

Executive summary

Introduction and key messages

This is our fourth annual report to Parliament on progress reducing emissions to meet carbon budgets, as required under the Climate Change Act.

In our first report we set out our approach to measuring progress reducing emissions, based on a set of indicators. The indicators allow us to differentiate between changes in emissions due to the economy and the weather, and underlying progress reducing emissions.

In subsequent reports we identified that emissions fell in 2009 due to the recession, and increased in 2010 due to the cold weather, without which emissions would have been broadly flat. We concluded that underlying progress through the implementation of measures would – if continued – be insufficient to meet future carbon budgets, which require annual emissions reductions of 3%.

We therefore identified the need for a step change in the rate of implementation of measures to achieve carbon budgets. We envisaged that the step change would be driven by new policies developed through the first carbon budget period (2008-2012), and would start at the end of that period. This is reflected in our indicators, which build in a relatively low level of ambition for implementation of measures during the first budget period, with an acceleration into the second carbon budget period (2013-2017).

In this fourth progress report we update our assessment using 2011 data, and we consider progress against policy milestones (e.g. the Electricity Market Reform, the Green Deal) required to drive the step change.

Our main conclusions, which lead us to specific recommendations summarised in Box 1, are:

- **Emissions trends.** Economy-wide greenhouse gas (GHG) emissions fell by 7% in 2011 to 547 MtCO₂e. However, 3 percentage points of this fall were due to the mild winter temperatures in 2011, with much of the remainder due to rising energy prices, falling real income and transitory changes in the power generation mix, and only around 0.8 percentage points due to implementation of measures to reduce emissions. This rate of underlying progress is only a quarter of that required to meet future carbon budgets.
- **Progress against indicators.** Although there has been progress against indicators, this is relative to a low level of ambition for the first budget period. Therefore there will be a need to do more across almost the full range of measures. There are major challenges sustaining and increasing the pace of investment in low-carbon power generation, buildings fabric measures and other energy efficiency improvements, renewable heat, electric vehicles, and travel behaviour change. Whereas when we first highlighted the need for a step change there was a lead-time of several years, this has now elapsed. Therefore the step change is needed urgently if we are to remain on track to meeting future carbon budgets. In other words, it is crucial now to move from the policy development phase to delivery.

- **Power sector.** Investment in onshore and offshore wind in 2011 was around one-third of the rate required annually by the end of the decade. There is a healthy project pipeline, but there are a number of barriers which need to be addressed if the pipeline is to be translated into actual investments. There has been slippage in the demonstration programme for carbon capture and storage (CCS), which should now proceed as a matter of urgency. There has been progress towards new nuclear investment, but whether this will proceed remains uncertain. One key driver across these technologies will be the Electricity Market Reform.
- **Buildings.** There has been progress on loft and cavity wall insulation and boiler replacement, but very limited progress on solid wall insulation and uncertainty over the extent to which people are purchasing the most efficient appliances. Going forward, it will be challenging to sustain an extensive loft and cavity wall insulation programme, and to ramp up solid wall insulation.
- **Renewable heat.** The Renewable Heat Incentive (RHI) was introduced in 2011 but currently is only available for non-residential installations. There has been very little uptake of renewable heat in the residential sector, which is problematic given the need to make significant progress here to meet carbon budgets (e.g. analysis for the fourth carbon budget assumes deployment of the order of several million residential heat pumps).
- **Industry.** Energy efficiency improvements may have been implemented in 2011. But much has to be done to make progress on the use of sustainable bioenergy and deployment of CCS.
- **Transport.** There has been good progress on new car emissions, which continue to outperform our indicator, but very limited progress on vans. There is concern that miles travelled increased across modes in 2011 and a risk that emissions will rise as the economy recovers. On electric vehicles, although conditions are in place to support market development, this is yet to happen at any scale and therefore remains a major challenge. A plan for full roll-out of Smarter Choices is required, as is more effort to support eco-driving, where rates of training have been very low.
- **Agriculture.** Although emissions in 2010 were in line with our indicator trajectory, there was an increase of 0.7% relative to 2009. Of particular concern was the increase in the use of fertiliser for crop production even though output fell.
- **Waste.** Emissions from waste fell in 2010, continuing a long-term trend, but there remains scope to go further.

- It will be crucial to develop and implement new policies generally, and specifically to support electricity sector decarbonisation, energy efficiency improvement and investment in residential renewable heat.
 - **Electricity Market Reform (EMR).** Progress has been made on EMR, most notably through the Government stating this will be based on long-term contracts for low-carbon power generation and submitting enabling legislation for pre-legislative scrutiny. It is important now that a clear carbon objective is set for the EMR (i.e. to achieve carbon intensity of the order of 50 gCO₂/kWh in 2030 through investment in a portfolio of low-carbon technologies), to provide investor confidence that there will be a market for low-carbon technologies built to schedule and cost, and that there will not be a second dash for gas. Specific commitments on minimum levels of less mature technologies should be made subject to cost reductions being achieved. There are also a number of detailed design questions which should be resolved as a matter of urgency so that the EMR can be implemented from 2014.
 - **Green Deal and Energy Company Obligation (ECO).** The Government has responded to our concerns around initial proposals consulted on in the autumn of 2011. The final design of the Green Deal and the ECO is likely to result in additional installations of cavity wall and loft insulation relative to very low levels under original proposals, as well as the insulation of around a million solid walls. However, incentives for the insulation of easy-to-treat cavity walls and lofts remain weak, and installation numbers projected by DECC remain substantially below our indicator trajectories, resulting in a carbon gap of at least 3 MtCO₂. Options to strengthen incentives for loft and cavity wall insulation should be developed. More generally, we will closely monitor the Green Deal and ECO to determine whether they deliver sufficient carbon savings.
 - **Residential renewable heat.** The residential sector is currently covered by a small-scale grant programme which has failed to deliver even against a low level of ambition. Given the importance of developing a residential renewable heat market to build supply chains and consumer acceptance, the Renewable Heat Incentive (RHI) should be made available to the residential sectors as soon as possible. Green Deal finance should also be made available in conjunction with the RHI to cover at least the additional costs of renewable heat investment compared to conventional alternatives. Approaches to address non-financial deployment barriers should be introduced.

Box 1: Summary of recommendations in 2012 progress report

Power

- Urgently resolve financial uncertainty for renewable projects by confirming support levels under the Renewables Obligation.
- Move forward with demonstration of carbon capture and storage (CCS), selecting projects by end-2012 and closing by end-2013; include gas CCS demonstration; develop long-term strategy including commercialisation approach (e.g. support for the next phase of investment following demonstration), storage sites and approach to CO₂ pipeline investment which anticipates future demand.
- Set a clear carbon objective for the Electricity Market Reform (EMR) (i.e. to achieve a carbon intensity of the order of 50 gCO₂/kWh by 2030 through investment in and development of a low-carbon technology portfolio); make commitments on minimum level of investment in less mature technologies subject to cost conditions being met.
- Set out detailed implementing arrangements for EMR by the end of 2012; allow renewable projects to be considered for early eligibility for Contracts for Difference under EMR (along with nuclear and CCS); make EMR support for intermittent generation as close to feed-in tariffs as possible.
- Ensure a major role for the Green Investment Bank in mobilising project finance for offshore wind investment (e.g. to reach around 12 GW by 2020).
- Engage with EU partners to strengthen the carbon price in the EU ETS.

Buildings

- Strengthen incentives for loft and cavity wall insulation prior to launch of the Green Deal in autumn 2012.
- Retain the CRC, but with reduced administrative burden, and redesigned league table to strengthen reputational incentives. Consider scope for rationalisation of policies covering the non-residential sector to one carbon price instrument, in conjunction with league tables and mandatory carbon reporting.
- Start the non-residential Green Deal no later than January 2013.
- Announce ambitious standards for private rented regulation in the non-residential sector by the end of 2013.
- Include the residential sector in the Renewable Heat Incentive (RHI) from summer 2013, make eligible for Green Deal finance in conjunction with the RHI, and introduce approaches to address non-financial barriers.

Industry

- Set out approaches by the end of 2012 (in the forthcoming industry strategy) to increase use of sustainable bioenergy in large industry and to develop and deploy CCS.

Transport

- Consider options to strengthen incentives for purchase of more efficient vans.
- Reverse budget decision on company car tax for electric vehicles.
- Set out, by summer 2013, an approach to fully roll out Smarter Choices nationwide.
- Include eco-driving as a key element in the practical driving test.
- Enforce the current motorway speed limit.

Agriculture

- Develop a robust framework for monitoring changes in farming practice based on survey data by the end of 2012.
- Set out by the end of 2012 triggers for introduction of new policies going beyond the current voluntary approach.

Waste

- Develop specific strategies by the end of 2013 to increase diversion of food, paper and card from landfill.

Data

- Improve the evidence base on energy efficiency of appliances, district heating, surface transport emissions by mode, agriculture emissions, waste emissions.

We set out the analysis that underpins these conclusions in 11 parts:

1. Economy-wide emission trends
2. Non-traded sector emissions
3. Traded sector emissions
4. Progress reducing power sector emissions
5. Progress reducing emissions from buildings
6. Progress reducing emissions from industry
7. Progress reducing transport emissions
8. Progress reducing emissions from agriculture
9. Progress reducing waste emissions
10. Progress reducing emissions in the devolved administrations
11. Current and future funding for implementation of measures

1. Economy-wide emissions trends

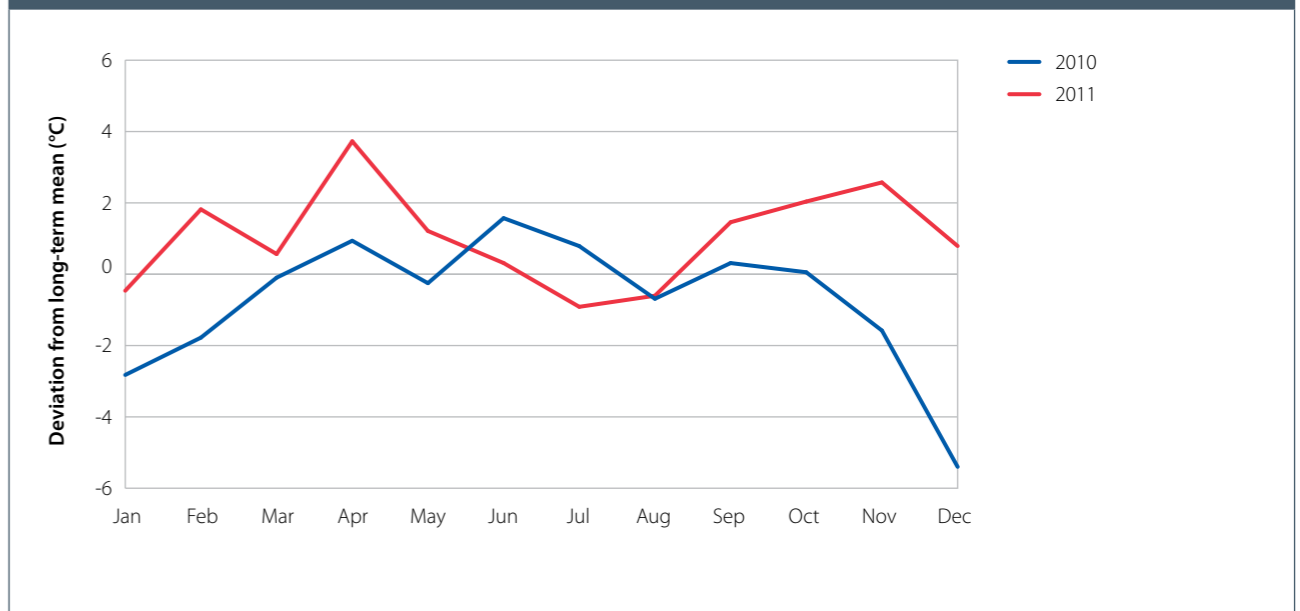
The context for our assessment in this report is one of milder winter temperatures, falling household real income, slightly rising GDP, and rising energy and fuel prices.

- The winter months in 2011 (i.e. January, February and December) were around 4°C warmer than the previous year and there were 27% fewer heating degree days (HDD) over the year (Figure 1).
- GDP grew by only 0.7% in 2011, following growth in 2010 of 2.1%. Within this, manufacturing output grew by 2.0%, while household real disposable income fell by 1.2% (Figure 2).
- Wholesale gas price increases in 2011 resulted in a 9% (7% in real terms) increase in residential gas prices, and an 8% (6% in real terms) increase in residential electricity prices (Figure 3).
- In the transport sector, petrol prices rose by 14% (11% in real terms) and diesel prices rose by 16% (14% in real terms) (Figure 4).

Economy-wide emissions in 2011 fell by 7% to 547 MtCO₂e, reflecting reductions in both CO₂ and non-CO₂ emissions (Figure 5).

