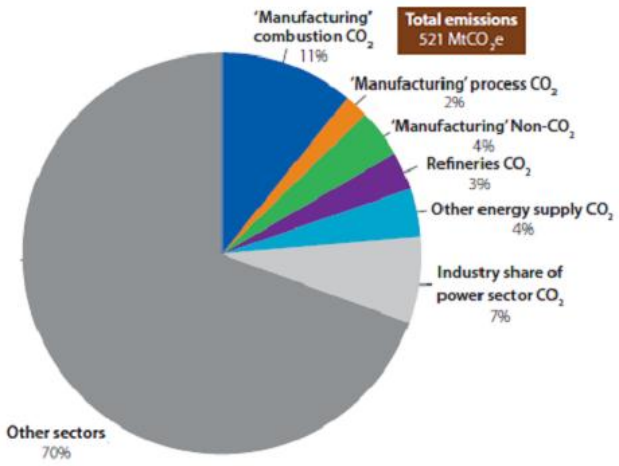
What does this sector include?

Industrial activity includes manufacturing industries[1], refining of petroleum products and other energy supply (extraction and production of oil, gas and solid fuels).

Industrial activity directly accounts for a quarter of UK greenhouse gas emissions in 2014 (around 120 $MtCO_2e$), of which around four-fifths are CO_2 (Figure 1). Of industry direct CO_2 emissions, two-thirds comes from manufacturing (split between combustion of fossil fuels and chemical processes). Industry consumes around a third of UK electricity produced which is around 7% of UK GHG emissions.

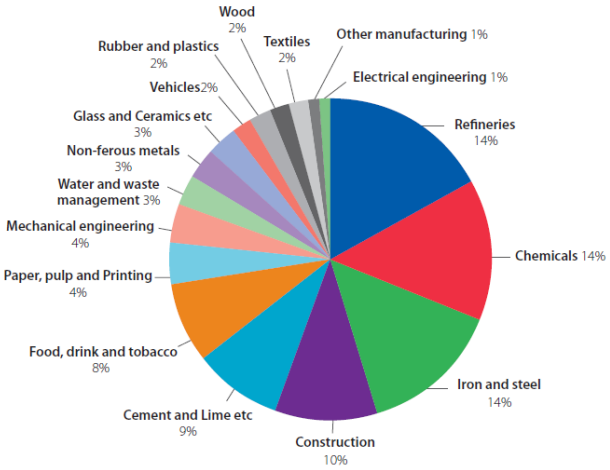
Within the manufacturing and refining sectors, around four-fifths of all CO_2 emissions and two-thirds of energy consumption is accounted for by eight industries, which make up almost a sixth of UK GHG emissions (Figure 2).

Figure 1: GHG emissions from industry in the context of total UK emissions (2014)



Note: DECC Provisional GHG statistics, CCC analysis. Percentage figures may not add up to 100% due to rounding.

Figure 2: Manufacturing and refining CO2 by sector (2012)



Note: ONS Environmental Accounts. Percentage figures may not add up to 100% due to rounding.

What has happened to emissions since 1990?

Over the period 1990-2007, industry CO_2 emissions fell an annual average of 0.8%, at total decrease of 12%, despite a 10% rise in output. The fall in emissions intensity of production is likely to be a consequence of significant improvements in energy efficiency and a switch to fuels with lower emissions.

