In Scotland the capacity of the coal plant due to be retired (1,200 MW) is likely to have a significant impact on Scotland's emissions profile. Nuclear plant in Wales is also due to be decommissioned in 2010.

- Around 30% of Britain's onshore wind potential lies in Scotland, and around 10% of both onshore and offshore potential lies in Wales[5]. There is also potential for both on and offshore wind in Northern Ireland. There is significant potential for marine and tidal technologies in Wales (Severn Estuary), Scotland (Pentland Firth) and to a lesser extent in Northern Ireland.

5 Source: SKM (2008) *Growth scenarios for UK renewables generation and implications for future developments and operation of electricity networks*

In Chapter 5, we argued that a key step in significantly increasing the level of renewable electricity generation in the UK would be to address a range of constraints related to the planning system and the transmission network. There will be a particularly important role for the national authorities in addressing these constraints given the balance of reserved and devolved powers in this area, which include:

- Each national authority has responsibilities for planning in relation to energy infrastructure. In Northern Ireland, the national authority is responsible for approving onshore electricity generation capacity and offshore capacity in adjacent territorial waters. In Scotland and Wales, local planning authorities grant permission for onshore capacity up to and including 50 MW. Scottish Ministers have responsibility for approving investments in plant of greater than 50 MW capacity and offshore capacity (wind and water driven) above 1 MW in adjacent territorial waters. In Wales, offshore projects over 1 MW may be approved by the Welsh Assembly Government under the Transport and Works Act where navigation routes are affected.

- Overhead electric lines above 20 kV are subject to consent by the UK Secretary of State in the case of Wales, and the relevant national authorities in the case of Scotland and Northern Ireland.

- National authorities in Northern Ireland and Scotland are also responsible for financing mechanisms (e.g. renewable obligations, see Chapter 5) to support investment in renewable generation.

Given these powers, the national authorities will have key roles to play in delivering our scenarios in Chapter 5 and those set out in the UK Government's draft Renewable Energy Strategy. In Chapter 3 we showed how successful delivery would contribute to the UK meeting the traded sector budget that we have proposed. Successful delivery would also have significant benefits in the context of national emissions reduction programmes, which we believe should include strategies for supporting a significant increase in the level of investment in renewable generation.

(ii) Energy efficiency and new energy sources in buildings and industry

Emission reduction in existing buildings: Estimates of emissions reduction potential in existing residential and non-residential buildings in Chapter 6: *Energy use in buildings and industry* were based on a range of measures including:

- Measures to reduce the energy needed to heat buildings through improved insulation and more efficient and lower carbon ways to generate heat.

- Measures to improve boiler efficiency and reduce gas demand

- The use of more efficient appliances and lighting, resulting in electricity demand reductions

- Investment in (electricity and heat) microgeneration technologies, reducing demand for gas, electricity and other fossil fuels.

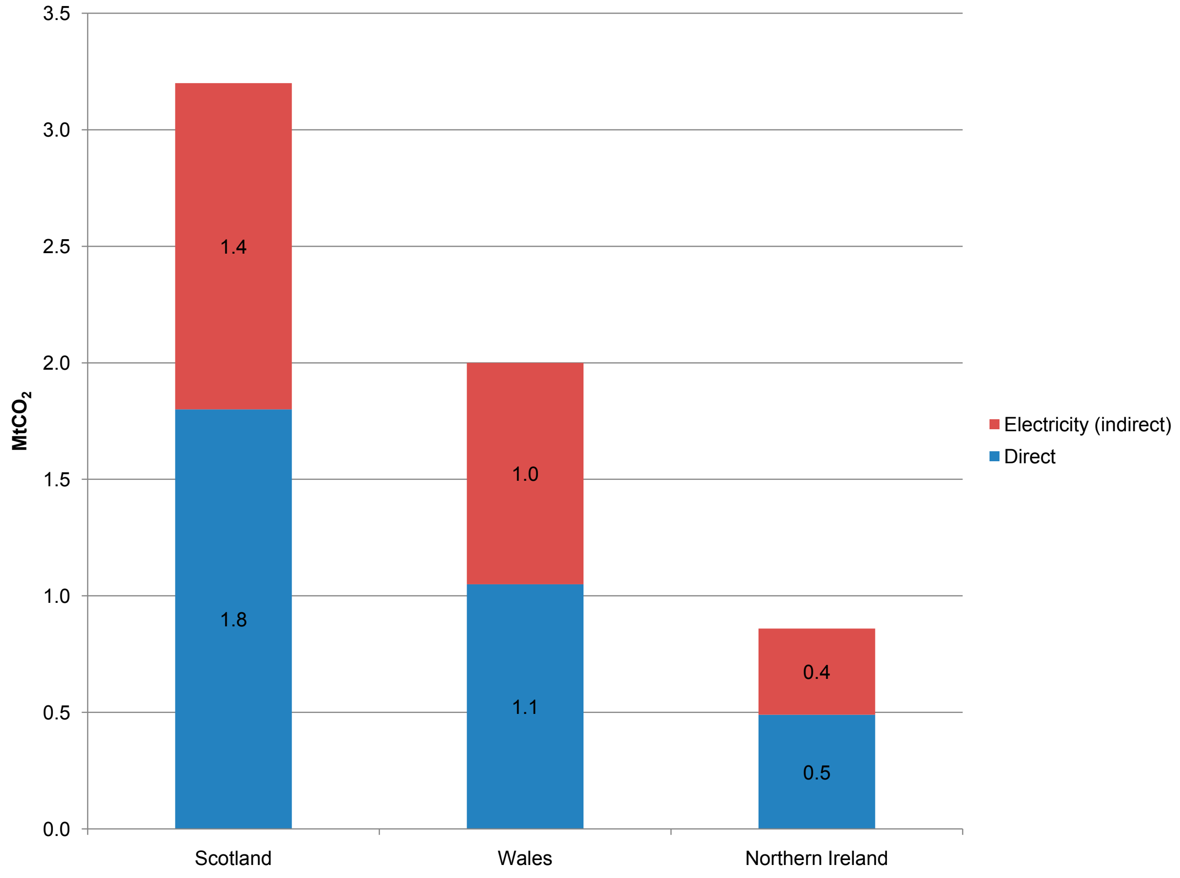
- Lifestyle and energy management measures (e.g. turning down heating thermostats, using economy washing programmes)

We estimated that the total technical potential for emissions reductions across the UK for these measures in 2020 is up to 134 $MtCO_2$. Taking account of emissions reduction constraints, we estimated that there is up to 35 $MtCO_2$[6] of realistically achievable emissions reduction potential in our Extended Ambition scenario.