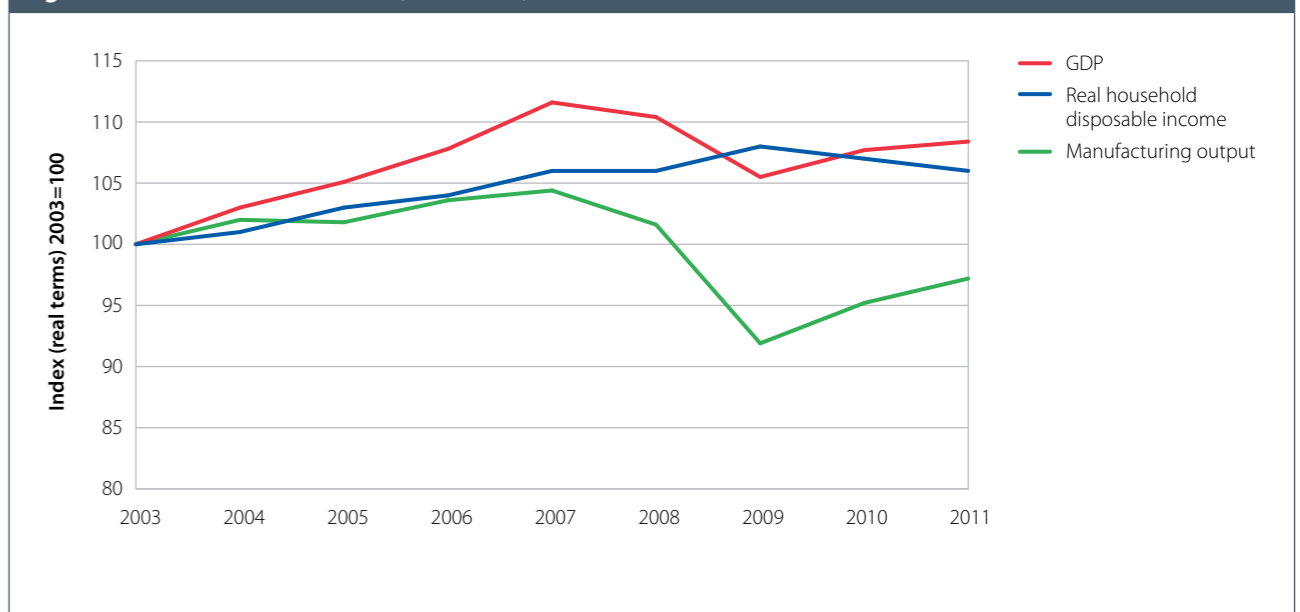
- CO₂ emissions fell by 8% in 2011 to 456 MtCO₂, reflecting reduced emissions from buildings, industry and power generation.
- Non-CO₂ emissions fell by 2% to 90 MtCO₂e, continuing long-term trends.

Figure 1: Average daily temperature – deviation from long-term mean (2010 and 2011)



Source: DECC (March 2012) Quarterly Energy Prices Table 4.1.2.
Notes: The long-term mean for each month is mean temperature between 1971-2000.

Figure 2: UK Economic Indicators (2003-2011)



Source: ONS (2012) Quarterly National Accounts.

Figure 3: Fuel prices in the residential sector (2007-2011)

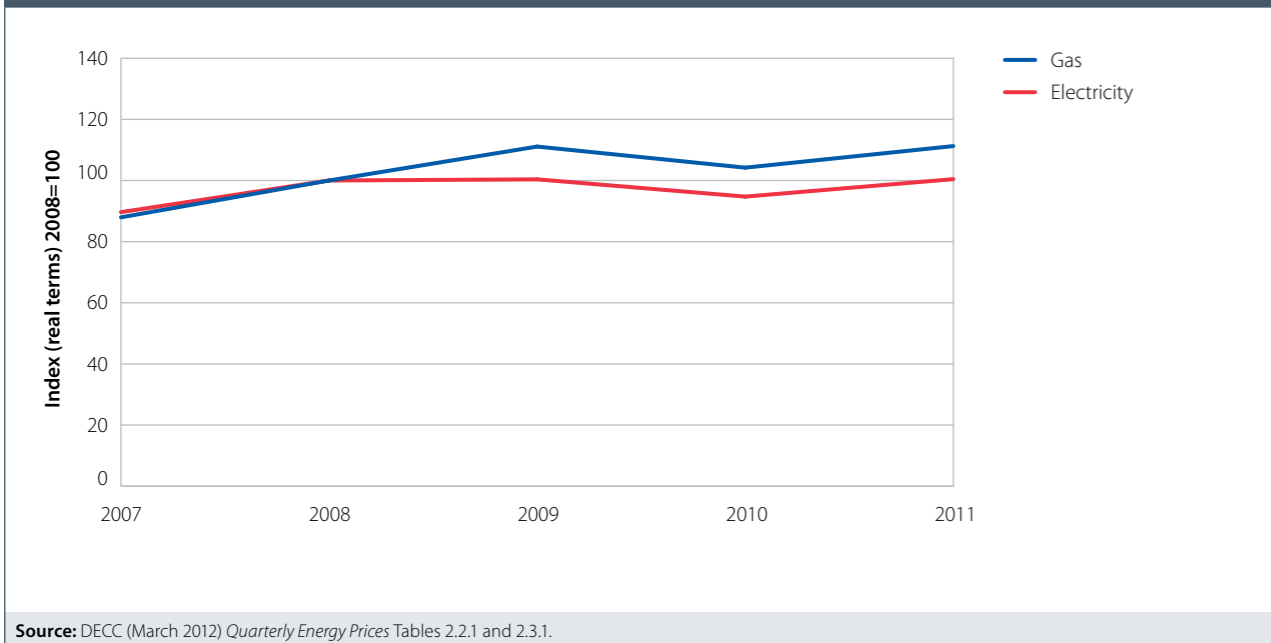


Figure 4: Petrol and diesel prices (2003-2011)

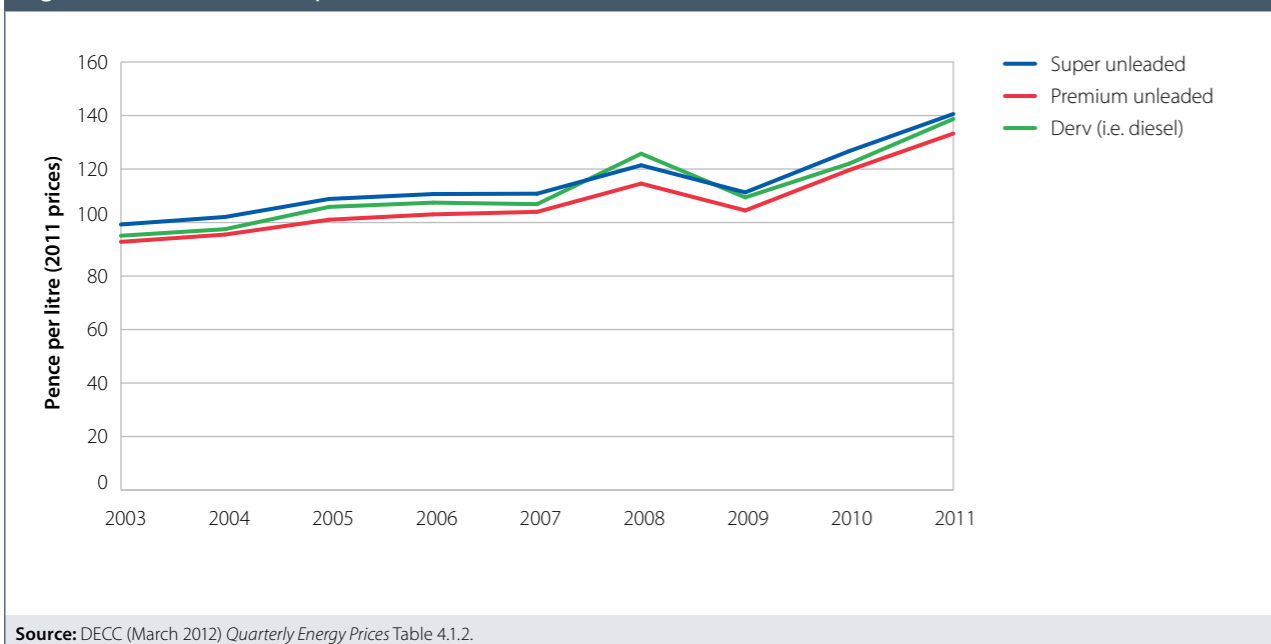
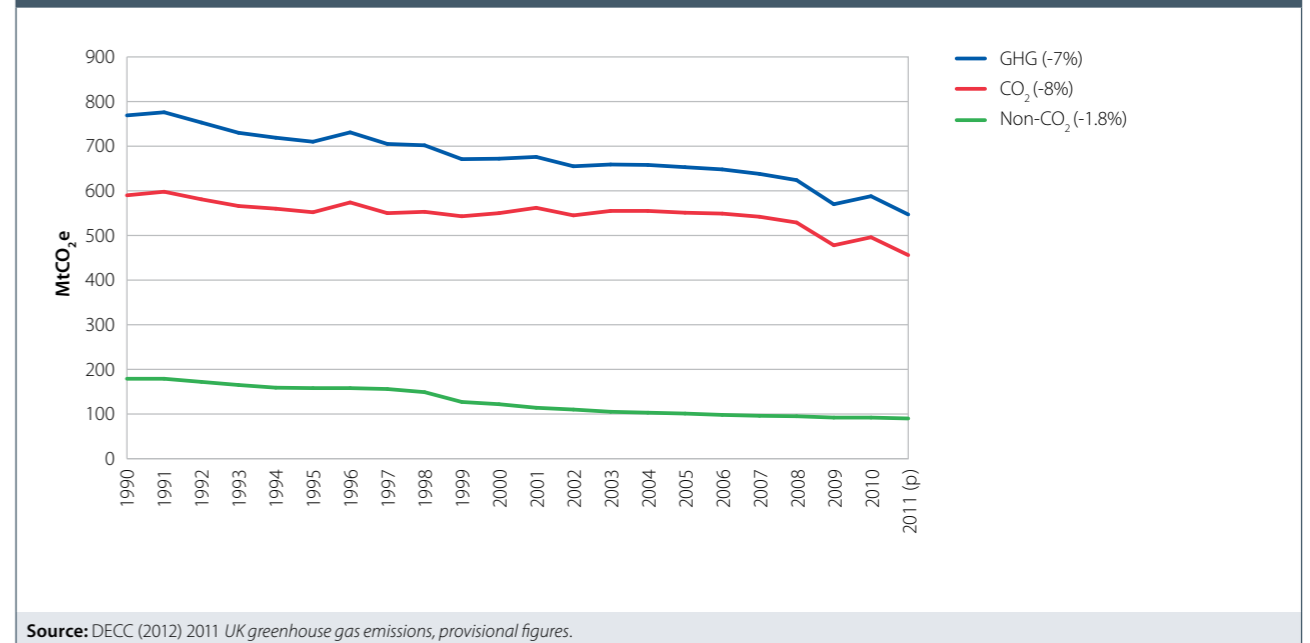


Figure 5: UK greenhouse gas emissions (1990-2011)



The key emissions driver in 2011 was the milder winter weather which resulted in reduced demand for heat in buildings:

- The emissions reduction after allowing for the weather effect was 4% between 2010 and 2011.
- Emissions reduction due to substitution of nuclear for fossil fuel power generation accounts for only a small part (around 0.4 percentage points) of this 4% reduction.
- Implementation of measures for which we have evidence accounts for emissions reduction of around 0.8 percentage points.
- It is likely that most of the remaining reduction can be attributed to the combination of reduced household real income and increased energy and fuel prices, partially offset by the impact of increased GDP.

Going forward, the key external drivers are likely to be weather, income, and energy and fuel prices:

- On average, winter temperatures can be expected to be slightly lower than in 2011 (e.g. by the 2020s mean winter temperatures across the UK are predicted to be around 5°C¹, compared to 5.4°C in 2011).
- From 2011 to 2020 the OBR projects GDP to grow by 20-25% in real terms, with household incomes also growing but at a slightly slower rate.

¹ UK Climate Projections <http://ukclimateprojections.defra.gov.uk/>

- Fossil fuel prices are highly uncertain, but wholesale gas and electricity prices in DECC's central projection increase to 2020 by 11% and 16% respectively. Retail gas and electricity prices in the residential sector are predicted to increase by 19% and 36% respectively and average petrol prices by 5%.

Combined with falling household income and rising fuel prices, implementation of measures was sufficient to reduce emissions in 2011. However, with stronger income growth in future and limited changes projected in fuel prices, implementation of measures will need to accelerate to deliver the 3% annual emissions reductions required to meet future budgets.

2. Non-traded sector emissions

Non-traded sector emissions primarily comprise direct emissions (i.e. emissions from burning fossil fuels, not from electricity use) from buildings and non-energy-intensive industry, and emissions from surface transport; they comprise around 60% of total UK greenhouse gas emissions.

