



# Reducing the UK's carbon footprint

BIEE Meeting  
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UK Committee on Climate Change

# Context & background

- Studies suggest that UK GHG emissions measured on a consumption basis are higher than those measured on a territorial/production basis, and are rising
- This raises questions about the current focus (UK/UN) on production emissions and links to concerns about the competitiveness impacts of carbon policy (i.e. are we exporting energy-intensive industries and then re-importing the emissions?)
- This is particularly the case given there is a great deal of uncertainty over the nature of a global deal for the 2020s



# HoC Energy and Climate Change Committee

## Report April 2012



### Some key recommendations:

- If the Government wishes the UK to continue its lead on climate policy it must recognise the growth in the UK's consumption-based emissions.
- DECC should explore the options for incorporating consumption-based emissions data into their policy-making process.
- 'We recommend that the Government commission the CCC [...] to explore the implications that consumption-based accounting may have for the UK's carbon budgets'



House of Commons  
Energy and Climate Change  
Committee

### Consumption-Based Emissions Reporting

Twelfth Report of Session 2010–12

#### *Volume I*

*Volume I: Report, together with formal minutes, oral and written evidence*

*Additional written evidence is contained in Volume II, available on the Committee website at [www.parliament.uk/ecc](http://www.parliament.uk/ecc)*

*Ordered by the House of Commons  
to be printed 27 March 2012*

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# Scope of CCC work (published April 2013)



In response to **2012 Energy and Climate Change Select Committee** report (April 2012), Greg Barker formally requested the CCC to advise the Government on the **role of consumption-based accounting in climate change mitigation policy**. This includes:

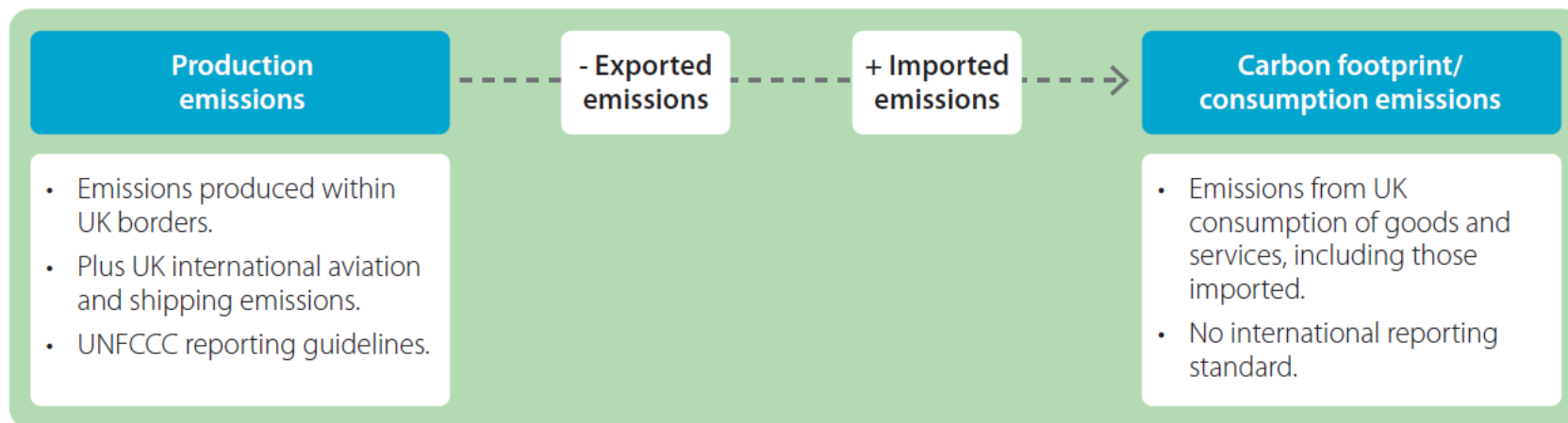
- Estimates of past and current consumption emissions
- Possible pathways for UK consumption emissions towards 2050
- Data/methodological issues
- Priority technologies/products
- Implications of current and future consumption emission trends on the design of policies

We also address whether offshoring of industry in response to low-carbon policies has been or could be a significant contributory factor to reductions in production emissions, and how competitiveness risks can be managed

# Structure of presentation

- Historical estimates of UK consumption emissions
- Scenarios for future UK consumption emissions
- Policy implications