6 This number excludes savings from Zero Carbon Homes as this policy covers England and Wales only and has not been disaggregated. The Sullivan Report: *A low-carbon buildings strategy for Scotland* has recommended similar measures to zero carbon homes for Scotland.

We have allocated this UK figure across nations according to current energy share (e.g. where Wales consumes 5% of total UK energy, we have assumed that it has 5% of the emissions reduction potential). Based on this methodology, we estimate that in 2020 there is up to 2 $MtCO_2$ feasible emissions reduction in Wales (1.1 $MtCO_2$ of which are direct savings), 3.2 $MtCO_2$ in Scotland (1.8 $MtCO_2$ of which are direct savings), and 0.9 $MtCO_2$ in Northern Ireland (0.4 $MtCO_2$ of which are direct[7] savings) (Figure 14.7).

Figure 14.7 Direct and indirect abatement in buildings – Wales, Scotland and Northern Ireland, 2020



Source: CCC analysis

We recognise that this methodology does not account for national differences in key aspects related to fuel use and energy efficiency of existing buildings which will impact on emissions reduction potential, as shown for the housing stock in Table 14.1:

- Lower levels of gas central heating, particularly in Northern Ireland, may provide opportunities for additional emissions reduction, for example, through switching from current carbon-intensive sources of heat (e.g. domestic fuel oil and coal) to renewable heat technologies (e.g. biomass, combined heat and power (CHP), heat pumps, etc.). On the other hand, scope for boiler efficiency improvement may be lower in Wales, Scotland and Northern Ireland.

- There may be greater scope for cavity wall insulation in Wales and Scotland relative to England, given that a higher proportion of cavity walls in these nations are not currently insulated. Conversely, there is relatively less opportunity in Northern Ireland as a smaller proportion of cavity walls are un-insulated.

7 Direct savings are reductions in emissions relating to consumption of fossil fuels in buildings (i.e. not electricity).

Given the need to account for these considerations, we stress that our estimates of national emissions reduction potential should be regarded as indicative; further work would be required before these could form part of national emissions reduction strategies or national carbon budgets.

Table 14.1 House Condition Survey statistics – England, Wales, Scotland and Northern Ireland, 2004

	England	Wales	Scotland	Northern Ireland
Number of households (000s)	21,620	1,209	2,269	680
Households with mains gas central heating	88%	78%	73%	8%
Households with un-insulated cavity walls	42%	44%	47%	17%

Source: English House Condition Survey 2004, Living In Wales 2004, Northern Ireland Interim House Condition Survey 2004, Scottish House Condition Survey 2003-04

Notwithstanding the need for further work on the level of abatement potential that is available, we have made a preliminary assessment of national authorities' ability to implement policies to reduce emissions. In doing this, we have considered the balance of control between the UK Government and national authorities over the main policy levers for reducing emissions (Table 14.2):

- National authorities in Wales, Scotland and Northern Ireland are responsible for promoting energy efficiency improvements, policy regarding microgeneration technologies, and public estate management.
- National authorities in Northern Ireland and Scotland have devolved control over setting building standards.

Table 14.2 Current balance of powers relating to emissions reductions in buildings

Reserved powers and UK/GB-wide policies			
Carbon Reduction Commitment (UK-wide)			
EEC/CERT and the Supplier Obligation (GB-wide)			
Devolved powers			
	Wales	**Scotland**	**Northern Ireland**
Promotion of energy efficiency	✓	✓	✓
Public sector estate management	✓	✓	✓
Microgeneration policy	✓	✓	✓
Building standards	x	✓	✓
Energy efficiency levy on power companies	x	x	✓

Source: CCC analysis

It is our conclusion that the national authorities have control over some key policy levers, and that devlolved action will be required in order to realise emissions reductions in buildings in Wales, Scotland and Northern Ireland.

Emissions reduction in industry: Estimates of potential for industrial emissions reductions in Chapter 6 were based on a range of measures such as improved energy management, insulation and heat recovery and building new more energy efficient plant. We estimated maximum technical emissions reduction potential of 7 $MtCO_2$ in 2020, and argued that this should largely be regarded as realistically achievable given that much of industry in the UK is covered by emissions caps/ trading.

We have allocated this potential across nations using national share of gross value added (GVA) by industrial sector (Table 14.3). On the basis of this methodology, nations with an estimated share of UK abatement potential comparable to their population share are:

- Scotland, where there may be significant scope for emissions reductions in electrical engineering and food and drink.
- Wales, where there may be significant scope for emissions reduction in basic metals.

Table 14.3 Share of UK GVA, by sector, and overall share of abatement potential – Wales, Scotland and Northern Ireland, 2005

Sector	Wales	Scotland	Northern Ireland
Chemicals	4%	5%	1%
Construction	4%	9%	4%
Electrical Engineering	7%	14%	3%
Food and Drink	4%	11%	2%
Mechanical Engineering	4%	7%	2%
Non-metallic mineral products	4%	6%	5%
Other Industries	6%	8%	2%
Paper and Printing	3%	5%	1%
Rubber and Plastics	5%	6%	5%
Basic metals	11%	5%	1%
Textiles and Clothing	3%	8%	2%
Vehicle Engineering	5%	5%	3%
Water	6%	9%	3%
Total share of abatement potential	**5%**	**7%**	**1%**

Source: AEA based on Annual Business Inquiry (ABI) data

More generally, we estimate that there may be up to 0.4 $MtCO_2$ emissions reduction in industry in Wales (0.1 $MtCO_2$ of which are direct savings), 0.5 $MtCO_2$ in Scotland (0.1 $MtCO_2$ of which are direct savings) and 0.1 $MtCO_2$ in Northern Ireland (0.02 $MtCO_2$ of which are direct savings).