Non-traded sector emissions in 2011 fell by 7% to 326 MtCO₂e, mainly due to mild winter temperatures which reduced demand for heat in buildings

- The non-traded sector emissions reduction between 2010 and 2011 after allowing for the impact of milder winter weather was 2%.
- Implementation of measures to reduce emissions accounts for around 1% of this 2% reduction.
- The remainder of the reduction is likely to be explained by falling real household income, and rising energy prices, resulting in further reduced heat demand. This may have been partially offset by impacts due to increased GDP, and within this, to increased industrial output and increased surface transport demand.

Our indicators of underlying progress reducing emissions set out trajectories for key emissions drivers for each of the major emitting sectors. The indicators incorporate an assumption of some but limited progress implementing measures during the first carbon budget period, reflecting the fact that there is a lead time for development of new and ambitious policies. Going beyond the first budget period, the indicators build in an acceleration in the rate of progress required to meet carbon budgets, and as should be possible given implementation of new policies (Table 1).

Table 1: Required ramp-up in delivery in the non-traded sector

	Annual uptake/improvement		
	Required Budget 1 average	Required Budget 2 average	Required Budget 3 average
Residential buildings			
Loft insulation (million homes)	0.9	2.1	n/a
Cavity wall insulation (million homes)	0.8	1.4	n/a
Solid wall insulation (homes)	90,000	150,000	220,000
Efficient boilers (millions)	1.0	0.9	0.7
Renewable heat			
Renewable heat penetration (% of heat demand) total	0.1%	0.8%	2.4%
Road transport			
New car emissions intensity (gCO ₂ /km)	-3.8	-6.0	-5.8
Biofuels penetration (% by vol)	0.7%	0.7%	0.4%
Car drivers undertaking eco-driving training	300,000	320,000	340,000
Electric car sales (PHEV/BEV)	5,000	130,000	450,000

Source: OFGEM (2012) CERT Update Quarter 15, DCLG (2012) Housing statistics – Table 241, Heating and Hotwater Council (2012), DECC (2012) Estimates of home insulation levels in Great Britain, DECC (2011) DUKES Table 7.7, SMMT (2012) New Car CO₂ Report, SMMT (2012), HMRC (February 2012) Hydrocarbon Oils Duties Bulletin, Energy Saving Trust (2012), CCC calculations.

Progress against indicators in 2011 was broadly on track, albeit against the limited ambition in our indicator framework for the first budget period, but with slippage in some key areas (Table 2).

- Surface transport.** The carbon intensity of new cars was ahead of our indicator trajectory for a third year running, while there was some progress in laying the foundations for electric vehicle market development, but limited progress on measures to encourage consumer behaviour change.
- Buildings.** There was continued progress on boiler replacement with mixed progress on insulation measures. Loft and cavity wall insulation were broadly on track against our indicator trajectory, but levels of solid wall insulation remained very low.
- Renewable heat.** In 2010, overall renewable heat penetration was ahead of trajectory based on deployment in the non-residential sectors. Although 2011 data on renewable heat penetration are not yet available, other data (i.e. from the RHI and RHPP) suggest continued progress in the non-residential sectors but very limited progress in the residential sector.

Table 2: Progress against measures in the non-traded sector					
	Annual progress†			Cumulative progress‡	
	2010 outturn	2011 outturn	2011* indicator	2011* outturn	2011* indicator
Residential buildings					
Loft insulation (millions)	0.5 (CERT professional) + 0.8 (DIY & other)	0.8 (CERT professional) + 0.3 (DIY & other)	0.6	2.4 (CERT professional) + 1.5 (DIY & other)	2.2
Cavity wall insulation (millions)	0.4	0.5	0.6	2.1	2.4
Solid wall insulation	13,000	19,000	120,000	60,000	330,000
Efficient boilers (millions)	1.3	1.3	1.0	4.9	4.0
Renewable heat					
Renewable heat penetration (% of total heat demand)	+0.2%	n/a	0.0%	1.8%	1.2%
Road transport					
New car gCO ₂ /km	-5.3	-6.1	-4.7	138.1	151.0
Biofuels penetration (% by volume)	+0.7%	-0.1%	+0.6%	3.5%	4.0%
Car drivers trained in eco- training	9,700	8,000	300,000	23,000	885,000
Electric car sales (PHEV/BEV)	170	1,100	8,100	1,300	13,000

Source: OFGEM (2012) *CERT Update Quarter 15*, DCLG (2012) *Housing statistics – Table 241*, Heating and Hotwater Council (2012), DECC (2012) *Estimates of home insulation levels in Great Britain*, DECC (2011) *DUKES Table 7.7*, SMMT (2012) *New Car CO₂ Report*, SMMT (2012), HMRC (February 2012) *Hydrocarbon Oils Duties Bulletin*, Energy Saving Trust (2012), CCC calculations.

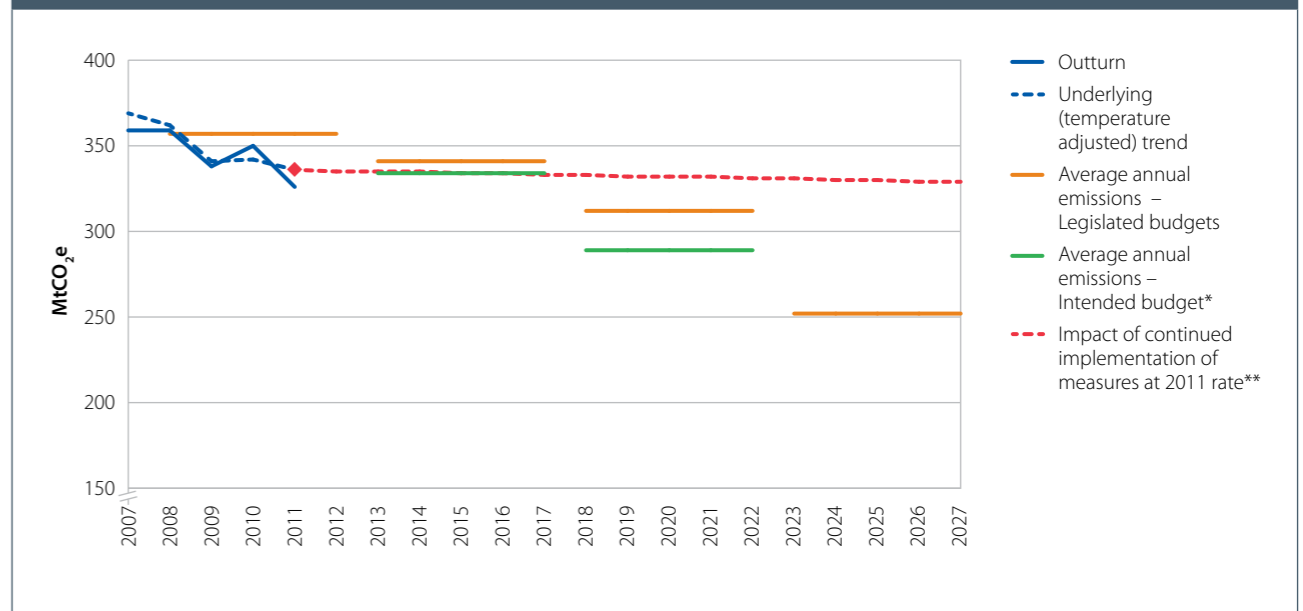
Notes: *2010 for renewable heat. †Annual progress represents additional uptake/improvement in 2011 (2010 for renewable heat) relative to the previous year. ‡Cumulative progress represents: for residential building measures, total additional installations between 2007 and 2011; for road transport measures, level achieved in 2011; for renewable heat penetration, level achieved in 2010.

Continuation of the rate of progress on measures achieved in 2011 would be sufficient to meet the first and second carbon budgets, but not the third and fourth budgets (Figure 6):

- Even after allowing for the effect of the milder winter weather in 2011, emissions were below the level of the first carbon budget. This is a result of the significant emissions reduction in 2009 due to the recession.
- The permanent loss of income associated with the recession together with continued progress implementing measures as in 2011 would also be sufficient to meet the second carbon budget.
- However, an acceleration in the rate of progress implementing measures – as set out in our indicator framework – will be required if deeper emissions cuts required to meet the third and fourth carbon budgets are to be achieved.

Therefore the conclusion we have reached in previous reports – that there is a need for a step change in the pace at which measures are implemented – continues to apply. When we first highlighted this need, we recognised there would be a lead time of several years. However, the

Figure 6: Non-traded sector emissions based on continued implementation of measures in 2011 (2007-2027)



Source: NAEI (2012); DECC (2012) *2010 UK Greenhouse gas emissions, provisional figures*; CCC calculations.
Notes: *As proposed in our 2008 report, the Intended budget (2008-2022) corresponds to the UK share of an EU 30% 2020 target. We recommended it should be enacted in the context of a global deal to reduce emissions. **Based on the Baseline scenario from DECC (2011) UEP, net of estimated savings ensuing from continued uptake of measures at the rates seen in 2011, until 2022 or until full potential is realised (e.g. all lofts have been insulated), whichever is sooner. Trajectory has been smoothed.

lead time has now elapsed. The step change in pace of implementation is therefore needed urgently if we are to remain on track to meeting future carbon budgets. Achieving the step change will depend on the effectiveness of policies, which we consider in our sectoral analysis below.

3. Traded sector emissions

UK traded sector emissions

The traded sector includes territorial emissions covered by the EU Emissions Trading Scheme (EU ETS)², namely emissions from power generation, energy-intensive industries (e.g. refineries, iron and steel and cement production) and from 2012, emissions from domestic aviation and some non-CO₂ emissions. It accounted for around 40% of total greenhouse gas emissions in the UK in 2011, of which around two-thirds were emissions from the power sector and around one-third from energy-intensive industries.

Under the accounting rules of the Climate Change Act, the traded sector carbon budget is measured according to net emissions (i.e. emissions adjusted for trade in allowances) and should therefore automatically be met. This is because any emissions above the budget will be offset through the purchase of European Union Allowances (EUAs) or offset credits in the EU ETS.

However, it is important that gross emissions (i.e. before adjusting for trade in allowances) in the traded sector are reduced in order that longer-term emissions pathways required under the Climate Change Act remain feasible. For example, we have highlighted the importance of early power sector decarbonisation in the context of meeting the 2050 target to reduce emissions by 80% on 1990 levels.

² It currently excludes emissions from international aviation

Gross emissions in the traded sector fell by 7% in 2011 to 221 MtCO₂e, driven by reductions in both power and industry.

- Power sector emissions reduced 7%, accounting for 4% out of the overall 7% reduction.
- Energy-intensive industry emissions reduced 8%, accounting for the remaining 3% of the overall 7% reduction.

As a result, given the impact of the recession in 2009, traded sector emissions were below the level of the EU ETS cap in 2011, suggesting either that the UK is a net exporter of EUAs or that UK firms are holding EUAs with a view to meeting EU ETS obligations in future periods.

We consider underlying emissions trends in power and industry, and whether these are compatible with meeting carbon budgets, in sections 4 and 6 below.

EU traded sector emissions and wider international action

Traded sector emissions at the EU level have important implications for the UK via the carbon price in the EU ETS.

Traded sector emissions in the EU fell by 2% in 2011, partly offsetting a 3% rise in 2010 (Figure 7).

The consequence of this reduction was that emissions remained below the level of the EU ETS cap in 2011. Given this headroom, and limited effort required to meet the cap in future, the EU ETS price fell to €7/tCO₂ in December 2011, from €14/tCO₂ in 2010. There have been further reductions in the early months of 2012, reaching lows of around €6/tCO₂.

The low carbon price is very problematic, both for the UK and EU, because it will dampen incentives for cost-effective emissions reduction, and because it signals a low level of emissions reduction ambition at the EU level.