# Consumption emissions accounting approach



# Methods for estimating consumption emissions

## “Production plus”

- High level analysis of emissions embedded in trade flows (e.g. Helm et. al, 2007)
- Fewer data requirements and conceptually straightforward, but cannot track supply chain emissions embedded in goods/services nor differentiate between goods/services for final versus intermediate consumption

## Input-output analysis

- Tracks economic flows across sectors and regions
- Potentially (particularly multi-regional input-output analysis) most accurate method for estimating consumption emissions but has greater data needs, requires complex modelling that is subject to errors and is less transparent
- Used by Government (Defra) to estimate the UK’s carbon footprint since 2008 (currently prepared by University of Leeds)

# Multi-regional input analysis - Key variables

## Consumption emissions are function of:

### 1. Final demand by sector

UK demand for domestic and imported goods and services, for final consumption (i.e. trade data in £)

### 2. Industrial structure

The inputs (both domestically produced and imported) that each sector in a given region uses to produce goods and services (this data is found in input-output tables published in national accounts)

### 3. Carbon intensity

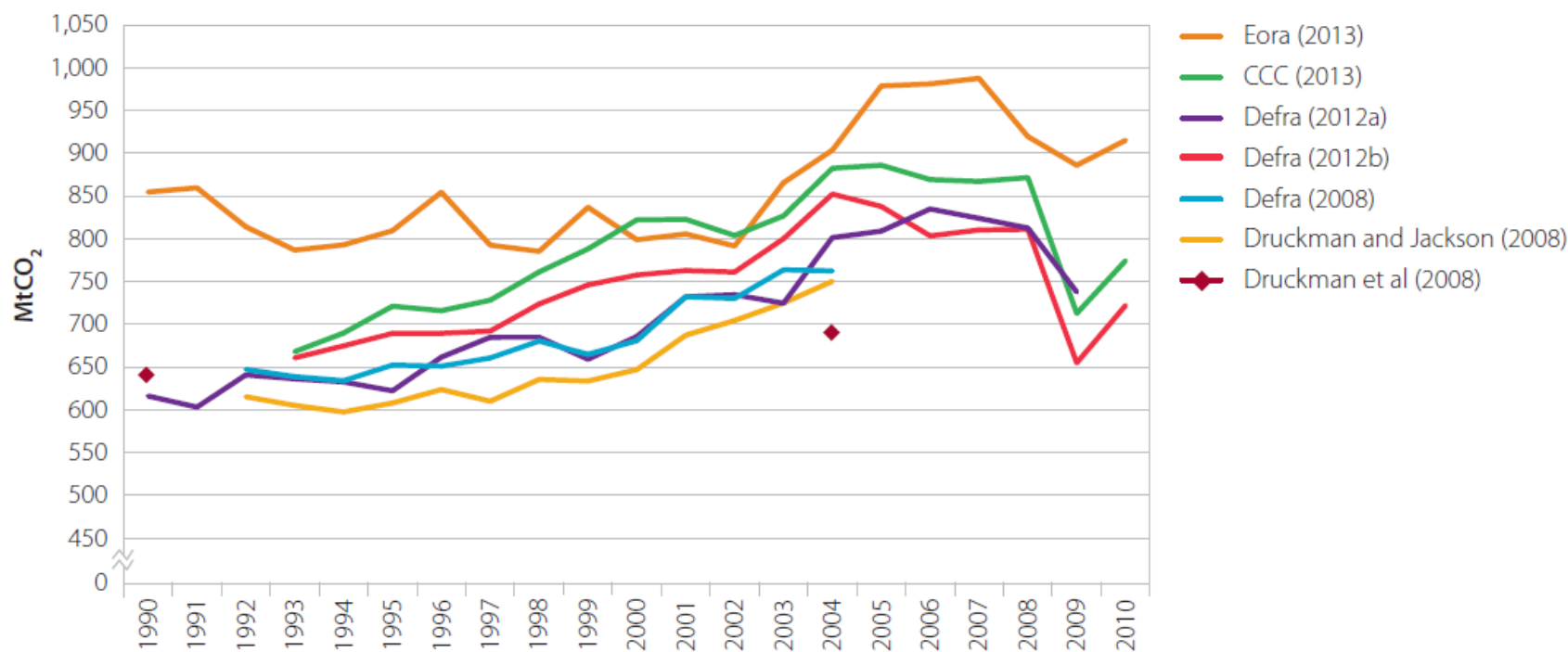
Emissions produced per unit monetary output of each sector