Delivery of these reductions will largely be driven by UK-wide initiatives such as the European Union Emissions Trading Scheme (EU ETS), the Carbon Reduction Commitment and Climate Change Agreements (see Chapter 6). There is an important role however for national authorities both in contributing to the design and implementation of these policies, and in helping to address emissions reduction constraints in sectors comprising small non energy-intensive firms, for which the policy framework is currently limited.

(iii) More efficient vehicles and new transport fuels

At the UK level, we noted that the large majority of UK transport emissions relate to road transport, and we identified potential for emissions reductions of up to 19 $MtCO_2$ in 2020 from supply-side measures in the Extended Ambition scenario (see Chapter 7: *Reducing domestic transport emissions*). We based this estimate on a model of the existing vehicle (cars, vans and HGVs) stock with assumptions about the rate of turnover and a range of opportunities for reducing emissions including increased use of biofuels and improved fuel-efficiency of new cars and vans.

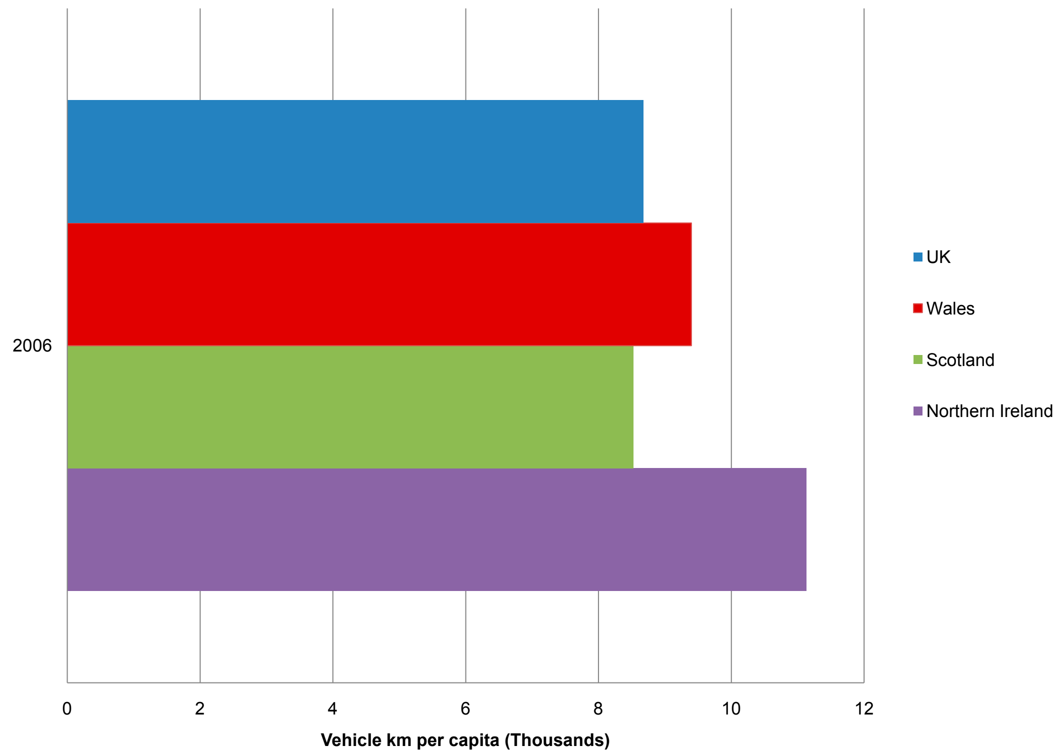
We have allocated our estimate of UK emissions reductions across nations on the basis of share in vehicle kilometres. In doing this we have assumed that the existing car stock is of similar composition across nations, both as regards vehicle size and fuel efficiency. We have also assumed a similar rate of stock turnover and technology options across nations. Under these assumptions, we estimate that in 2020 there is 1 $MtCO_2$ emissions reduction potential in Wales, 1.5 $MtCO_2$ in Scotland, and 0.7 $MtCO_2$ in Northern Ireland.

The delivery mechanism for these emissions reductions will be an EU-wide framework based around legally binding targets for car fuel efficiency and possibly for van fuel efficiency. To the extent that delivering these targets will require strengthening of fiscal incentives, this will be a matter for the UK Government rather than national authorities, given that fiscal matters (e.g. vehicle excise duty) are reserved.

There is a role, however, for national authorities to support delivery of transport demand-side emissions reduction. We suggested, for example, that there may be up to around 3 $MtCO_2$ of emissions reduction available at the UK level through implementation of Smarter Choices measures (e.g. modal shift, car sharing, etc.).

Whether this can be achieved equally across nations will depend to an extent on geography. For example, it may be the case that the higher vehicle kilometres per capita in Northern Ireland (Figure 14.8) reflects higher levels of rural travel for which it would not be economic to substitute public transport. Conversely, there may be scope for more modal switch in areas where public transport networks are currently either underdeveloped or underutilised.

Figure 14.8 Vehicle kilometres per capita – UK, Wales, Scotland and Northern Ireland, 2006



Source: DfT, Department for Rural Development in Northern Ireland and GAD

It is our view that there is worthwhile opportunity for reducing emissions through modal shift, better journey planning and other demand-side measures in each nation. The emissions reductions available may not be large in absolute terms, but could form a useful part of wider national emissions reduction programmes. National authorities have a key role unlocking emissions reduction potential here given that powers to support modal shift are devolved.