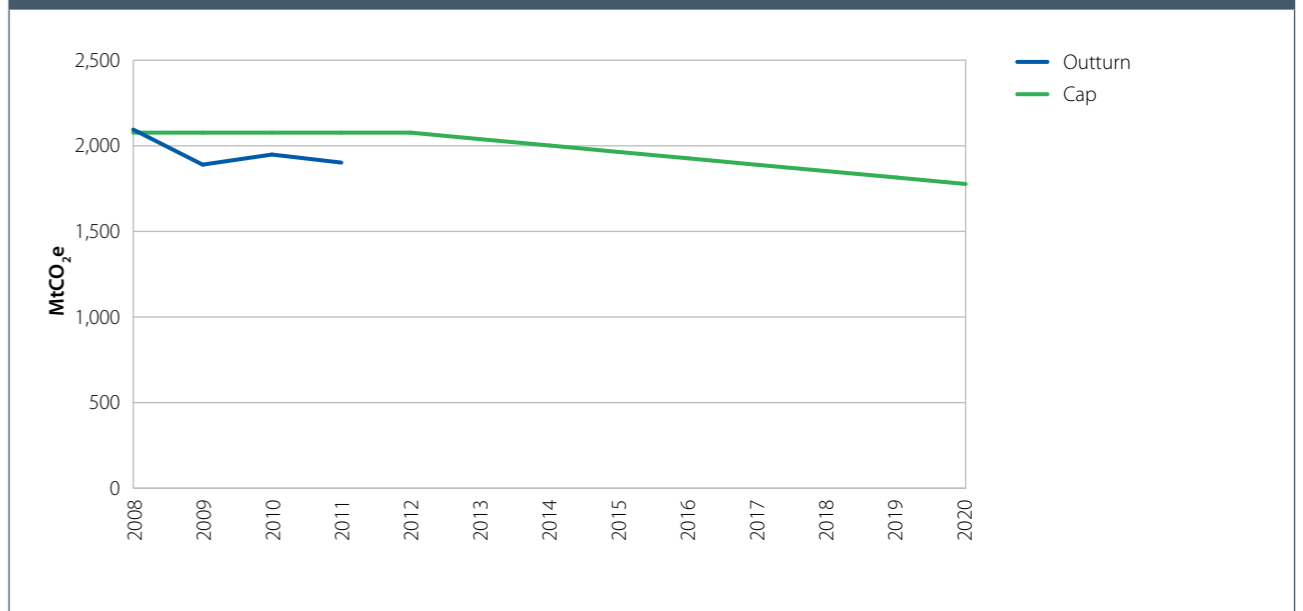
Options for addressing the low carbon price at EU level include:

- Tightening of the existing EU ETS cap to 2020 (e.g. through holding back and retiring EUAs).
- Underpinning the EU ETS carbon price (e.g. through setting a reserve price in auctions of EUAs).
- Agreeing ambitious EU emissions reduction targets for 2030.

The UK should strongly support measures which would increase EU ambition to 2020 and drive up the EU ETS price, strengthening incentives in the UK and putting the EU on a more cost-effective path to achieving its 2050 target.

Increasing EU ambition would also be constructive in the context of international climate negotiations, where progress has been made but significant risks remain:

Figure 7: Emissions within the EU ETS versus cap (2008-2020)



Source: European Commission (April 2012) *Verified emissions data for 2011*; European Commission (22 October 2010) *Commission Decision 2010/364/EU*.
Notes: Excludes international aviation.

- The latest United Nations Conference of the Parties was held in Durban in December 2011. Parties are committed to limiting global warming to 2°C, but noted the significant gap between this objective and the current emissions pledges for 2020. The Durban Platform paves the way for agreement on a new, globally comprehensive deal to be implemented by 2020, although the level of ambition it will set on emissions reduction has yet to be agreed.
- A number of countries and jurisdictions have begun to act through committing to ambitious emission reductions, enacting new legislation and introducing cap-and-trade schemes. These include China, Australia, South Korea and Mexico, as well as the state of California and the province of Quebec.
- The International Energy Agency (IEA) has highlighted the risks in further delaying rapid global action. It concludes that 80% of total CO₂ emissions allowed to 2035 are already “locked in” by existing infrastructure. Without further action before 2017 this will reach 100%, meaning that all subsequent stock would have to be zero-carbon (or high-carbon infrastructure would need to be scrapped prematurely) to be consistent with a 2°C trajectory.

It is also important that the EU starts discussion of a 2030 package including overall ambition, a split of emissions reduction effort between traded and non-traded sectors, and potential sectoral targets (e.g. for new car emissions in 2030). Providing this long-term visibility for investors would address uncertainties relating to the period beyond 2020 which currently undermine the low-carbon investment climate across the EU, and could help strengthen the carbon price alongside other measures.

The UK should pro-actively engage in discussion on the 2030 package in order to put the EU on a cost-effective pathway to meeting its 2050 target and buttress commitments that have already been made here through legislation of the fourth carbon budget.

4. Progress reducing power sector emissions

Power sector emissions reductions

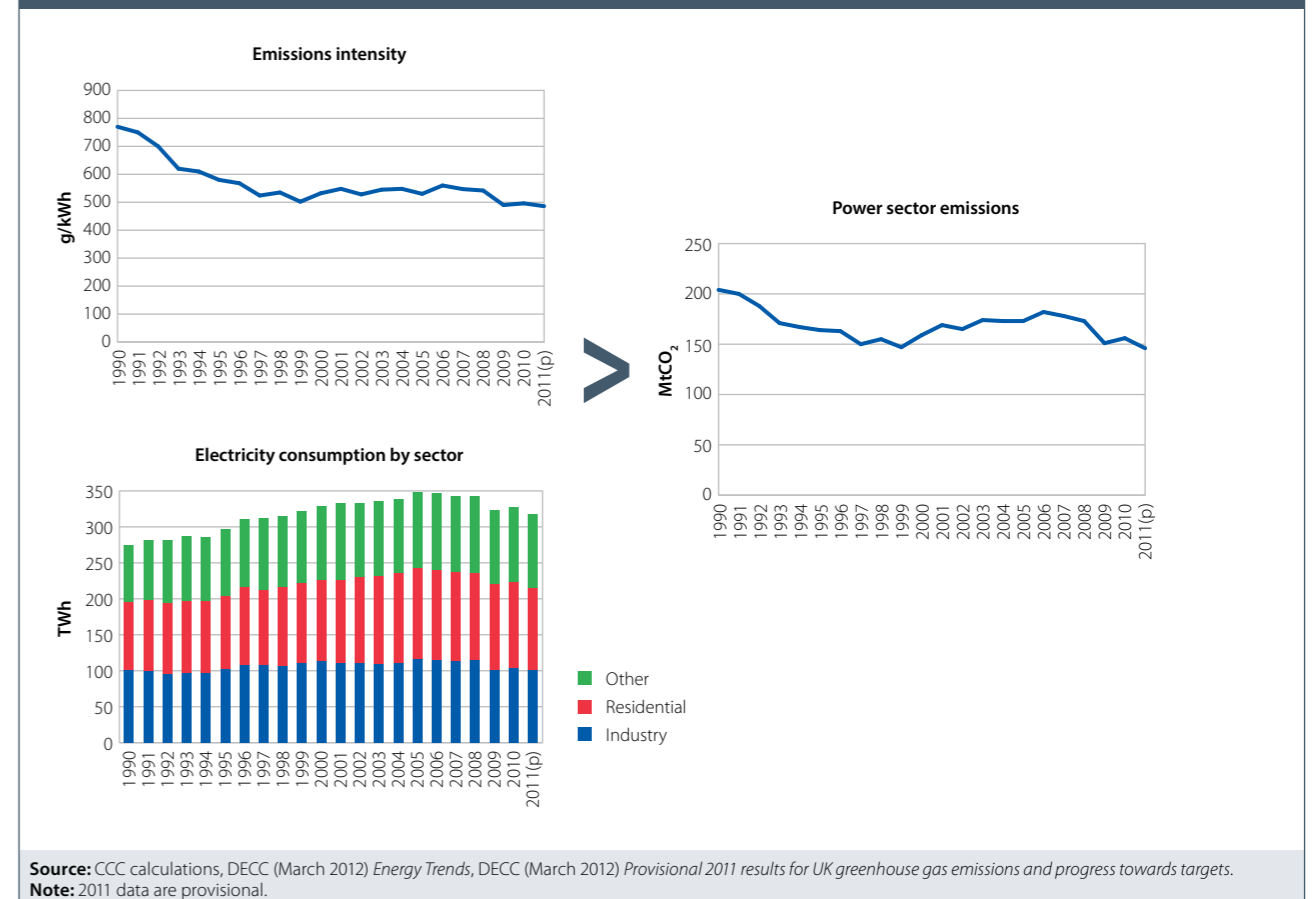
Power sector emissions account for around 27% of UK greenhouse gas emissions. Provisional data for 2011 suggests power emissions fell by 7% from 156 MtCO₂ in 2010 to 146 MtCO₂. The power sector emissions reduction in 2011 was due to reductions in demand and carbon intensity of generation (Figure 8).

- Demand fell by 4%, largely as a result of falling consumption in the residential (-5%) and industrial sectors (-4%), due to higher average temperatures during 2011. After adjusting for changes in temperature, residential demand fell by around 1%.
- Carbon intensity fell by 2%, from 496 gCO₂/kWh in 2010 to 486 gCO₂/kWh in 2011 due to an increased share of renewables and nuclear generation in the mix.
 - There was a 31% (8 TWh) increase in renewable generation, due to favourable weather conditions for wind and hydro as well as an increase in capacity (2.9 GW).
 - Nuclear generation also increased by 11% (6 TWh), reflecting plants returning to operation after maintenance outages in 2010.
 - Gas generation fell 30% (29 TWh) and coal generation stayed broadly flat, reflecting favourable conditions for coal versus gas over the year.
 - Had there been more fuel switching (i.e. a reduction in coal, rather than gas generation, which a higher carbon price would have helped incentivise) carbon intensity could have fallen by 14%.
- Emissions fell by 7% (10 MtCO₂) in 2011. Following an increase in 2010 due to unusually cold weather and temporary nuclear outages, they are now roughly back at their level of 2009 (when temperatures and nuclear generation were at similar levels).

Achievable emissions intensity is the carbon intensity of electricity that would be achievable if power plants were despatched to the grid in order of least emissions rather than least cost, and if they were available to generate as often as in an average year. In 2011, achievable emissions intensity improved by 35g, from 308 gCO₂/kWh in 2010 to 273 gCO₂/kWh. This shows that there is scope to reduce current emissions intensity by over 200g (40%) through fuel switching away from highly carbon-intensive fuel (i.e. coal and oil) to gas.

To assess underlying progress reducing emissions, as opposed to changes driven by fluctuations in demand and nuclear load factors, our indicators focus on investments in low-carbon technologies.

Figure 8: Emissions intensity of electricity supply, electricity demand and CO₂ emissions from the power sector (1990-2011)



Progress against power sector indicators: wind generation

Investment in onshore and offshore wind continued in 2011, but at one-third of the rate required by 2020. Although there is a healthy project pipeline, there are barriers which are preventing consented projects entering construction, and stopping projects moving through planning in a timely manner.

- Investment in offshore wind was in line with our indicators (0.5 GW), but will need to ramp up quickly (e.g. to 1.1 GW per year in 2016, 1.8 GW per year in 2020). Investment in onshore wind increased slightly (to 0.6 GW) but fell short of our indicator trajectory for a second year in a row, and well below the levels required by 2020 (1.5 GW).
- There is already sufficient capacity in the project pipeline to meet our 2020 indicator onshore and our 2017 indicator offshore. However, planning approval rates for onshore capacity have fallen to around 50%, and determination periods remain long. There is also evidence that onshore projects with approval are moving slowly through to construction. This is likely to reflect current uncertainties over support mechanisms and difficulties with radar interference and grid connection; the supply chain appears healthy. We would expect a similar bottleneck for offshore wind unless uncertainties and barriers are addressed.

In order to address these barriers, the Government and regulators should:

- Confirm support for projects under the Renewables Obligation, which has been delayed due to an ongoing debate about support for onshore wind. Any decision to reduce support from the initially proposed level of 0.9 ROCs (Renewable Obligation Certificates) should be made based on a full assessment of investment prospects (e.g. across the distribution of projects in the pipeline). To the extent that lower support would reduce the number of viable projects, an assessment of alternative means for meeting the 2020 renewable energy target should be undertaken.
- Ensure that the planning process appropriately accounts for the benefits of onshore wind, in order to avoid higher levels of investment in more expensive technologies that would have adverse affordability impacts. For example, onshore wind could be as little as half the cost of offshore wind.
- Ensure clarity over the details of support under the Electricity Market Reform (EMR), including a provision for renewable projects to be considered for early eligibility for Contracts for Difference (e.g. in 2013); and design support under EMR for intermittent projects to be as close as possible to feed-in tariffs.
- Explore options to address barriers to finance, such as intervention from the Green Investment Bank (GIB).
- Continue to work with industry, the Ministry of Defence and others to address radar interference strategically and collaboratively.
- Bring forward the grid connection dates for projects and confirm final arrangements for transmission pricing.

Given appropriate actions, it is realistic that ambitious renewable energy targets for 2020 can be achieved, and that wind generation can make a valuable contribution to power sector decarbonisation required to meet carbon budgets.

Progress against power sector indicators: nuclear

There was continued progress on forward indicators for nuclear new build, with Parliamentary approval of the Nuclear National Policy Statement and submission of the planning application for the first new plant (Hinkley C).

However, significant risks remain, and the project pipeline is weak. For example, the Horizon venture to build new plants in Wylfa and Oldbury recently stalled and is now up for sale, with a buyer yet to come forward. This 5 GW investment is important in the context of delivering required power sector decarbonisation.

The key determinant of whether projects will proceed – Hinkley C, Wylfa, Oldbury and others – will be the EMR, which if designed correctly should help make investments financially viable (see below).

There is scope for life extensions of existing nuclear plants to help manage the transition (e.g. extensions of 5-7 years on existing lifetimes of seven of the eight existing nuclear plants have been proposed).