Above data available in a growing number of databases (e.g. Eora, WIOD) but often reflect different time periods, currencies, industrial classifications, and levels of disaggregation that need to be harmonised for use in input-output analysis



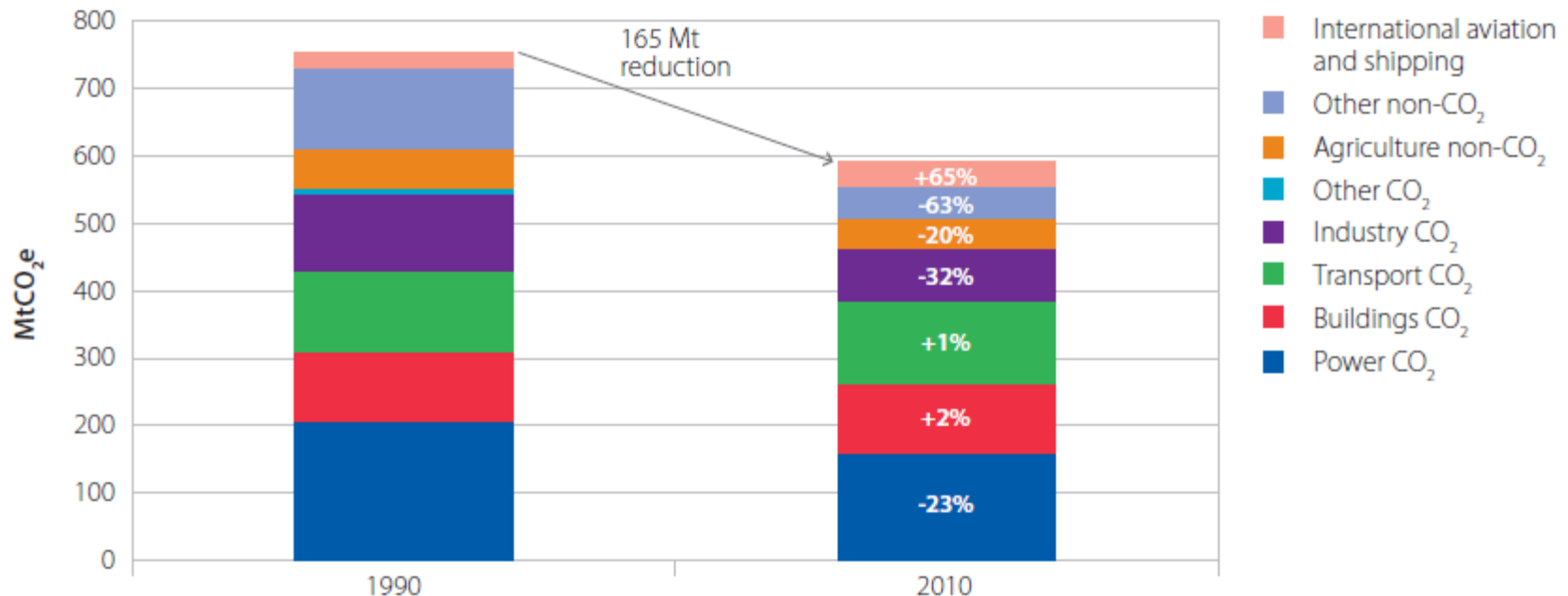
# Different methodologies and datasets can produce very different estimates

## Range of estimates for UK consumption emissions (1990-2010)



- Studies show an increase in the UK's carbon footprint over time
- Uncertainty in consumption emissions accounting has implications for policy
- Area of significant ongoing research, which should narrow range of uncertainty