(iv) Emissions reduction in non-CO_2 greenhouse gases

Abatement potential in agriculture, land use and forestry: We set out our analysis of emissions reduction potential in agriculture and forestry in Chapter 9: *Non-CO_2 greenhouse gases*, where we considered a range of options including:

- Measures to reduce N_2O emissions from crops and soils
- Measures to reduce methane emissions from livestock
- Peatland restoration[8]
- Increasing the number of trees

Our conclusion was that there is 7 $MtCO_2e$ of realistically achievable emissions reduction potential in 2020, under the central feasible scenario.

8 In Chapter 9, we suggested that the research has not identified significant abatement potential from peatland restoration and other land use measures and therefore savings from this option have not been disaggregated here. However, if peatland restoration were to be identified as a cost-effective measure, it is likely that a significant share of the savings would occur in Scotland.

We have disaggregated this potential[9] across nations on the basis of the following methodologies:

- For measures to reduce N_2O emissions from crops and soils, we have used the proportion of land currently used for each type of crop to determine the share of savings
- For livestock measures, we have estimated the share of savings based on the number of livestock in each nation
- For reforestation/avoided deforestation, we have estimated the share of savings based on Centre for Ecology and Hydrology's nation-specific modelling work of different rates of tree planting.

Applying these methodologies suggests that there are significant opportunities for emissions reduction from agriculture and forestry across the nations:

- In Wales, reductions in emissions from livestock could be up to 0.1 $MtCO_2e$ and from crops and soils measures 0.4 $MtCO_2e$. Forestry measures could deliver 0.06 $MtCO_2$ of savings.
- In Scotland, reductions in emissions from livestock could be 0.1 $MtCO_2e$ and from crops and soils measures 0.6 $MtCO_2e$. Forestry measures could deliver 0.3 $MtCO_2$ of savings.
- In Northern Ireland, reductions in emissions from livestock could be 0.1 $MtCO_2e$ and from crops and soils measures 0.3 $MtCO_2e$. Forestry measures could deliver 0.04 $MtCO_2$ of savings.

Our conclusion in Chapter 9 was that the policy framework for unlocking emissions reduction potential is currently not developed, and that there should be serious consideration of the alternative policy options available. There is an important role for the national authorities in this context, given the balance of reserved and devolved powers. Specifically, though the influence of EU policy is strong, this is largely a devolved policy area, with each national authority having responsibility for its rural development plan and having its own forestry service.

Given the significant emissions reduction potential and the policy levers available to national authorities, therefore, it will be important going forward that national climate change strategies include measures to reduce emissions from agriculture, land use and forestry.

Non-CO_2 emissions reduction in waste management: In Chapter 9 we identified feasible abatement potential of up to 6 $MtCO_2e$ as a result of directing waste away from landfill to energy-producing processes. The MACC model for waste constructed for the CCC included an initial analysis of how the abatement would be distributed across the nations. This analysis estimated that of this potential, 0.3 $MtCO_2e$ could be saved in Wales, 0.7 $MtCO_2e$ in Scotland and 0.1 $MtCO_2e$ in Northern Ireland. Waste management policy is devolved to each of the national authorities, however, some of the key mechanisms for delivering emissions reductions are set at EU level (the landfill directive) or UK level (the landfill tax).

Non-CO_2 emissions reduction in industrial processes: Half of the 3 $MtCO_2e$ of abatement potential identified for industrial process and energy-related non-CO_2 emissions (Chapter 9) largely relates to upgraded recovery and utilisation of methane from coal mines. Whilst we have not undertaken a detailed analysis of the distribution of these savings, given that current activity resulting in coal mining emissions is located in England (84%), Wales (13%) and Scotland (3%), the savings identified are likely to be distributed accordingly.

9 This figure includes savings from anaerobic digestion measures, however due to data constraints, it has not been possible to disaggregate the potential between England, Wales, Scotland and Northern Ireland.

3. ECONOMIC IMPACTS OF CARBON BUDGETS IN WALES, SCOTLAND AND NORTHERN IRELAND

At the UK level, we have undertaken an analysis of the wider economic costs of carbon budgets (Chapter 11: *Economic costs and fiscal implications*). We have not, however, attempted to estimate the GDP impact at the level of the national authorities. Rather, our focus has been on the potential competitiveness impacts of carbon budgets and consequences for employment and output in Wales, Scotland and Northern Ireland.

In Chapter 10: *Competitiveness challenges and opportunities*, we argued that potential competitiveness impacts relate to a small number of energy-intensive sectors. In particular, sectors regarded as being at risk would have to meet two criteria:

- Energy costs should be a significant proportion of production costs and/or gross value added (GVA), such that energy cost increases due to carbon prices would significantly impact output prices.

- Products should be tradable or potentially tradable, implying that transport costs and other trade barriers should not be prohibitive

Our conclusion was that a number of sectors may potentially be at risk, which may include iron and steel, lime, cement and aluminium.

National output and employment impacts: We have developed the analysis in Chapter 10 to understand possible national implications for output and employment as consumers and firms respond to increased production costs and possible competitiveness impacts. At the UK level, we have argued that these impacts are likely to be small. But at the national level, impacts are potentially significant given geographical concentration of energy-intensive sectors.

Our starting point was to group the sectors shown in Chapter 10 into three categories according to their production cost increase:

- Category 1 comprises sectors with cost increase as a share of GVA of more than 25%, plus aluminium[10]

- In Category 2 are sectors with cost increase as a share of GVA of between 15% and 25%

- Category 3 includes sectors that have cost increase as a share of GVA of between 5% and 15%.

10 Aluminium is expected to have <25% increase in production costs as a proportion of GVA but is most highly exposed to electricity cost increases. Its inclusion also negates disclosure issues with the ABI data. Other sectors in this category in fact have >50% increase in production cost as a proportion of GVA.