Progress against power sector indicators: carbon capture and storage (CCS)

Although there was a setback on CCS when the first demonstration project was abandoned in October 2011, there has been progress subsequently, with the announcement of a new competition supported with the £1 billion of capital funding originally earmarked for the first demonstration. This would be sufficient to support the four demonstration projects committed to in the Coalition agreement, provided it is supplemented with additional funding through the Electricity Market Reform and possible funding from the EU.

The new process has addressed some of the weaknesses in the first demonstration competition. It is open to a wider range of fuels and CCS technologies, while the sharing of CO₂ transport and storage infrastructure is encouraged. Projects will be selected by the end of 2012, to commence operation in the period 2016-2020.

Given the urgent need to prove the viability of CCS, it will now be crucial to maintain the focus on delivery and the momentum that currently exists, and to deliver these projects towards the beginning of the 2016-2020 period.

Although commencing operation around 2017 would represent some slippage relative to our original indicator – which envisaged four demonstration projects starting to operate between 2014 and 2016 – this would still be consistent with having a second phase of investment from the early 2020s, and a significant contribution to power sector decarbonisation over the next two decades and beyond.

It will be important that there are four demonstration projects in order to provide critical mass, both for testing alternative applications in the UK, and for the UK to collaborate with international initiatives. Ideally at least one project would be based on gas, given the potential importance of gas CCS for decarbonising mid-merit generation, and benefits that it would offer in a low gas price world.

In order to deliver these and future milestones for CCS, progress is needed on Electricity Market Reform (EMR) and a strategy for commercialisation and infrastructure:

- **EMR.** Early delivery will require that the reforms, or transitional funding arrangements, are in place to enable contracts for CCS projects to be signed in 2013.
- **Commercialisation.** Going beyond the initial projects, and depending on what is learned from them, it will be important that ambition is sustained and that further projects follow. In order to provide confidence for supply chain investment, greater clarity should be provided on the scale of such investments, and the circumstances under which they would proceed.
- **Infrastructure.** A strategic approach to CO₂ infrastructure, including development of scenarios for the scale and location of CCS deployment to 2030, would help to identify 'least regret' sizing of pipeline infrastructure and would also provide greater credibility to carbon capture readiness assessments.

It is crucial, with progress in these areas together with successful demonstration, that we exploit the potential for CCS to play a major role in power sector decarbonisation in the 2020s.

Progress against policy milestones: the Electricity Market Reform

There has been progress in reforming electricity market arrangements in the last year, with enabling legislation submitted for pre-legislative scrutiny as part of the Draft Energy Bill. Most notably, the Government accepted the Committee's recommendations and announced that the model for the Electricity Market Reform (EMR) will be based on long-term contracts ("Contracts for Difference") to provide revenue security for investors. This should bring forward required investments at least cost to the consumer.

In this report we present new analysis which reinforces our conclusions that early power sector decarbonisation (i.e. to the order of 50 gCO₂/kWh by 2030) is an appropriate objective across a wide range of scenarios for gas and carbon prices:

- Investing in low-carbon technologies over the next two decades offers significant cost savings under central case assumptions about gas and carbon prices compared to the alternative of investing in unabated gas-fired generation.
- Even under extreme assumptions about low gas prices, cost penalties from investment focused on low-carbon technologies are limited, if any.
- Significant departure from the early decarbonisation path would not only raise costs, but require higher build rates for low-carbon capacity in the 2030s and 2040s which may challenge the limits of feasibility.

However, there remains a perceived risk that there will be a second 'dash for gas'. This perception was heightened with the announcement in March 2012 of an Emissions Performance Standard (EPS) that would allow continued operation of unabated gas-fired plant through to 2045. A second dash for gas would be a very bad thing, given the clear advantage of a low-carbon path (i.e. it would increase costs and risks of meeting carbon budgets).

This uncertainty undermines the investment climate and should be resolved. This could be achieved through the Government making a clear statement that the objective of EMR is to decarbonise the power sector to 2030 through delivering a portfolio of low-carbon technologies provided these can be built to schedule and cost.

Specifically, an appropriate objective for the EMR would be to reduce the carbon intensity of the UK power generation sector to a level of the order of 50 gCO₂/kWh by 2030, to be achieved through investment in a portfolio of low-carbon technologies. Some flexibility should be retained over the precise path, to be determined as current uncertainties are resolved over costs, carbon prices, achievable build rates, and the level and shape of demand. Delivering on the objective will require that low-carbon investments are pursued where these are cost-competitive with unabated plant over their lifetimes, and that technology support will be provided for less mature technologies.

We therefore recommend that, in the context of new energy legislation, a carbon objective should be set and a process put in place to ensure that this objective is achieved (i.e. a set of checks and balances so that the delivery plan proposed by the System Operator and approved by the Government is consistent with the objective). There should also be a clear statement as part of the Government's planned Gas Generation Strategy that there will not be a second

'dash for gas', but rather sufficient low-carbon plant will be contracted to ensure that gas largely plays a back-up role by 2030.

In addition, it is important that technology policy objectives are set to resolve current uncertainties about the future for less mature technologies. For example, the current lack of visibility around the offshore wind market beyond 2020 is a barrier to required supply chain investment. This could be addressed through setting minimum levels of offshore wind (and other less mature technologies) to be supported through the EMR subject to cost conditionalities being met (e.g. the Government's commitment that 18 GW of offshore wind would be supported by 2020 subject to costs being reduced to £100/MWh could be extended out to 2025, by which time there is more chance that this level of cost reduction can actually be achieved).

Finally there are also a number of detailed design questions which should be resolved by the end of this year in order that the EMR can be implemented from 2013, and to ensure that contracts are bankable and projects can attract financial support (see Box 2).

Box 2: Electricity Market Reform

There are currently a number of risks related to contract design which the Government needs to address:

- **Financial security.** Investors have raised concerns about the financial security of Contracts for Differences. For example, in the absence of Government guarantees, there are questions about how investors would be protected against future changes in legislation. In addition, if contracts are to be multi-party – between a generator and all suppliers in the market – this could make resolution of disputes problematic.
- **Price risk.** There is a risk of divergence of prices paid to generators in the market and reference prices in Contracts for Difference. This risk could be mitigated by choosing the reference price for intermittent generation so as to make Contracts for Differences equivalent to feed-in tariffs.
- **Cost risk.** Investors have limited control over various cost components. For example, at least some of construction cost is exogenous to investors (e.g. the wage rate), as are fossil fuel prices (i.e. these are relevant for CCS projects). There are economic arguments that such costs should be shared between investors and consumers, through indexing of prices in Contracts for Differences, which would result in reduced cost of capital and overall benefit to consumers.
- **Demand risk.** There is uncertainty over the future load factor of low-carbon plant, given uncertainty over how much baseload demand will grow. Given this uncertainty, Contracts for Differences which remunerate generators only through operating payments could result in unnecessarily high prices. The alternative, to provide both fixed and operating payments would result in lower overall prices paid.
- **Storage risk.** This is an issue in the context of CCS investment, where generators will not operate storage facilities, and will have limited ability to manage storage risk. Offering a payment to generators which relies on successful storage would raise risks for generators, at best increasing costs and possibly stopping investment.

These risks need to be addressed to ensure that EMR can fulfil its key objective of bringing forward low-carbon investment at least cost.

Given clear objectives and detailed effective implementing arrangements, it is plausible that significant investments will be forthcoming across the range of low-carbon technologies.

This is something that should be closely monitored, with the possibility that further incentives may be needed if there were to be limited investment in low-carbon capacity (e.g. limiting the running hours of new unabated gas-fired plant deployed in the 2020s should not be ruled out at this stage).

5. Progress reducing emissions from buildings

Buildings emissions trends

Emissions from buildings account for 35% of total UK greenhouse gas emissions. In 2011, buildings emissions fell by 13% to 186 MtCO₂, mainly as a result of the milder winter weather in 2011 compared to the cold 2010 winter months. Weather adjusted, emissions fell by 3.5%.

- **Residential buildings.** Total residential CO₂ emissions fell by 16% in 2011 to 122 MtCO₂ due a combination of energy efficiency measures, higher electricity and gas prices and relatively mild winter months in 2011.
 - Direct emissions account for 55% of total residential emissions and fell by 22% in 2011. This reduction can be explained largely by the mild weather in 2011, with rising gas prices (up 7% in real terms) and the implementation of energy efficiency measures also playing a role.
 - Indirect emissions account for 45% of residential emissions and fell by 8% in 2011. The key factors were a slightly lower carbon intensity of power generation (see Chapter 2), the milder weather affecting heating-related electricity use (20% of residential electricity use) and rising electricity prices (6% increase in 2011).
- **Commercial buildings.** In 2011, commercial sector emissions fell by 5% to 47 MtCO₂, despite a small rise (1.6%) in output.
 - Direct emissions fell by 8% in 2011, primarily due to milder winter weather and the rising gas price.
 - Indirect emissions fell by 4% in 2011, due to a combination of the milder weather, higher electricity prices and a fall in the carbon intensity of power generation.
- **Public buildings.** Public sector emissions in 2011 fell 4% to 17 MtCO₂.
 - Direct emissions, accounting for around half of public sector emissions, fell 6% in 2011, primarily because of the reduced use of heating fuels due to the milder winter weather.
 - Indirect emissions decreased by 3% in 2011, largely due to the improvement in carbon intensity of power generation.

Buildings emissions in 2011 were 18 MtCO₂ below our indicator trajectory, mainly reflecting the impact of the recession (around 10 MtCO₂), together with relatively mild weather in 2011 and increases in energy prices.

This raises a question about the extent of the future emissions reduction effort required to meet carbon budgets (e.g. the first and second carbon budgets could be achieved with limited effort given the impact of the recession). The crucial point is that the implementation of all the measures that we have previously identified is still required to meet the third and fourth carbon budget, notwithstanding the impacts of the recession.

Progress against residential buildings indicators

Progress implementing energy efficiency measures in the residential sector has been mixed:

- **Loft insulation.** Professional installations increased by 62% to 0.8 million and are in line with our overall indicator. DIY installation figures decreased by 57% to 0.3 million, although there is a concern over the reliability of DIY data.
- **Cavity wall insulation.** Installations increased by 22% to 0.5 million but are still below our indicator trajectory.
- **Solid wall insulation.** While the rate of installations increased by 25%, numbers are still very low, with only 20,000 delivered in 2011.
- **Boiler replacement.** 1.3 million efficient boilers were installed in 2011. Although this is a reduction of 4% relative to 2010, this is not necessarily of concern, particularly given that uptake in 2010 is likely to have increased due to boiler scrappage schemes operating in that year.
- **More efficient appliances.** There are no data to assess the sale of energy-efficient appliances for 2011, due to a lack of monitoring by government. However, new energy efficiency minimum standards under the EU Ecodesign for Energy Related Products Directive will gradually eliminate the most inefficient appliances.

It is important to note that our indicators include a rapid increase in the pace of loft, cavity wall and solid wall insulation from 2012. The key driver for achieving this step change will be the Green Deal and the Energy Company Obligation (ECO).

Progress against residential policy milestones: the Green Deal and ECO

In October 2011, the Government passed the Energy Act which sets out the new framework for energy efficiency policy:

- **Green Deal.** Provisions in the Act enable a new financing framework to facilitate energy efficiency improvements and low-carbon heating measures in homes and non-residential properties. This is funded through a charge on energy bills that avoids the need for consumers to pay upfront costs, with the charge attached to the house rather than the owner, and paid back through the energy bill savings. The Green Deal for homes will launch in autumn 2012.
- **ECO.** This obligation on energy suppliers will replace CERT and CESP, as well as (in England) the fuel poverty programme (Warmfront). The ECO will have three separate targets to support energy efficiency measures in fuel-poor households, fund carbon-saving measures in low-income areas and subsidise solid wall insulation and hard-to-treat cavity wall insulation. The ECO will operate from October 2012 to March 2015.
- **Energy efficiency standards.** The Act includes a provision for minimum energy efficiency standards in the private rented sector from 2018.

In a December 2011 letter to the DECC Secretary of State, we expressed concern that with an ECO primarily focused on solid wall insulation (as initially proposed) and uncertainty about uptake under the Green Deal, insufficient numbers of lofts and cavity walls would be insulated. We recommended that the ECO should be made more flexible, and that this should include loft and cavity wall insulation, at least for a transitional period.

The Government announced its final design for the Green Deal and ECO in June 2012, with some significant changes that should result in more cavity walls and lofts being insulated, relative to the very low numbers in the initial proposal.

However, incentives for easy-to-treat cavity wall and loft insulation remain weak, and the estimated installation numbers are substantially below our insulation indicator trajectories, thus resulting in a potential carbon gap of at least 3 MtCO₂.