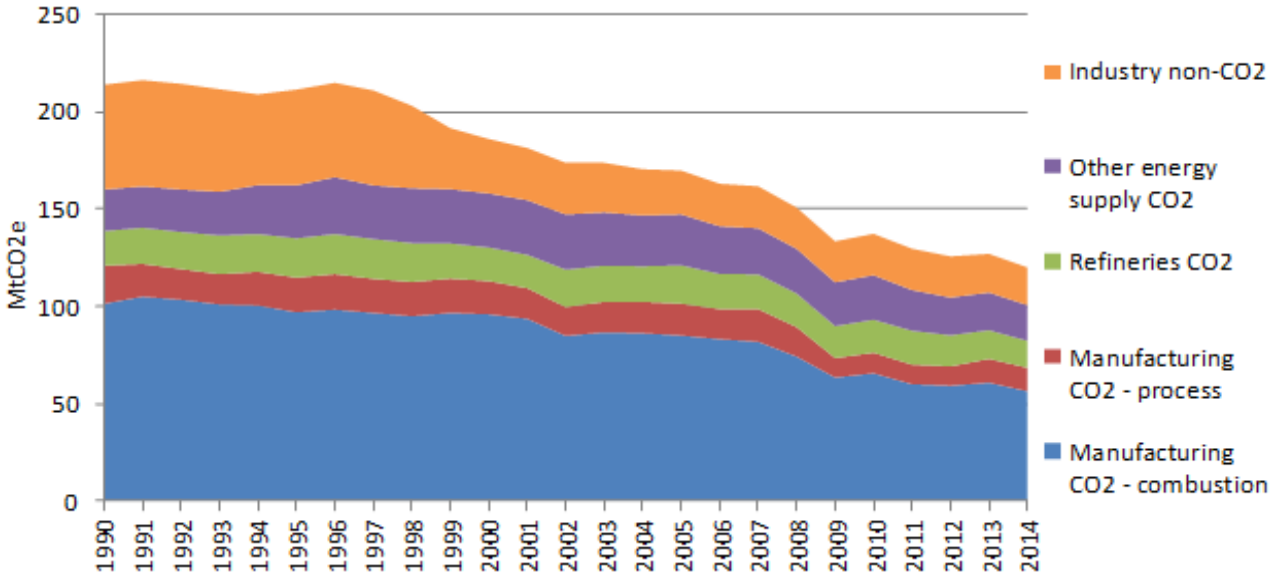
Over the period 2007-2009, industry CO_2 emissions fell 20%. This can be attributed to output falling 11% due to the recession. This had a disproportionate impact on carbon-intensive sectors.

Over the period 2009-2013, industry CO_2 emissions fell an annual average of 1.2%, at total decrease of 4.6%. Output was 1% down over the period. The after-effects of the recession, which disproportionately impacted carbon-intensive sectors, caused a structural movement towards a less carbon-intensive mix of industrial output. It was the largest contributor to falling direct emissions, with some improvement in energy intensity and changes in the fuel mix also reducing emissions.

[1] Manufacturing of products from steel, minerals, chemicals, paper, food & drink etc. This category also includes emissions from the construction sector.

Provisional estimates suggest 2014 direct industry GHG emissions fell by 6%. While refining output fell, there is no clear explanation for the 6% drop in manufacturing emissions in 2014, as production grew 3% during the year and verified industrial EU Emission Trading System (EU ETS) emissions fell by only 0.4%. Provisional statistics are prone to revision, so we focus our assessment on the longer term trend in manufacturing emissions.

Figure 2: GHG emissions from industry (2007-2012)



Notes: NAEI GHG Inventory

What can be done to reduce emissions?

The *Fourth Carbon Budget Review* published in December 2013 updated our view on the scope for reducing direct emissions in industry from around 140 $MtCO_2$ in 2007 to around 70 $MtCO_2$ in 2030 (Figure 3).

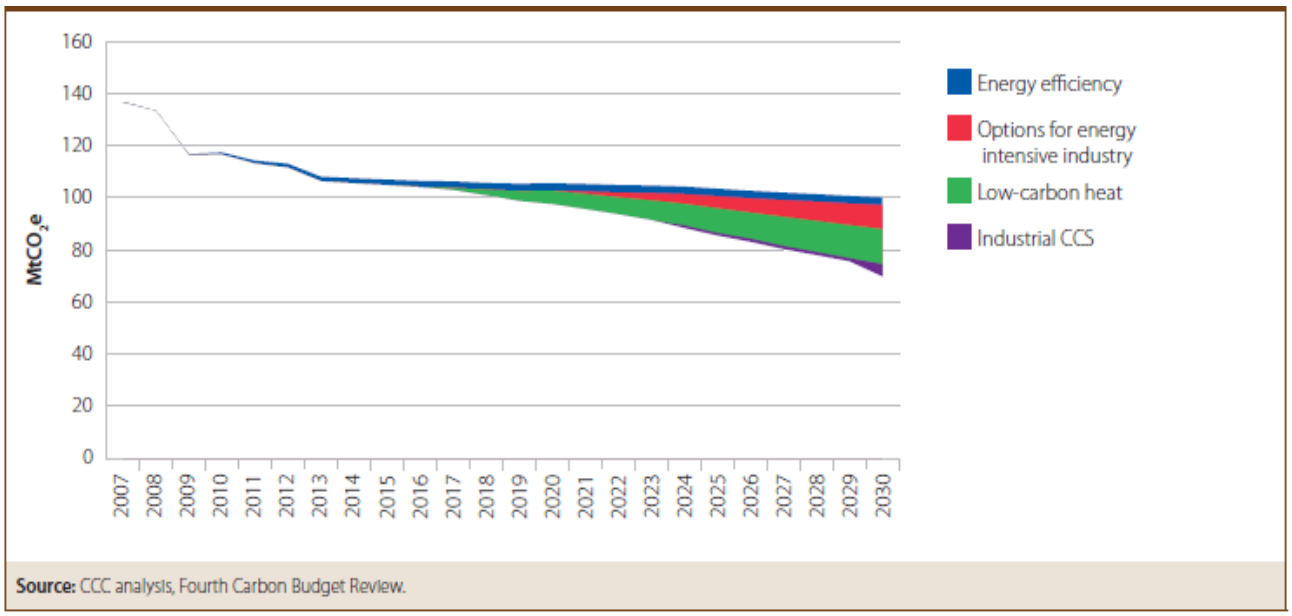
- **Energy efficiency improvement**. There is significant but uncertain potential. Our best estimate comes from the ENUSIM model that suggests scope for reducing direct industry emissions by around 3 $MtCO_2$ per year in the period to 2020 through energy efficiency measures.[2]
- **Options in energy-intensive industry**. Further cost-effective options for energy-intensive industry could provide up to around 9 $MtCO_2$ per year abatement by 2030. These include increased electric-arc steel production, clinker substitution in cement and optimisation of refineries.[3]
- **Low-carbon heat and use of bioenergy**. There is potential to reduce direct industry emissions by 13 $MtCO_2$ per year by 2030. This is primarily through use of biomass and biogas within sustainability limits, with smaller contributions from heat pumps and combined heat and power (CHP).[4]
- **Industrial carbon capture and storage (CCS)**. CCS could be feasible and cost-effective for deployment in a range of industrial sectors during the 2020s, reducing emissions by 5 $MtCO_2$ per year by 2030. By 2050 industrial CCS could contribute to cost-effective reductions of around 33 MtCO2 per year.