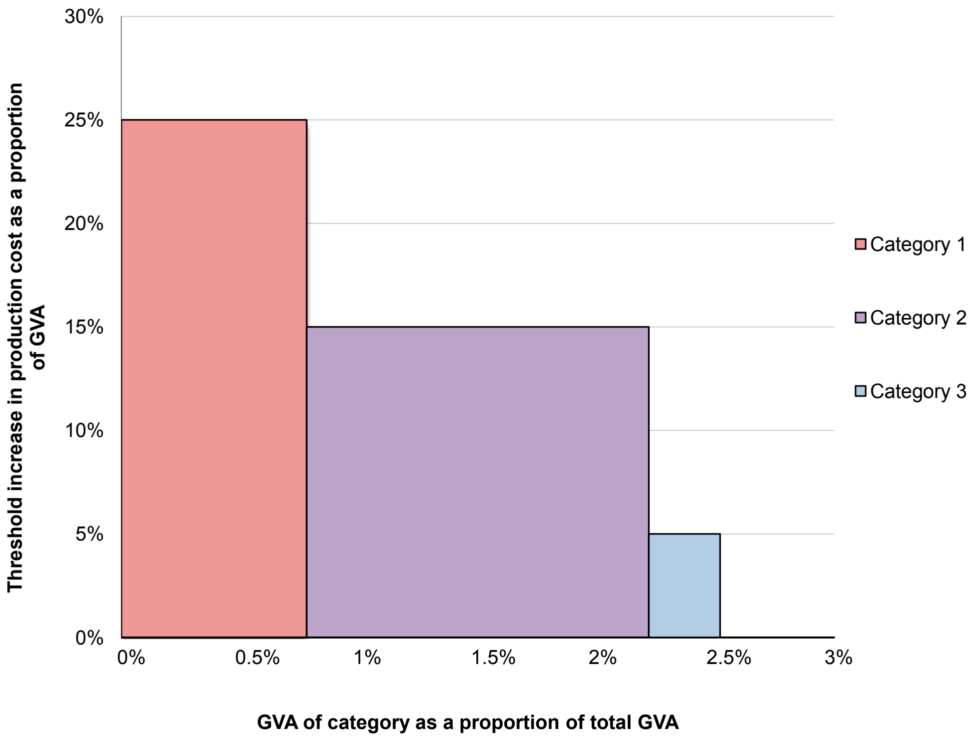
Table 14.4 Industrial sectors at risk by category

Category 1	Category 2	Category 3
Most GVA at risk	**Moderate GVA at risk**	**Some GVA at risk**
Basic iron & steel	Refined petroleum products	Malt
Cement	Starches & starch products	Coke oven products
Lime	Fertilisers & nitrogen compounds	Industrial gases
Aluminium	Other inorganic basic chemicals	Non-wovens
	Pulp, paper & paperboard	Household & sanitary goods
		Finishing of textiles
		Hollow glass
		Rubber tyres & tubes
		Retreading & rebuilding of rubber tyres
		Veneer sheets, plywood, etc.
		Flat glass
		Other textile weaving
		Copper
		Silk & filament yarn
		Casting of iron

Mapping these categories to national production suggests that sectors at risk account for only a small proportion of national GVA (Figures 14.9.a-c). Category 1 sectors accounted for 0.8% of 2005 GVA in Wales but only 0.1% in Northern Ireland and 0.07% in Scotland.

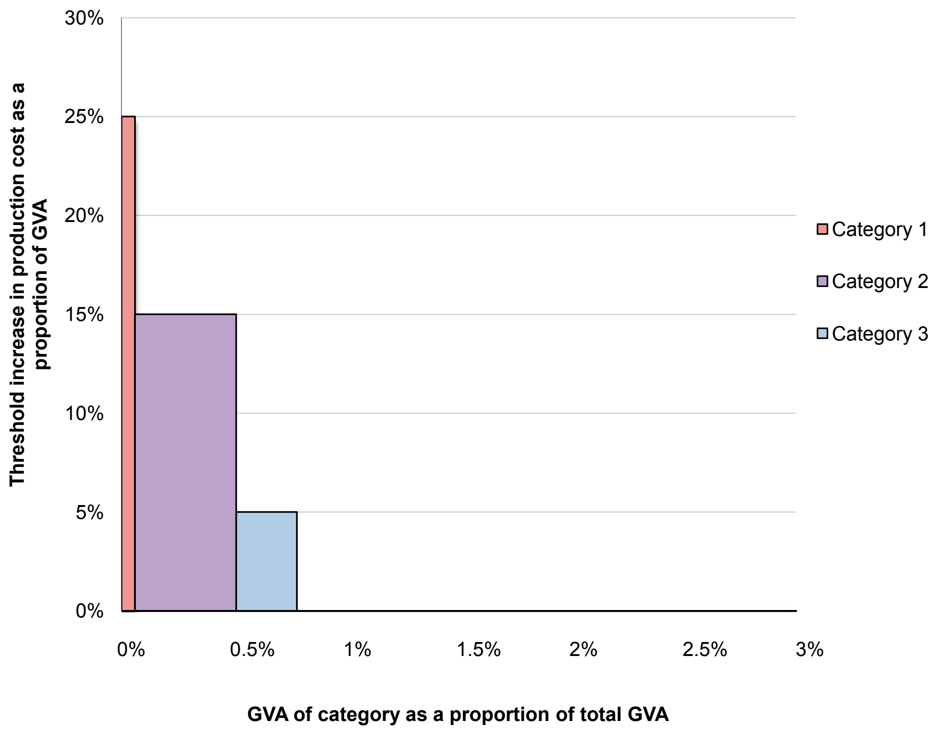
Mapping the same categories to employment suggests that sectors at risk account for only a small proportion of national jobs, and no more than 1.4% in any nation in 2005 (Figures 14.10.a-c). We note, however, that local impacts within nations may be significant (Table 14.5). In particular, around half of the 16,000 jobs in at risk sectors in Wales relate to two industries around which form important parts of local economies.