Options to strengthen incentives, which should be considered prior to the launch of the Green Deal in autumn 2012 include:

- Spend some of the £200 million funding made available by the Treasury for the initial phase of the Green Deal to support loft and cavity wall insulation.
- Roll any underperformance against CERT and CESP targets into the ECO.
- Link loft and cavity wall insulation to boiler replacements and extensions via the building regulations as currently being considered by the Government.
- Introduce fiscal incentives to encourage energy efficiency improvement (e.g. stamp duty or council tax differentiation according to energy performance).

The Green Deal and ECO will require close monitoring to determine whether they deliver sufficient carbon savings, with flexibility retained to further modify design and introduce additional measures as appropriate.

Progress in the non-residential sector: the CRC Energy Efficiency Scheme

The main policy covering the non-residential sector is the CRC Energy Efficiency Scheme (previously Carbon Reduction Commitment). In 2010, we published our recommendations for the capped phase of the scheme. Subsequently, the government decided to postpone the start of the scheme and dropped both the trading aspects and revenue recycling. Participants will have to purchase their first allowances covering their emissions for 2011-12 in June/July 2012.

In addition, in April 2012 the Government published a consultation on proposals to simplify the scheme and has said that if no significant reduction in administration costs can be achieved, it would abolish the CRC and replace it with a straight tax.

In considering the future of the CRC, it is important to recognise that the scheme offers a potentially powerful combination of financial and reputational incentives for energy efficiency improvement. This is in a sector where incentives have traditionally been weak, and where there is a significant opportunity to improve energy efficiency (e.g. our analysis suggests

scope for a 30% reduction in energy consumption by 2020). Dropping revenue recycling has weakened but not totally eroded the financial incentives that the scheme provides.

The Government's simplification proposals would not undermine these incentives, and therefore should be welcomed to the extent that they result in a reduced administrative burden.

However, abolition of the scheme now would risk weakening incentives for energy efficiency improvement. This would be premature, particularly given evidence that the CRC has resulted in a greater focus on measuring energy consumption. The CRC should therefore be retained, at least for the time being.

In retaining the scheme, it is important that design changes are implemented to ensure that the scheme does actually provide reputational incentives, and that complementary levers are in place:

- **Reputational incentives.** These work through the league table, the first version of which was published in November 2011. Changes to the league table are required, so that it provides better reputational incentives. In particular, the table should be disaggregated such that comparable organisations are benchmarked against each other.
- **Complementary levers.** These include a provision in the Energy Act for minimum energy efficiency standards in commercial rented properties, as well as the non-residential Green Deal. Ambitious standards under the Act should be announced as soon as is practical (i.e. no later than the end of 2013), as well as an early start date for the non-residential Green Deal (i.e. no later than January 2013). This would strengthen incentives for energy efficiency improvement and help inform investment decisions with long-lived consequences to be taken by landlords.

There may also be opportunities over time to rationalise multiple policies that currently cover or impact on the non-residential sector (e.g. Climate Change Levy, Climate Change Agreements, EU ETS), and to provide financial and reputational incentives through a combination of the Climate Change Levy together with the new rules on mandatory carbon reporting that were announced in June 2012.

Progress in the public sector

As we noted in previous reports, it is imperative for its credibility that Government set an example and address its own emissions. In 2010-11, central government outperformed its target for a 10% reduction in CO₂ emissions and reduced emissions by 13.8% in 3,000 buildings on the central government estate. Some government departments achieved much larger reductions, for example the Department for Education achieved a 21.5% reduction, closely followed by 21.3% by DECC. In 2011, central government set itself a new target to reduce greenhouse gas emissions from the whole estate and business-related transport by 2015 by 25% from a 2009/10 baseline.

Progress on low-carbon heat

There is a crucial longer-term role for heat pumps in decarbonising the buildings sector to meet the 2050 target. In order to prepare for this, our indicators include renewable heat penetration of 12% in the buildings sector by 2020.

In 2011, the Renewable Heat Incentive (RHI) was introduced to promote the take-up of renewable heat technologies, although initially it has been restricted to the non-residential sector. To March 2012, around 5 MW of capacity had been accredited under the RHI, with the vast majority of this accounted for by biomass boilers.

In the residential sector, grants have been made available under the Renewable Heat Premium Payment (RHPP) but take-up has been low, with the first phase (August 2011 to March 2012) only allocating 60% of the available grants (worth £15 million).

There remains a major challenge to support investment in renewable heat in the residential sector. For example, the just over 2,500 residential heat pump installations under the RHPP can be compared to the 2.6 million installations by 2025 assumed in our analysis for the fourth carbon budget. The very limited progress to date suggests a risk that significantly increased levels of investment will not be achieved:

- In order to manage this risk, the Government should extend the RHI to the residential sector as a matter of urgency (e.g. no later than summer 2013, as currently proposed). This would provide confidence to industry about ongoing funding, and would provide a basis for investment in supply chain development, training and marketing. Inclusion should be on a basis compatible with what is required to meet the fourth carbon budget.
- Green Deal finance should also be made available in conjunction with the RHI to cover at least the additional costs of renewable heat investment compared to conventional alternatives; this would otherwise be a barrier to uptake in capital-constrained households.
- In addition, it is likely that there will also be non-financial barriers to deployment (e.g. lack of consumer information, lack of trust in renewable heat technologies and installers). The Government should set out its approach to addressing these barriers, as it has done for building fabric measures in the context of the Green Deal.

With action in these three areas we would expect to see increased uptake of these crucial technologies.

6. Progress reducing emissions from industry

Emissions from industry fell by 5% in 2011, reflecting a 6% drop in CO₂ emissions (both direct and indirect fell by 6%) and a 2% drop in non-CO₂ emissions. The extent to which these reductions reflect underlying progress is uncertain due to data constraints. However, it is unlikely that these reductions reflect fuel switching or reductions in output, suggesting that energy efficiency improvements may have been implemented in 2011:

- **Fuel switching.** Given that energy demand fell broadly in line with emissions in 2011 (7% and 6% respectively), fuel switching is unlikely to be a significant driver of lower emissions in 2011. This is borne out in data on fossil fuel consumption by industry, where the shares of various fossil fuels remained broadly constant.
- **Output.** Although overall manufacturing output in industry increased by 2%, large differences across industry sectors make it difficult to relate output and emissions for 2011. However, an initial assessment of the impact of output on emissions suggests that the net impact is broadly flat.
- **Energy-efficiency.** High fuel prices and increased investment are consistent with progress in energy efficiency in 2011; however there is a lack of direct evidence to substantiate this.

Industry emissions in 2011 were 7% below our indicator, largely because of reduced output during the recession and changed relative fuel prices that have encouraged switching to less carbon-intensive fuels.

In future reports we will use more disaggregated industry data to better understand the extent of underlying progress.

Key opportunities for reducing industry emissions over the next two decades are the use of sustainable bioenergy and carbon capture and storage (CCS) technology:

- **Bioenergy.** Modelling for our fourth carbon budget report suggested that bioenergy could meet around 25% of industry heat demand by 2030 within sustainability limits. In the near-to-medium term, our indicators envisage 13% penetration in industry by 2020.
- **CCS.** This is promising for application in a range of energy-intensive industries (e.g. iron and steel), and could result in around a 20% emissions reduction from current levels in industry over the longer term. Although widespread deployment of CCS in industry will not start until the 2020s at the earliest, it is important that approaches to deployment are developed now, given the long lead-times for investment and supporting policy development.

However, there is a need for policy development in both these areas:

- **Bioenergy.** In our 2011 Renewable Energy Review we suggested that the support levels indicated in the RHI consultation document were broadly aligned with requirements. But, in response to concerns about State Aid, the tariff level for large biomass installations was significantly reduced, resulting in low projected uptake relative to what is required in the longer term.
- **CCS.** The new competition for CCS demonstration is open to applications from industrial installations when these form part of a cluster (i.e. the application must also contain at least one power sector installation). This may be a cost-effective option for the CCS competition, but it is uncertain how this will develop and stronger incentives may be required.

Given the need to significantly reduce industry emissions to meet carbon budgets, and therefore to make progress both on the use of bioenergy and CCS, the Government should elaborate its approaches in both these areas, and show that conditions are in place to provide confidence that longer-term objectives will be achieved. This should be part of the forthcoming industry strategy, to be published by the end of the year.

7. Progress reducing transport emissions

Surface transport emissions trends

Surface transport emissions account for 24% of UK CO₂ emissions. Following two years of decline, there was no change in surface transport CO₂ emissions in 2010³.

Data on distance travelled, biofuels and new vehicle emissions suggest that car emissions fell in 2010, while van and HGV emissions increased:

- Car travel fell by 2% in 2010, biofuel penetration increased from 2.1% to 3.2% and new car CO₂ emissions fell by 3.5%, from 149.5 gCO₂/km to 144.2 gCO₂/km.
- Van travel increased by 0.9% in 2010, while biofuel penetration was unchanged. These outweighed the improvement in new van CO₂ emissions which fell by 4.9% from 206 gCO₂/km to 196 gCO₂/km.
- HGV travel rose by 0.4% in 2010. Combined with a slight fall in biodiesel penetration and a worsening of HGV fleet emissions intensity, this suggests an increase in overall HGV CO₂ emissions.

A provisional assessment for 2011 suggests that CO₂ emissions may have fallen overall:

- Total car travel in 2011 increased 0.5% on 2010 levels. New car CO₂ emissions fell a further 4.2% to 138.1 gCO₂/km, though the emissions impact of this improvement was muted given low car sales (see below). Biofuel penetration increased marginally (up by 0.1% on 2010). The combination of these effects is that car emissions are likely to have decreased by around 1.8% in 2011.

³ Provisional 2011 results for UK greenhouse gas emissions include total transport emissions, but not the constituent components (road transport, rail transport, domestic and international aviation and shipping). Estimates of surface transport emissions in 2011 are therefore not available.

- Total van travel in 2011 increased 3% on 2010 levels, which combined with a slight decrease in biofuel penetration and limited improvement in new van efficiency suggests that van CO₂ emissions may have increased by up to 3.1% between 2010 and 2011.
- Total HGV travel in 2011 increased 0.3% on 2010 levels, and there was a fall in biofuel penetration, suggesting that CO₂ emissions may have increased by up to 0.8% between 2010 and 2011.

The increase in car and van distance travelled between 2010 and 2011 cannot be explained simply through changes in fuel prices and income. It is possible that other factors were important (e.g. car travel was low in 2010 partly due to the particularly heavy snowfall in the winter months) and/or that the increase in miles reflects the fact that data are preliminary and typically subject to significant revision before they are finalised. We will continue to monitor trends in miles data to establish whether there has been a structural change in the relationship with demand drivers. Although we envisage a small increase in miles travelled over the next decade in line with official projections, significant increases would be a matter for concern in the context of meeting carbon budgets.

Since CO₂ emissions by mode are not directly measured, these must be estimated from other sources. We have reviewed the estimation methodology used to develop the National Atmospheric Emissions Inventory (NAEI) and concluded that this produces implausible estimates of emissions by mode. We therefore recommend that a new methodology should be developed based on accurate data for fleet efficiency.

Progress against indicators: new car and van emissions

New car emissions continued to fall significantly in 2011, and continue to outperform our indicator, although the impact of this will be dampened given relatively low new car sales:

- Average new car CO₂ emissions in 2011 were 138.1 gCO₂/km, compared to 144.2 gCO₂/km in 2010 and 149.5 gCO₂/km in 2009. This compares to our indicator of 150.5 gCO₂/km for 2011.
- New car emissions fell across all car classes in 2011, by an average of 4.6% in each class. However, there was a slightly higher share of larger, higher-emitting cars in the total in 2011, which reduced the overall reduction in new car CO₂ to 4.2%
- New car sales fell in 2011 to 1.9 million units, from 2.0 million units in 2010 and a pre-recession (2002-2007) average of 2.5 million units.

Drivers of progress reducing new car emissions are likely to have been the EU new car CO₂ regulations, together with supporting fiscal policies (e.g. Vehicle Excise Duty (VED) differentiation according to CO₂ emissions). In addition, it is likely that the combination of the recession and higher fuel prices have resulted in increased weight being attached to fuel efficiency in the car purchase decision. This is therefore something we will closely monitor in future as the economy recovers, particularly as road demand remains strong. For example, it may be necessary to further differentiate VED to support achievement of EU targets.

In comparison to new car emissions, there was much less progress on new van emissions (these decreased by only 0.5% from 196 gCO₂/km in 2010 to 195 gCO₂/km in 2011). Although we expect that this would pick up following implementation of the new EU legislation agreed in May 2011, the Government should consider scope for use of complementary policy levers to strengthen incentives (e.g. fiscal levers).

Progress against indicators: electric vehicle market development

There is increasingly robust evidence showing that there is in principle a major role for ultra low emissions vehicles (e.g. battery electric, plug-in hybrid and hydrogen fuel cell) in meeting the 2050 GHG reduction target.