# UK greenhouse gas production emissions over time

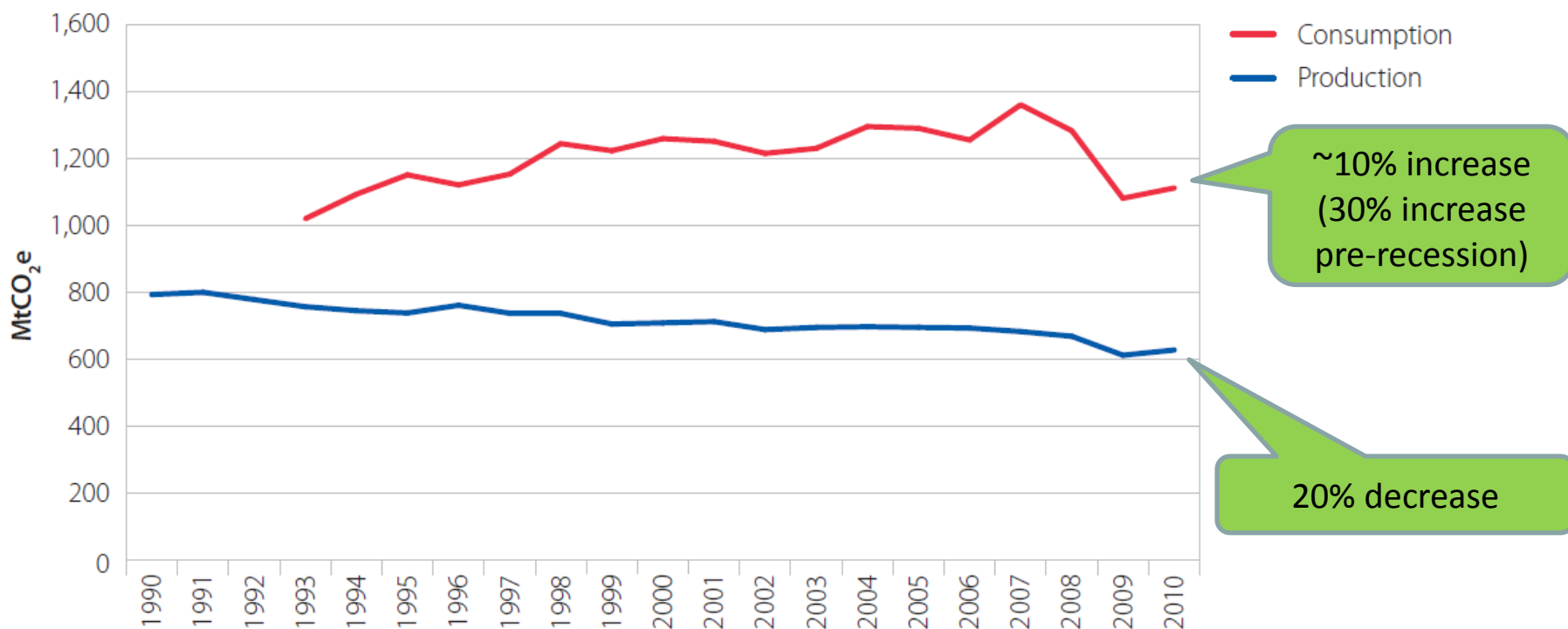


Source: NAEI (2012)

- Production emissions fell 21% between 1990 and 2010 due to switching from coal to gas in power generation and reductions in non-CO<sub>2</sub> gases such as waste methane emissions
- Industry reductions have been due to fuel switching, energy efficiency, industrial restructuring related to broader processes of globalisation, and more recently the recession