Figure 14.9.a Proportion of GVA represented by category 1, 2 and 3 sectors – Wales, 2005



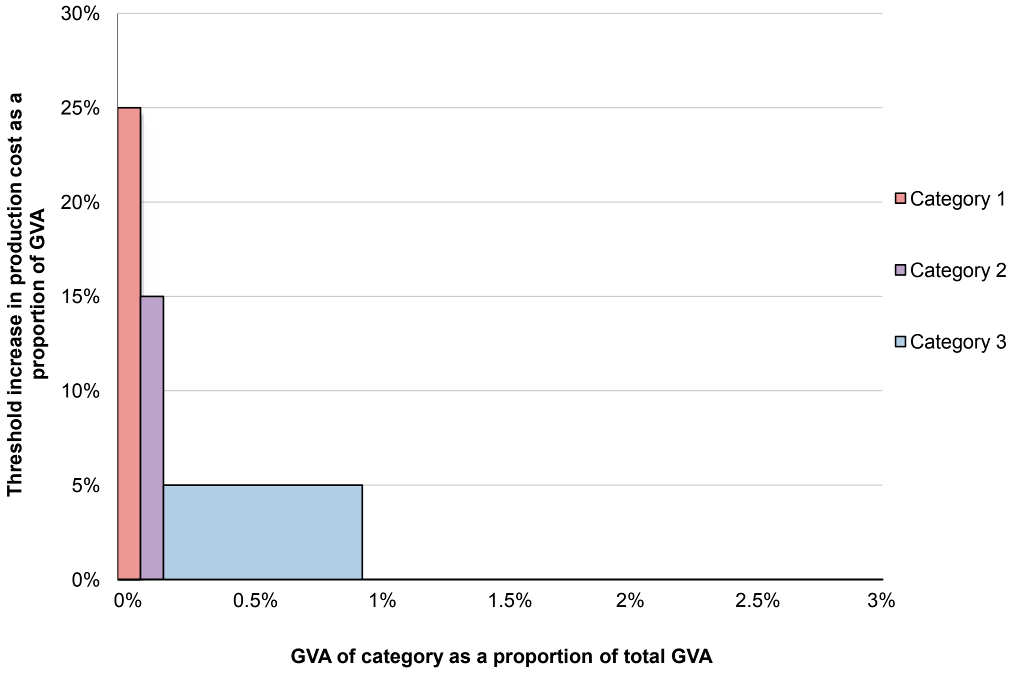
Source: CCC calculations based on ABI data

Figure 14.9.b Proportion of GVA represented by category 1, 2 and 3 sectors – Scotland, 2005



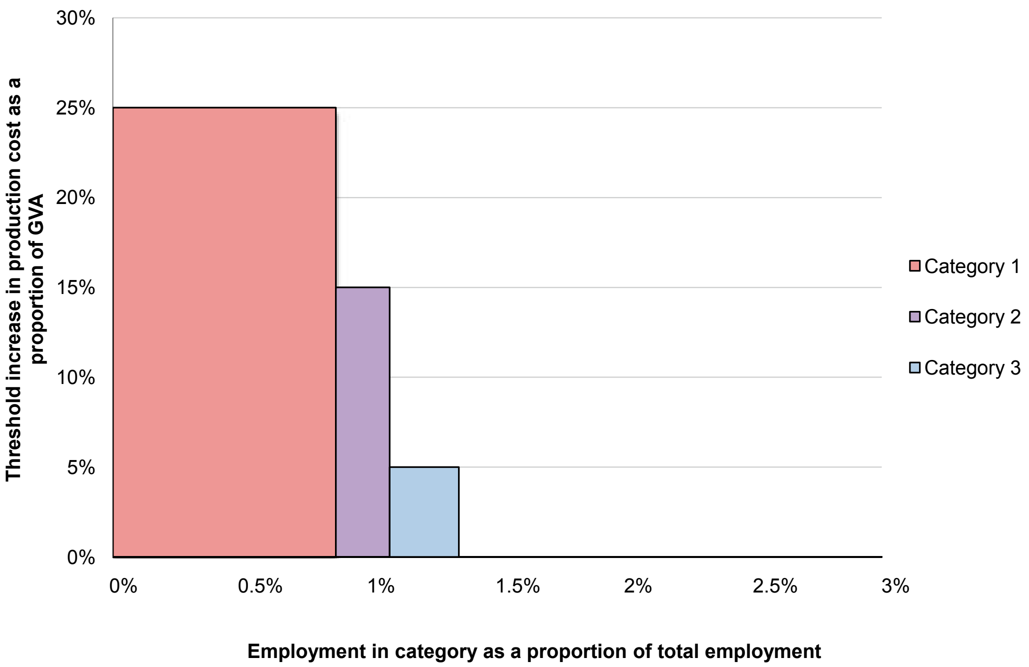
Source: CCC calculations based on ABI data

Figure 14.9.c Proportion of GVA represented by category 1, 2 and 3 sectors – Northern Irealand, 2005



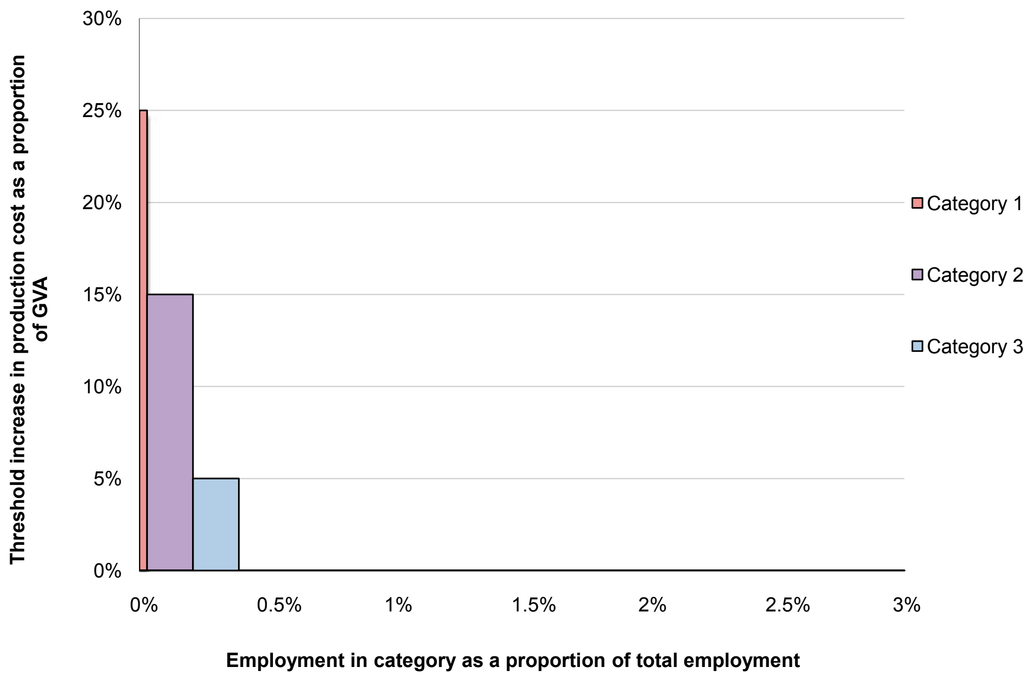
Source: CCC calculations based on ABI data