Given long lead-times for technology innovation and changing consumer preferences, it is important to lay the foundations now for electric vehicle market development. This is reflected in our scenarios for meeting carbon budgets, which envisage around 1.7 million electric vehicles on the road in 2020, rising to around 11 million by 2030. This path is compatible with a close to 100% share of electric vehicles in new vehicles by the mid 2030s, and a close to 100% electric vehicle fleet by 2050.

The Government has made progress developing policies to support electric vehicle market development, extending the Plug-in Car Grant to vans, with subsidies of £5,000 for cars and £8,000 for vans. Development of electric vehicle charging infrastructure has begun, with around 6,000 charge points installed across the UK in the period to end-March 2012.

Electric vehicle sales in 2011 were low, partly reflecting the fact that a limited number of models had come to market (only four electric car models were available to purchase on the UK market in 2011). However, a further five models have since been introduced in 2012, and a considerable range are currently under development and due to come to market in the near future.

Given the limited availability of electric vehicles in 2011, and that take-up in early years of new technologies is naturally expected to be slow, the low uptake in 2011 is not a matter of major concern. Rather, electric vehicle uptake should be closely monitored over the next several years, during which further approaches to addressing any barriers to uptake may be needed.

In the Budget 2012 it was announced that company car tax exemption for electric vehicles would be withdrawn from 2015/16. This decision will not raise significant revenue, given low sales of electric vehicles. However, it will undermine incentives for purchase of electric vehicles as company cars, a market niche where there is a potentially high share of early adopters. Given the importance of electric vehicles, scope for uptake as company cars, and limited tax revenues from electric vehicle sales, the budget decision should be reversed.

Progress against indicators: consumer behaviour change

Behaviour change offers around 35% of total abatement potential in surface transport to 2020. Key measures are Smarter Choices (i.e. encouraging people to switch to public transport and other means to reduce car journeys), eco-driving (i.e. encouraging people to drive in a way that maximises fuel efficiency), and enforcing the existing speed limit.

Progress towards roll-out of Smarter Choices has been good – although more is needed – with limited progress on eco-driving training, and the risk of a backward step on limiting speed:

- **Smarter Choices.** In February 2011 the Government committed £560 million funding from the November 2010 Spending Review to support sustainable travel through the Local Sustainable Transport Fund. A high-level assessment suggests that this could support roll-out of Smarter Choices across 25% of the UK. While this is positive, it leaves much to do in terms of comprehensive implementation. There is therefore a need to build on early projects and develop plans for a full roll-out of Smarter Choices over the next decade.
- **Speed limits and their enforcement.** Rather than enforcing the current speed limit on motorways, the Government is considering increasing this to 80 mph. This would both increase emissions, and provide a negative signal more generally about the Government's commitment to meeting carbon budgets. It would also increase the number and severity of accidents, and is based on a highly questionable economic rationale. We therefore strongly urge that the Government should include an appraisal of and consult on enforcing the existing speed limit as part of its proposed consultation on increasing the speed limit.
- **Eco-driving training.** The level of eco-driving training remained very low in 2011. Although eco-driving is a very cost-effective measure, the risk is that this opportunity will remain unexploited. To encourage eco-driving, the Government should consider including this as a key element in the practical driving test, and consider options to increase eco-driving training and other opportunities to provide information on fuel consumption and other benefits of eco-driving.

Going forward, the challenges are therefore to implement and then extend the current programme of Smarter Choices, to increase levels of eco-driving, and to consider enforcing rather than raising the current speed limit.

8. Progress reducing emissions from agriculture

Agriculture emissions account for around 9% (51 MtCO₂e in 2010) of total UK greenhouse gas emissions.

The key gases are nitrous oxide emissions, arising largely from fertiliser use on land for crops and pasture (56% of agricultural emissions) and methane emissions from livestock (36% of agricultural emissions).

Agricultural emissions increased by 0.9% in 2010, with livestock-related emissions increasing by 1.1% and crop-related emissions by 0.6%.

The increase in livestock-related emissions reflected an increase in output of 3.2%. The fact that the emissions increase was less than in proportion to output suggests reduced carbon intensity of production and can be explained by productivity improvements in meat and dairy products and improved carbon intensity of grassland.

The increase in emissions related to crop production reflects increased carbon intensity (up 1.3%), driven by a significant increase in the use of inorganic fertiliser per unit of output (up 3.9%), whilst overall output fell (down 0.7%). This is of particular concern and runs counter to the reduction required if agriculture emissions are to be reduced and carbon budgets achieved. The context is one where there was a small (5%) increase in the price of fertiliser in 2010, following a significant reduction in 2009 (33%).

Although emissions in 2010 were in line with our indicator trajectory, the evidence base for assessing progress reducing emissions remains incomplete (i.e. we do not have a systematic understanding of current farming practice, and therefore potential for reducing emissions through changing practice). In order to address this, a framework of indicators and supporting data on farming practices should be established by the end of 2012, and clear milestones set for the Government's project to develop a smart emissions inventory.

The Government's policy review includes a number of useful elements but should be broadened in scope to consider the full range of policy options (e.g. carbon price, cap and trade, regulation) and circumstances under which it would be appropriate to move from the current voluntary approach to one with stronger incentives for action. Triggers for moving from the current voluntary approach should be set out by the end of the year.

9. Progress reducing waste emissions

Waste emissions, mostly methane, account for around 3% of UK greenhouse gas emissions. In 2010 (the latest year of data available), waste emissions fell by 3%, continuing a longer-term trend whereby emissions have fallen 64% over the period since 1990. This is largely due to a reduction in biodegradable waste sent to landfill in response to the landfill tax, which was introduced to meet targets under the EU Landfill Directive. It also reflects an increase in the share of emissions assumed to be captured at landfill sites

The Government projects emissions will be reduced by a further 22% by 2020 relative to 2010 (i.e. a 72% reduction from 1990) in line with targets under the Directive for diverting waste away from landfill.

The Government's strategy to deliver reductions in waste emissions is centred around further increases in the landfill tax, but may not effectively incentivise actions throughout the waste chain (e.g. households threw away 4.4 million tonnes of food waste that could have been avoided in 2010 and less than half of English local authorities have introduced separate collections for food waste in response to the landfill tax). The Waste Review (2011) set out further measures, with a focus on waste prevention programmes and voluntary responsibility deals rather than regulatory measures.

Greater reductions are possible (particularly for food and paper/card waste), given opportunities for waste prevention and for using non-landfill disposal options such as recycling, composting, and energy from waste. While the costs associated with these opportunities are uncertain, increased ambition may be desirable, given that legacy emissions from waste may make future carbon targets harder to meet (i.e. once biodegradable waste is landfilled it will continue to emit methane for many years) and given potential co-benefits from waste reduction and alternative waste treatments (e.g. anaerobic digestion can contribute towards the UK's renewable targets).

We therefore recommend that the Government considers increasing its ambition for emissions reductions from waste. In particular, specific strategies for reducing both food and paper/card waste sent to landfill should be developed, given the potential to do more in these areas.

Since the Government's approach also carries the risk that there may not be sufficient action to drive further reductions, the effectiveness of waste policy should be carefully monitored throughout the waste chain, with stronger levers introduced as needed (e.g. recycling targets, mandatory sorting and collection requirements, and landfill bans/restrictions).

10. Progress reducing emissions in the devolved administrations

Final emissions data for 2009 (the most recent available) show a large fall in emissions in all devolved administrations, which, as for the 9% fall in UK emissions in 2009, was primarily due to the drop in economic activity during the recession.

- Emissions fell 7% in Scotland to 48.1 MtCO₂e, with the largest falls in non-residential buildings (12%), industry (11%), and the power sector (7%).
- Emissions fell 14% in Wales in 2009 to 42.6 MtCO₂e, with significant falls in the power sector (23%), industry (16%) and non-residential buildings (12%).
- Emissions fell 8% in Northern Ireland in 2009, with the largest falls in power (24%) and industry (21%).

Energy data for 2010, together with EU ETS, temperature and macroeconomic data, suggest emissions are likely to have increased in 2010 across the devolved administrations. At the UK level, emissions fell 7% in 2011; it is likely that emissions will also have fallen in the devolved administrations in 2011, given milder winter weather and large reductions in emissions observed in the energy-intensive sectors in the EU ETS.

Progress has been made in the last year by each of the devolved administrations in continuing to develop emission reduction strategies and targets:

- The Scottish Government legislated emission reduction targets to 2027. These follow advice provided by the Committee and reflect a halving of 1990 emissions by 2025.
- The Welsh Government has produced its first update on progress meeting emission reduction targets and refreshed its climate change strategy.
- The Northern Ireland Executive has increased the emission reduction target for Northern Ireland from a 25% reduction to a 35% reduction by 2025 relative to 1990 and published its first annual report on progress. Following advice from the Committee on the appropriateness of climate change legislation in Northern Ireland, the Environment Minister is now taking forward plans for a legally-binding climate change framework.

Our assessment of progress so far in implementing these programmes is that there are a number of positive areas. These include progress increasing renewable capacity, implementing energy efficiency and fuel poverty programmes, developing firm and ambitious policies on waste and, in the case of Scotland, improving afforestation rates. However major challenges remain in meeting the increase in effort across all sectors that will be needed to meet future emission reductions and continued action to develop and implement policies across all sectors will be vital. Key areas of devolved powers include transport demand-side measures, energy efficiency, waste, agriculture and land use, though there is also an important role in the development and implementation of UK policy, such as the EMR.

11. Current and future funding for implementation of measures

It will be important that policies are adequately funded through a combination of Exchequer and levy funding:

- Some of the required funding will be provided from budget revenues (e.g. for investment in renewable heat, support for electric vehicle market development, roll-out of Smarter Choices programmes).
- Funding for energy efficiency under the ECO will come from consumer levies.
- Funding for low-carbon generation (e.g. under the Renewables Obligation and Electricity Market Reform) will come from consumer levies covered by the Levy Control Framework. This provides a funding cap, and is set by HM Treasury.

For policies covered by budget revenues, our high-level assessment – set out in previous reports – is that funding for the current Spending Review period (2011/12 – 2014/15) is broadly adequate, but that further and increased funding will be required for the next period. It is important to note that revenues from carbon policies will also increase (e.g. from the carbon price underpin).

For the ECO (which will be funded through consumer levies but which is outside of the Levy Control Framework), the Government has recently confirmed that around £1.3 billion will be available; there is uncertainty over whether this will support required emissions reductions (see discussion of the Green Deal above).

Our assessment of the current Levy Control Framework suggests that it is broadly consistent with what is required to deliver the renewable power investments in our indicator framework to 2015.

In the period to 2020 increased Levy Control funding will be required to support achievement of renewable energy targets and carbon budgets (e.g. our analysis suggests a funding requirement of the order £8 billion in 2020 in real terms).

As we have shown in our analysis of energy bill impacts,⁴ the implication of costs of this order for the typical dual-fuel household is an increase in annual energy bills in 2020 of around £100; there is scope for energy efficiency improvement to broadly offset this.

Clarity on Levy Control future funding would be helpful given long project lead times. This could best be provided by agreeing a funding envelope (i.e. around £8 billion in 2020), together with flexibility mechanisms in recognition that future funding costs are highly uncertain (e.g. the funding requirement could be +/- 20-25% depending on gas prices and low-carbon technology costs).

Funding will be a crucial determinant of whether future carbon budgets will be achieved, with the need to ensure that commitments made for the current Spending Review period are maintained, and that adequate funding is provided for the next Spending Review period. This is required under the Climate Change Act (Section 13) which states that policies must be in place – and by implication funded – to meet carbon budgets. We will continue to monitor and provide more detailed analysis of funding in future progress reports.

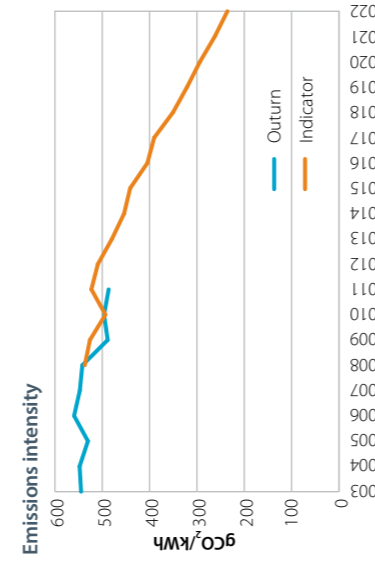
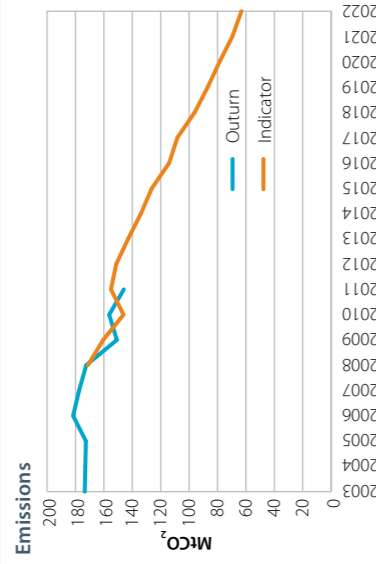
⁴ CCC (December 2011) *Household energy bills – impact of meeting carbon budgets*.