After 2030 there is greater uncertainty. There are opportunities to reduce emissions further through CCS and bioenergy, together with additional options for decarbonising industrial heat through the use of electrification and hydrogen. Use of bioenergy in conjunction with CCS could additionally provide 'negative emissions',

[2] The Energy End-Use Simulation Model (ENUSIM) is a technology based, bottom-up industrial energy end-use simulation model which projects the uptake of energy-saving and/or fuel-switching technologies taking into account the cost effectiveness of technology options under future carbon and fossil fuel prices.
[3] Ricardo-AEA (2013) Updating and extending carbon budget trajectories: A review of the evidence. Available at: http://www.theccc.uk
[4] NERA (2010), Updating Decarbonising Heat: Low -Carbon Heat scenarios for the 2020s, Available at: http://www.theccc.uk

providing headroom for emissions from other hard-to-reduce sources. Electrification could provide further significant emissions reductions, but appears to be relatively expensive.

Figure 3: 4th Carbon Budget Review industry emission cost-effective pathway (MtCO2)



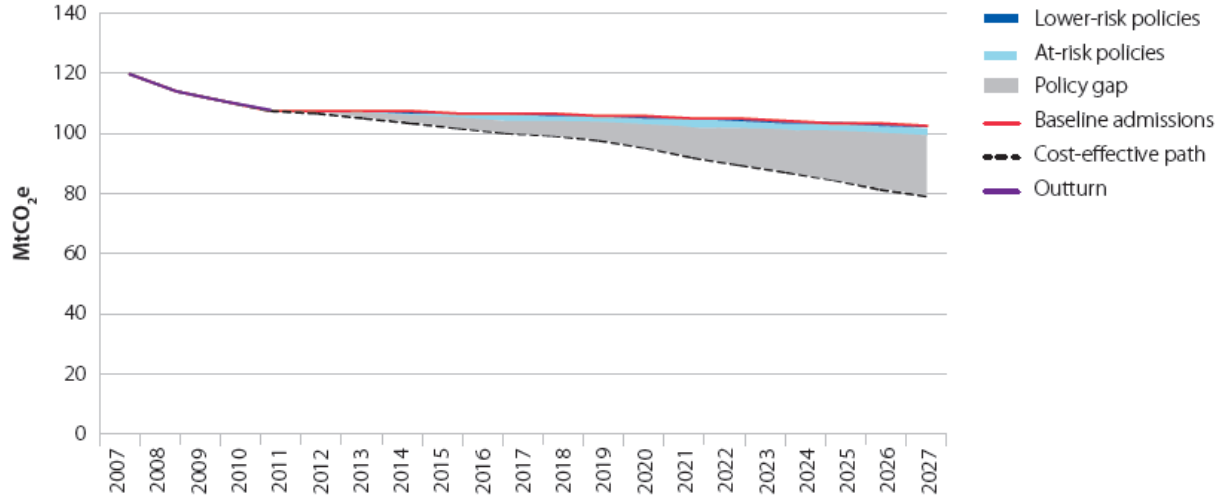
What is Government doing?