Figure 14.10.a Proportion of employment represented by category 1, 2 and 3 sectors – Wales, 2005



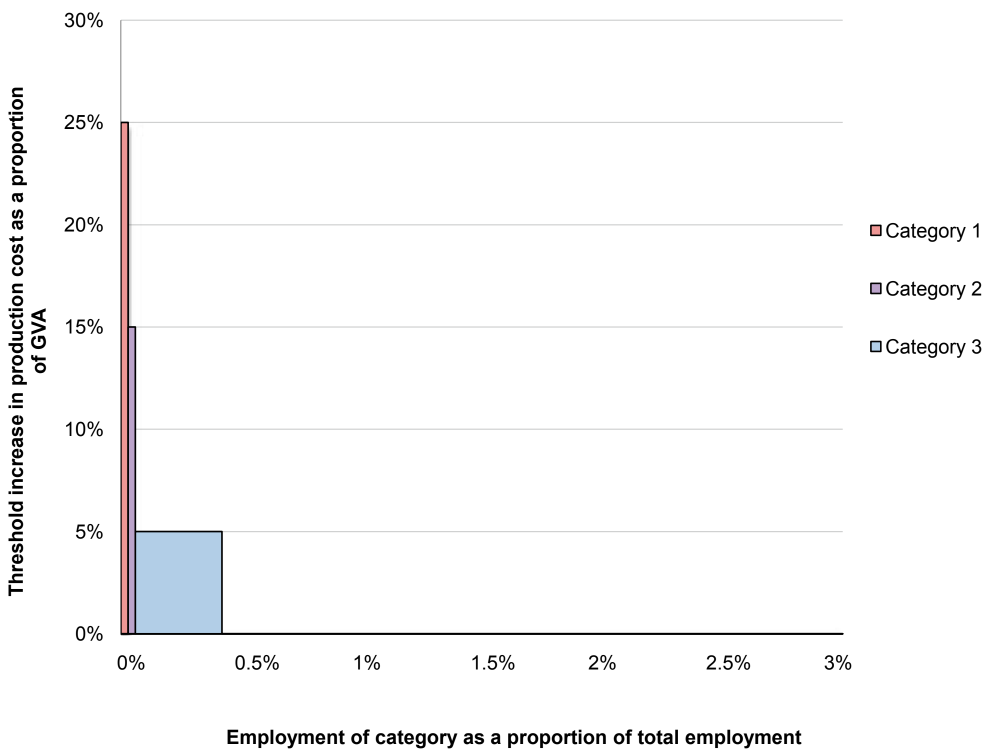
Source: CCC calculations based on ABI data

Figure 14.10.b Proportion of employment represented by category 1, 2 and 3 sectors – Scotland, 2005



Source: CCC calculations based on ABI data

Figure 14.10.c Proportion of employment represented by category 1, 2 and 3 sectors – Northern Ireland, 2005



Source: CCC calculations based on ABI data

Table 14.5 Location of main plant in category 1 in Wales, Scotland and Northern Ireland

Sector	Nation	Location
Aluminium	Wales	Anglesey
Cement	Wales	Flintshire
	Scotland	East Lothian
	Northern Ireland	Co. Fermanagh, Co. Tyrone
Iron and Steel	Wales	Cardiff, Carmarthenshire, Newport, Port Talbot

Source: Defra, EU ETS UK National Allocation Plan

Risk mitigating measures: It is important to stress that whilst there are risks for energy-intensive sectors, there are also risk-mitigating mechanisms (e.g. issuing free carbon allowances to sectors at risk, see Chapter 10). Moreover, these mechanisms are and will be an integral part of the EU ETS framework. Whilst competitiveness impacts may therefore be an issue in principle, in practice we do not expect the localised output and employment impacts identified above to ensue.

Opportunities: We feel more confident in this conclusion recognising that over time dynamic labour markets will facilitate growth in other sectors to offset any output reduction in energy-intensive industry, and to take advantage of specific opportunities related to building a low-carbon economy. The location and scale of these opportunities are difficult to predict, but key growth sectors are likely to include offshore wind energy, wave and tidal, and auto-engines (see Chapter 10).

4. FUEL POVERTY IMPACTS OF CARBON BUDGETS

Fuel poverty is already a significant issue across the nations of the UK, this in the absence of major carbon impacts on energy prices. In 2006, the range for the number of households in fuel poverty in the national authorities was 20%-34%, up from 11%-23% in 2004 (Table 14.6). Given increasing international oil and gas prices which have been reflected in domestic energy prices, we would expect these numbers to have increased further in the last two years.

Table 14.6 Proportion of fuel poor households in Wales, Scotland and Northern Ireland, 2004 and 2006

Year	Scotland (1)	Wales	Northern Ireland
2004	15%	11%	23%
2006	24%	20%	34%

(1) Scottish Fuel poverty estimates relate to survey years 2003-04 and 2005-06 respectively.