Summary of progress against indicators and future challenges

Economy-wide

Fall in emissions in 2011 largely reflects warm weather and other transitory factors. Implementation of measures reduced emissions by around 1%. Implementation of measures was broadly on track, though some areas continue to lag behind even the low ambition built into our indicators for the first budget period. A step change in the rate of implementation is now needed urgently as we move into budget two. There has been progress developing policies but a number of key policy challenges remain (e.g. a clear objective for the EMR, strengthening incentives for investment in renewable heat).

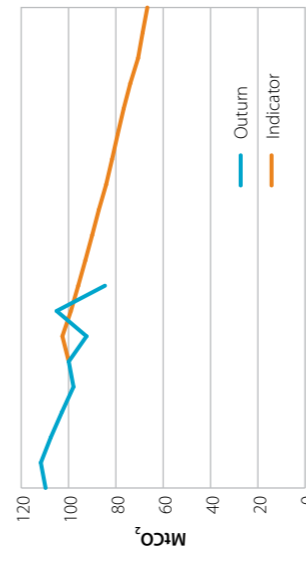
	Progress against indicators and milestones	Challenges
Power		
Emissions	White Paper (July 2011) confirmed long-term contracts for low-carbon capacity.	Needs a clear carbon objective and process to ensure this is delivered. Detailed design issues need to be resolved.
Transmission	Some transmission owner business plans approved by Ofgem, progress on gaining planning approval for some key investments, review of charging system for transmission network completed.	Still a need for approval of the National Grid business plan and planning approvals for some infrastructure, especially in Wales.
Planning	An increasing stock of onshore wind projects awaiting approval. Declining approval rates. The average time taken for wind projects to be determined remains high (e.g. up to 55 months for large scale onshore), and well above our indicator and guidance (12 months).	Deployment is at risk if there is a continuation of the decline in approval rates.
Wind	Total installed capacity broadly in line with our indicators, but with slow progress from approval to commissioning for onshore projects.	Significant acceleration in the pace of investment required in longer-term. Resolution of financial and non-financial uncertainties required in order to translate the strong project pipeline into generation.
Nuclear	Generic Design Assessment received interim approval, final approval expected by end 2012. National Policy Statement for nuclear approved in July 2011. First planning application submitted for approval.	Successful implementation of the Electricity Market Reform is required for nuclear investment to proceed.
CCS	First competition failed to award funding to projects. Second competition launched in 2012.	Urgent need to award funding this year to facilitate the first demonstration plant becoming operational as soon as possible (e.g. from 2017).



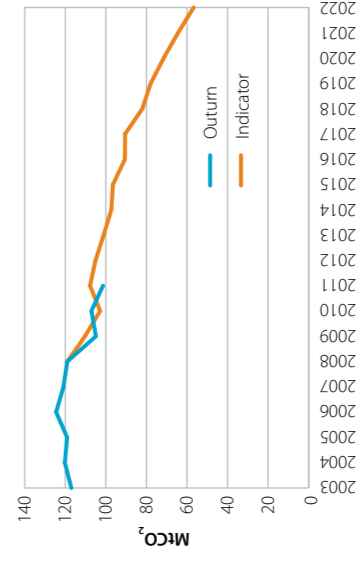
Summary of progress against indicators and future challenges

Buildings

Direct emissions



Indirect emissions

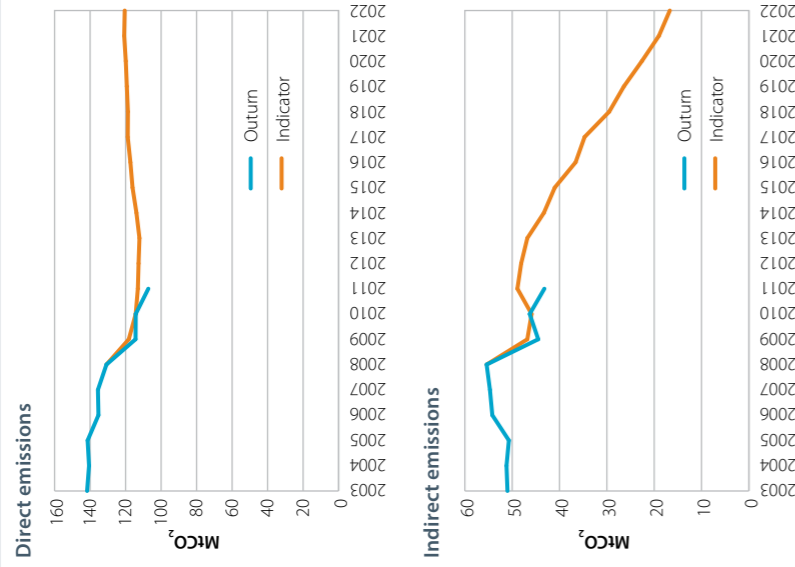


Progress against indicators and milestones

	Progress against indicators and milestones	Challenges
Residential	Delivery increased in 2011 for cavity wall, solid wall and professional loft insulation but fell for DIY loft insulation. Good progress on boilers. Energy Act 2011 set up the framework for the Green Deal and the Energy Company Obligation as successor to CERT. ECO to focus on solid wall insulation and hard to treat cavity wall insulation, as well as fuel poverty measures. Minimum energy efficiency standards for private rented properties to be introduced in 2018. Green Deal for non-residential sector to start in 2013. First CRC league table published. CRC simplification proposals and suggestion of possible abolition. Minimum standards for rented premises proposed from 2018. Public sector – central government 10% reduction target for 2010-11 achieved and new target set for 2015.	Uptake of insulation measures is likely to fall substantially after the end of CERT. Uncertainty over uptake of measures due to market-based nature of Green Deal. Additional measures may be needed. ECO and Green Deal uptake figures are potentially well below numbers needed for carbon targets. Amount of money available for fuel poverty measures is reduced which may be an issue for energy affordability in low income households. Standards should be introduced earlier.
Non-residential	Green Deal for non-residential sector to start in 2013. First CRC league table published. CRC simplification proposals and suggestion of possible abolition. Minimum standards for rented premises proposed from 2018. Public sector – central government 10% reduction target for 2010-11 achieved and new target set for 2015.	Voluntary uptake of Green Deal expected to be low. Abolition would be premature in the absence of other effective policy levers. Standards need to be firmed up soon to ensure that landlords make relevant appropriate investment decisions.
Renewable heat	RHI started for the non-residential sector in November 2011. Residential sector RHI delayed until 2013, small grant scheme available.	Abolition of national indicators for local authorities – unclear whether there are now enough incentives for emission reductions across all local authorities. Lack of interest in residential grant system. RHI needs to be available to residential sector as soon as possible. Need to resolve uncertainty about RHI beyond 2015.

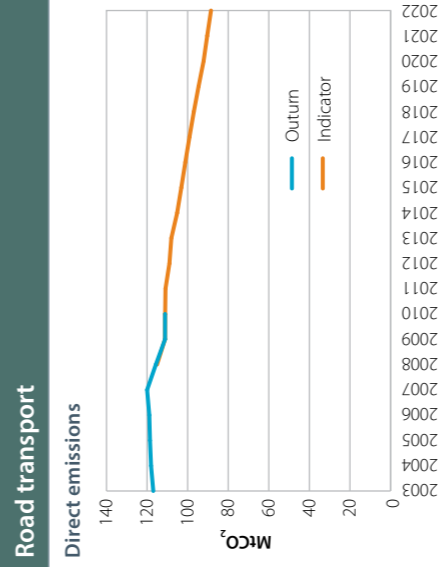
Summary of progress against indicators and future challenges

	Progress against indicators and milestones	Challenges
Industry		
Energy intensity	To be reported next year	
Renewable heat	Good progress, ahead of indicator trajectory.	Given that large biomass installations are likely to be a priority in future, Government should closely monitor uptake and set out an approach to large scale applications of biomass.
CCS	CCS competition announced that is open to industry if part of a cluster.	Limited progress internationally. Need to outline approach to CCS development and deployment.
Other milestones	New design of CCAs announced which reduce the scope of coverage to non-EUETS emissions only, and does not address barriers to uptake.	Significant barriers remain in industry, new policies are required to provide stronger incentives, particularly for investment in more expensive measures. The Government's forthcoming industry strategy provides an opportunity to set out how gaps in the current policy framework can be filled, and more confidence provided over implementation of the measures that we have highlighted, and that are also included in the Government's carbon plan.



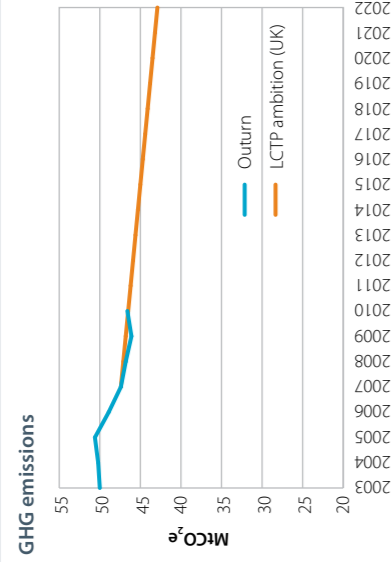
Summary of progress against indicators and future challenges

	Progress against indicators and milestones	Challenges
Road transport		
Direct emissions		
New car fuel efficiency	Significant improvement in new car gCO ₂ /km, reduced by small shift towards larger, higher-emitting cars.	To ensure continued progress, potentially through use of fiscal levers if required.
Reducing van emissions	In May 2011, EU adopted a limit of 147 gCO ₂ /km for new vans by 2020.	To ensure new vans in the UK achieve the EU target.
Development of electric car market	Price support of up to £5,000 for purchase of electric cars came into effect in January 2011. Grants of £8,000 were introduced in January 2012 for electric vans. Funding had been provided for eight Plugged-in Places (PIP) pilots in different parts of the country. Commitment to mandate and to deliver a nationwide strategy for national recharging network for electric vehicles.	Need deployment targets for 2020. Greater price support may be required to support early market. Budget 2012 announcements on removal of tax exemptions for company cars from 2016 threaten progress and should be reversed. Substantive investment in public charging infrastructure is necessary. Continued implementation of the PIP programme is crucial to providing investor confidence.
Increased use of biofuels	Biofuels penetration remained broadly unchanged in 2011. Still on track to meet our indicator for 2020.	Sustainability criteria for biofuels need to be strengthened to ensure that indirect land use impacts are minimised.
Smarter Choices	Local Sustainable Transport Fund is sufficient to roll out Smarter Choices to around 25% of the UK by 2015.	Further funding will be required to support full roll out by 2020.
Eco-driving	Very low levels of eco-driving training in 2011.	Consider steps to facilitate large-scale roll out though inclusion of eco-driving in the practical driving test, and consider other options to increase eco-driving.
Speed limiting	Almost 50% of drivers violated speed limits on motorways in 2010, resulting in increased emissions.	Proposals to raise the speed limit will increase emissions. Government should consult on stricter enforcement of existing speed limits.
Land use/transport planning	New National Planning Policy Framework published in March 2012.	To ensure that the new framework results in appropriate land use planning decisions by monitoring decisions on new developments and their implications for emissions.



Summary of progress against indicators and future challenges

	Progress against indicators and milestones	Challenges
Agriculture		
GHG emissions	<p>Phase 1 of the GHG Industry Action Plan completed in 2012.</p> <p>Government policy review due end of 2012.</p> <p>Government is developing a longer-term evaluation framework of performance indicators to track progress reducing emissions, with supporting data on farm practices.</p>	<p>More detail required on Phase 2 delivery: resolving the funding arrangements for the roll-out of the Farm Efficiency Hub, and the establishment of a framework to monitor progress.</p> <p>Policy assessment should include the full range of options and a set of triggers for the introduction of new policies if voluntary measures fall short of agreed savings set out in the LCTP.</p> <p>Should be established as a matter of urgency.</p>



Summary of progress against indicators and future challenges

	Progress against indicators and milestones	Challenges
Waste		
GHG emissions	<p>Recent revisions to emissions inventory and projections show emissions were lower in 1990 relative to previously modelled, have fallen more quickly and will continue to decrease faster than previously expected.</p> <p>The Government's Waste Review (2011) aims to put the UK on a path towards a 'zero waste' economy with the landfill tax remaining a key driver and with a commitment to implementing measures targeting actions across the waste chain. AD Strategy and Action Plan also published.</p>	<p>Data limitations mean that the precise level of emissions remains uncertain, and makes monitoring of progress difficult.</p> <p>The costs and carbon benefits from some landfill diversion treatments are poorly characterised/understood.</p> <p>Higher ambition for waste emissions reductions should be considered.</p> <p>Barriers to recycling/sorting/separate food waste collection and energy from waste (e.g. AD) may require stronger levers than planned in the Government's Waste Review.</p> <p>Specific strategies should be developed to reduce food and paper/card waste sent to landfill (the largest contributor to future waste emissions).</p>