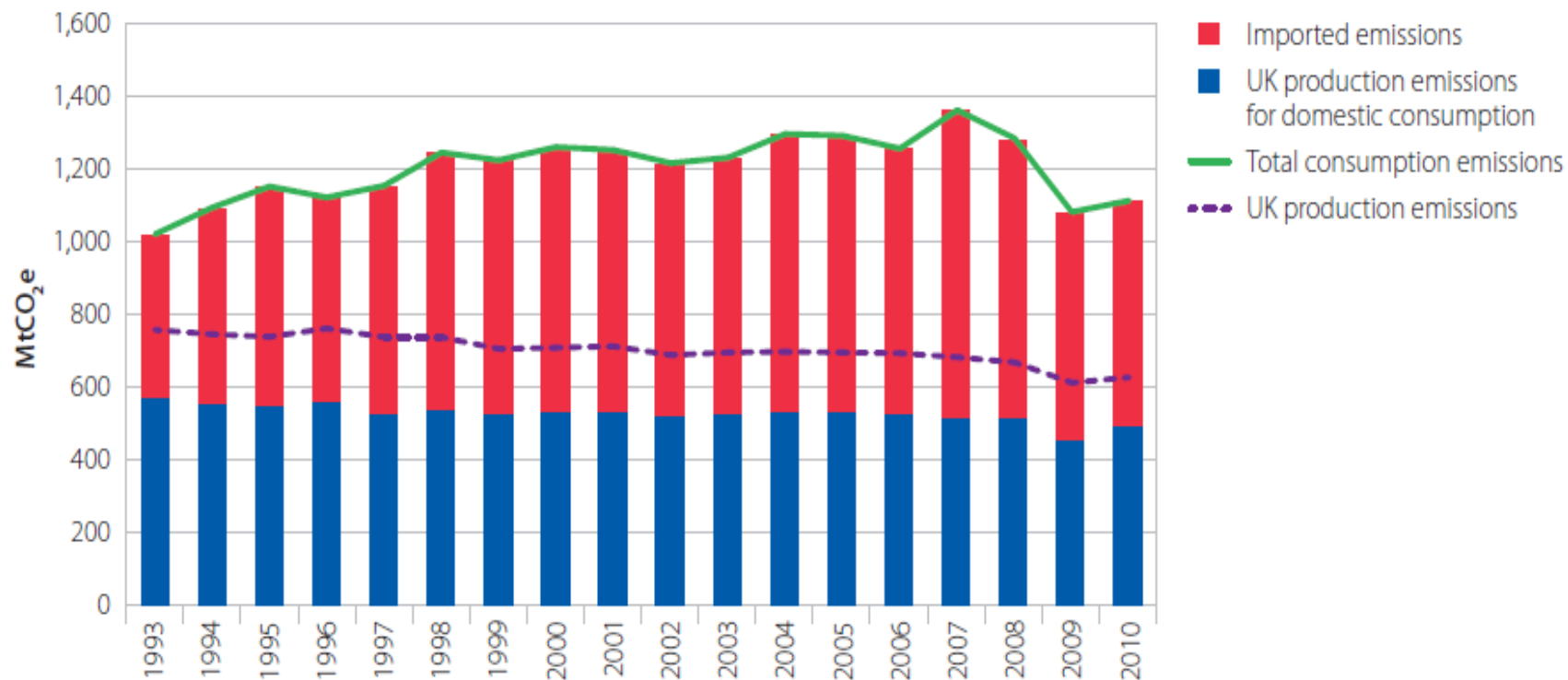
# GHG emissions associated with UK consumption (CCC estimates) and production

- Defra has reported on UK consumption emissions since 2008 and in 2012 produced a time series of consumption emissions
- We commissioned University of Leeds to rerun Defra model but with greater disaggregation of regions



Source: NAEI (2012); CCC estimates developed by the University of Leeds (2013)