Source: Fuel Poverty In Wales 2004, Northern Ireland House Condition Survey 2006, Scottish House Condition Survey 2005-06

Chapter 12: *Fuel poverty implications*, sets out our analysis of incremental fuel poverty impacts due to carbon budgets. This analysis suggested that up to 600,000 UK households could be pushed into fuel poverty through carbon budget impacts on the electricity price in 2022, rising to 1.7 million households through possible gas price impacts. Offsetting these impacts, we estimated that energy efficiency improvement could potentially reduce the number of households in fuel poverty by up to 400,000.

Our analysis is based on a model developed for us by the Buildings Research Establishment (BRE). We have built on the model, which relates to households in England only, to draw indicative implications for fuel poverty in Wales, Scotland and Northern Ireland. To do this, we consider three key potential differences across nations:

- Income, which varies across regions in the UK, with average household disposable income in Northern Ireland, Wales and Scotland being lower than the UK average[11]. For given energy consumption and carbon cost, more households will enter fuel poverty where incomes are lower.

- Demographic changes, including the growth in the number of households, changes in type of household as well as the age structure of the population. For example, the projected number of households in 2022 is expected to be around 19% higher than in 2006 in Northern Ireland and 13% higher in Scotland and Wales[12].

- Differences in opportunities for energy efficiency improvements across nations given differences in the building stock (see Section 2 above).

11 Source: ONS (2005) Gross Disposable Household Income.
12 Source: General Registrar Scotland (2006-based), Northern Ireland Statistics and Research Agency (2006-based) and Welsh Assembly Government (2003-based).

The results of this analysis suggest that up to around 250,000 households in the three national authorities could enter fuel poverty due to electricity and gas price impacts net of energy efficiency improvements:

- In the reference scenario, there are estimated to be 130,000 households in fuel poverty in 2022 in Wales (Table 14.7.a). Electricity price impacts in Wales could result in an additional 40,000 households entering fuel poverty, rising by 90,000 households due to possible gas price impacts. Energy efficiency improvements could take 30,000 households back out of fuel poverty.

- In the reference scenario, there are estimated to be 290,000 households in fuel poverty in 2022 in Scotland[13] (Table 14.7.b). Electricity price impacts in Scotland could result in an additional 40,000 households entering fuel poverty, rising by 90,000 households due to possible gas price impacts. Energy efficiency improvements could take 30,000 households back out of fuel poverty.

- In the reference scenario, there are estimated to be 120,000 households in fuel poverty in 2022 in Northern Ireland (Table 14.7.c). Electricity impacts in Northern Ireland could result in an additional 20,000 households entering fuel poverty. Possible gas price impacts should be less important in the case of Northern Ireland, given the low level of gas penetration. However, an additional 50,000 households could enter fuel poverty in Northern Ireland if a renewable heat levy were applied to all heating fuels. Energy efficiency improvements could take 20,000 households back out of fuel poverty.

We argued in Chapter 12 that emissions reduction effort should not be lowered given possible implications for fuel poverty. Rather, fuel poverty impacts should be addressed. The balance of reserved and devolved responsibilities is such that there will be an important role for the UK Government in addressing fuel poverty impacts, through income transfers and/or through possible introduction of social tariffs. There will also be an important role for national authorities, however, particularly as regards supporting and facilitating energy efficiency improvements which our analysis suggests has significant potential to reduce, if not fully offset, fuel poverty impacts of carbon budgets.

13 This figure does not include demographic changes in Scotland as the base year data were not available. Supplementary analysis suggests the number of households in fuel poverty in 2022 in Scotland could be 17% higher (up to 340,000 households) in the reference case, based on the impact of demographic changes in England.

Table 14.7.a Fuel poverty impacts in Wales

Year	Number of households in fuel poverty (thousands) under:				
	Reference projection	Electricity price increases	Electricity price increases and energy efficiency measures	Electricity and gas price increases	Electricity and gas price increases and energy efficiency measures
2006	240				
2012	190	210	200	220	210
2017	150	180	170	240	220
2022	130	170	150	260	230

Source: BRE modelling, based on CCC assumptions

Table 14.7.b Fuel poverty impacts in Scotland

Year	Number of households in fuel poverty (thousands) under:				
	Reference projection	Electricity price increases	Electricity price increases and energy efficiency measures	Electricity and gas price increases	Electricity and gas price increases and energy efficiency measures
2006	540				
2012	410	430	420	440	420
2017	330	370	350	420	390
2022	290	330	300	420	390

Source: BRE, based on CCC assumptions

Table 14.7.c Fuel poverty impacts in Northern Ireland

Year	Number of households in fuel poverty (thousands) under:				
	Reference projection	Electricity price increases	Electricity price increases and energy efficiency measures	Electricity and gas price increases	Electricity and gas price increases and energy efficiency measures
2006	230				
2012	170	190	180	190	180
2017	140	160	140	180	170
2022	120	140	120	190	170

Source: BRE modelling, based on CCC assumptions

5. NEXT STEPS IN DEVELOPING THE EVIDENCE BASE

Each of the national authorities has adopted emissions reduction targets:

- Wales is targeting a 3% annual emissions reduction from 2011 in areas of devolved competence. Current renewable electricity targets are to produce 4 TWh by 2010 and 7 TWh by 2020.

- Scotland is targeting a 50% GHG emissions reduction by 2030 relative to 1990, rising to 80% in 2050. In addition, Scotland is aiming to generate half of its electricity from renewable sources by 2020.

- Northern Ireland will aim to reduce GHG emissions by 25% in 2025 relative to 1990, and to have 12% of its electricity coming from renewable sources by 2012.

The analysis in this chapter and the accompanying technical paper, together with analysis being carried out by the national authorities, could be used to inform how these targets might be met. It would not, however, form the basis for design of climate strategies in the national authorities. Given the indicative nature of our analysis, we have avoided moving from our estimates of emissions reduction potential to indicative national budgets. To the extent that it would be desirable to design national budgets, either to embody and help deliver national targets, or to set out national contributions to UK budgets, further work would be required. We have highlighted some of the areas where we see a need for further work in this chapter. Going forward, it is our intention to work with the national authorities to build on existing analysis and provide more detailed consideration of key national differences that should be accounted for when designing carbon budgets and climate strategies.