- **Industrial Decarbonisation and Energy Efficiency Roadmaps to 2050.** Published in March 2015, the roadmaps establish decarbonisation pathways that could be possible while ensuring sectors remain competitive for eight heat-intensive sectors.
- **EU Emissions Trading Scheme**. A carbon trading scheme which covers large industrial users of energy and power generators in the EU.
- **Renewable Heat Incentive (RHI)**. A feed-in type mechanism that provides long-term support to producers of renewable heat. It supports a range of renewable and low-carbon heat options.
- **Industrial Carbon Capture and Storage (ICCS).** The Teesside Collective has been awarded £1 million by DECC to develop a plan, including potential funding mechanisms, for deploying an industrial cluster CCS development that could save up to 5 $MtCO_2$ by the 2020s.
- **Climate Change Agreements (CCAs)**. CCAs are voluntary agreements that allow eligible energy-intensive sectors to receive up to 90% reduction in the Climate Change Levy (CCL) if they sign up to government-agreed absolute or relative energy efficiency targets.
- **Energy Savings Opportunity Scheme (ESOS).** Compulsory energy audits required under the EU Energy Efficiency directive for all 'large' enterprises (over 250 employees and/or above turnover and balance sheet thresholds). The first year of audits is 2015, to be repeated every three years.
- **Combined Heat and Power (CHP)**. Both fossil fuel and low-carbon CHP plant may qualify for support from CCL and business rate exemptions and ECAs. Renewable-fuel CHP may also qualify for incentives under the Renewables Obligation, Renewable Heat Incentive and Feed-in tariff. Fossil-fuel CHP may qualify for Hydrocarbon Oil Duty Relief. Fuel used in CHP for electricity generated to supply manufacturing firms would be exempt from the Carbon Price Floor.
- **Enhanced Capital Allowances (ECAs)**. Companies can write off 100% of the cost of new energy-saving plant or machinery against the business taxable profits in the financial year of the purchase.
- **Private-rented sector regulations.** Legislation passed in early 2015 requires all business premises in the private-rented sector in England and Wales to meet a minimum EPC standard of 'E' from 2018 when rented/leased.

What is the CCC's position?

In our *Fourth Carbon Budget Review*, we suggested that direct industry emissions could fall to 84 $MtCO_2$ in 2025 (Figure 4). According to DECC's Energy and Emissions Projections (EEP), industry direct emissions would be 99 $MtCO_2$ when estimated savings of current and planned government policies are included. This leaves a gap of around 15 $MtCO_2$ in 2025 which needs to be addressed to stay on the cost-effective path we have identified to meet carbon budgets. This gap comprises uptake of low-carbon heat (9 $MtCO_2$), further options in energy-intensive sectors (5 $MtCO_2$) and initial deployment of industrial CCS (1 $MtCO_2$).

Figure 4: DECC industry emission projection risk assessment (2007-2027, MtCO2)



Notes: NAEI *GHG inventory*, DECC EEP 2014, CCC analysis.

In our June 2015 progress report, we made a number of recommendations aimed at closing this policy gap.

Our recommendations for DECC, working with BIS, are:

Ahead of 2016 Progress Report

- **Develop joint work with industry into action plans**: publish plans setting out specific actions and clear milestones to move abatement efforts forward along the paths developed with industry in the "Roadmaps".

Ahead of 2017 Progress Report

- **Complete roll-out of "Roadmaps" to other industrial sectors**: taking account of lessons learned, roll-out roadmaps to industrial sectors not covered in first wave.
- **Join-up industrial CCS with power sector projects**: set an approach to commercialisation of industrial CCS alongside the approach adopted for the power sector, including ensuring industry can link into planned infrastructure.
- **Evaluate effectiveness of compensation to at-risk industries for low-carbon policies**: independent evaluation of industries that are at-risk and effectiveness of the compensation framework.

Links to recent work by CCC

- **2015 Annual Progress Report,** Chapter 3 - Progress reducing emissions from industry http://www.theccc.org.uk/publication/reducing-emissions-and-preparing-for-climate-change-2015-progress-report-to-parliament/
- **The Fourth Carbon Budget Review,** Chapter 4 – Reducing emissions from industry http://www.theccc.org.uk/publication/fourth-carbon-budget-review/
- **The 2050 target,** Chapter 5 – Reducing emissions from industry http://www.theccc.org.uk/publication/international-aviation-shipping-review/