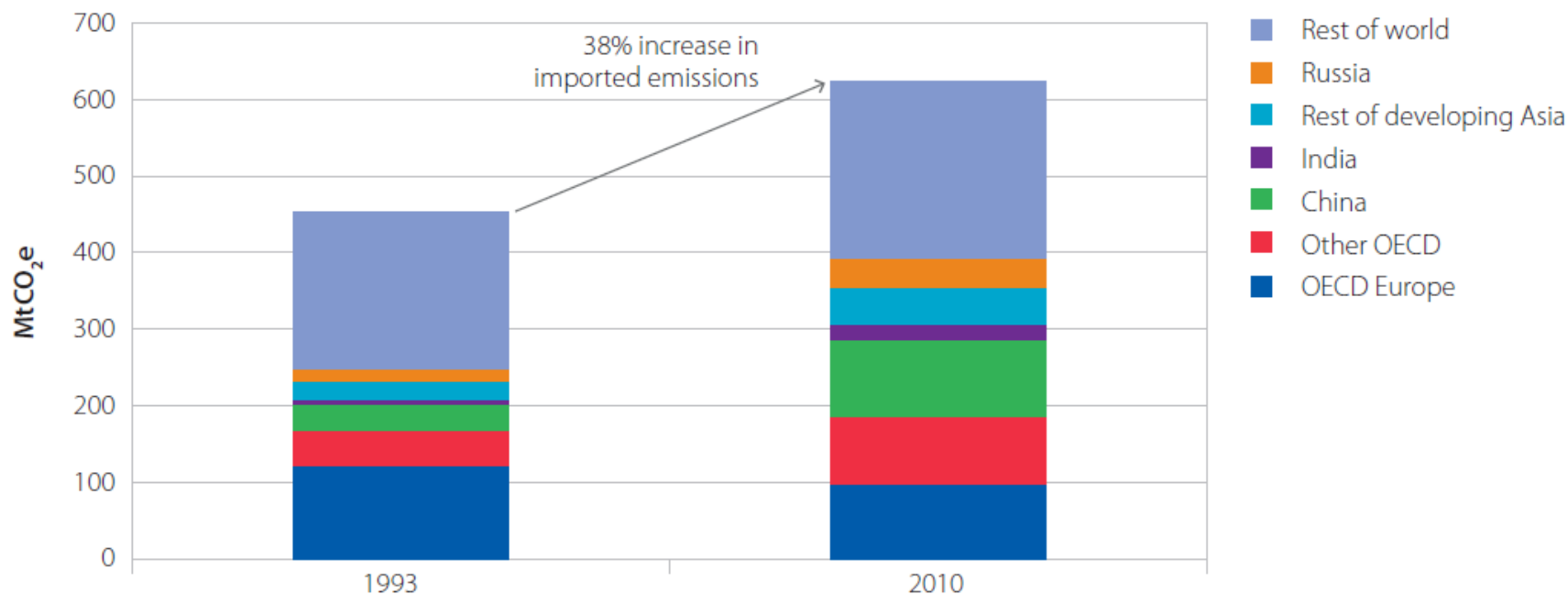
# Trends in the UK's carbon footprint



Source: NAEI (2012); CCC estimates developed by the University of Leeds (2013)

- The UK's carbon footprint has increased over the past two decades, as growth in imported emissions (~40%) has more than offset reductions in production emissions

# UK imported GHG emissions by region

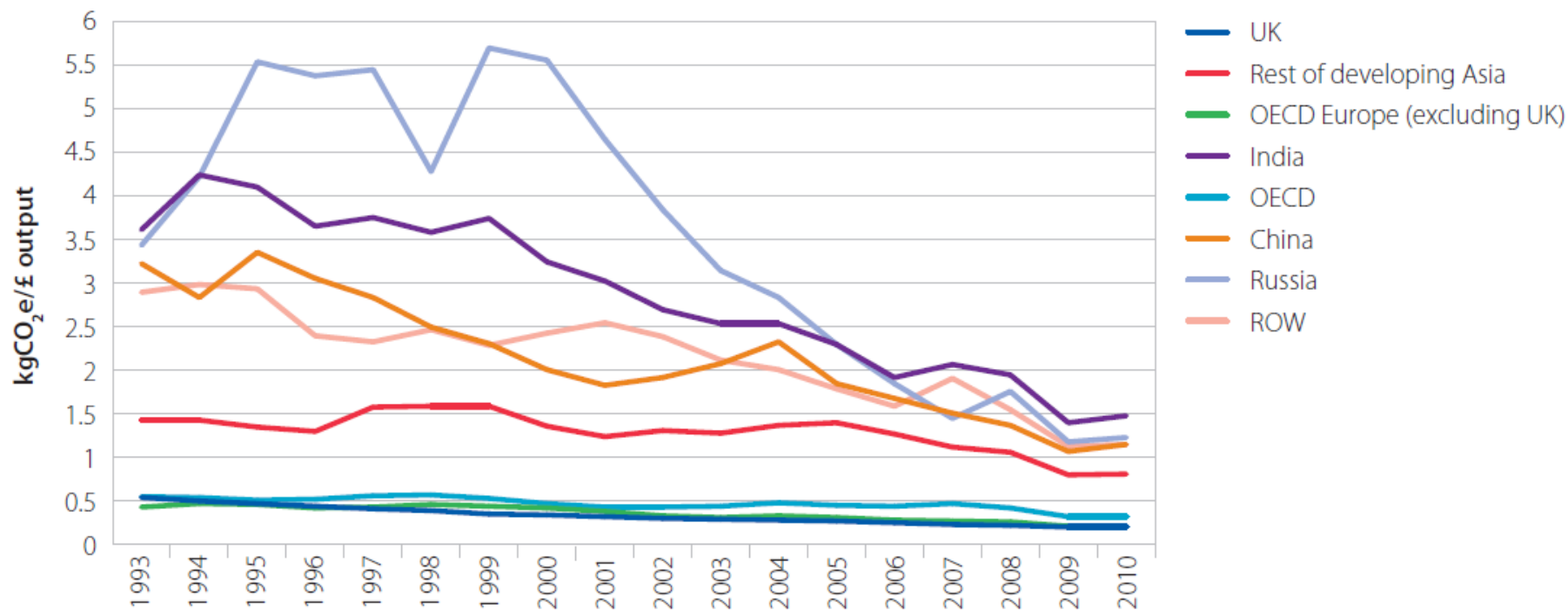


Source: University of Leeds (2013)

- 15% of imported emissions from OECD Europe, an additional 15% from other OECD countries
- Developing Asian economies account for one-third of UK's imported footprint (half of which are from China) and for majority of growth in imported emissions

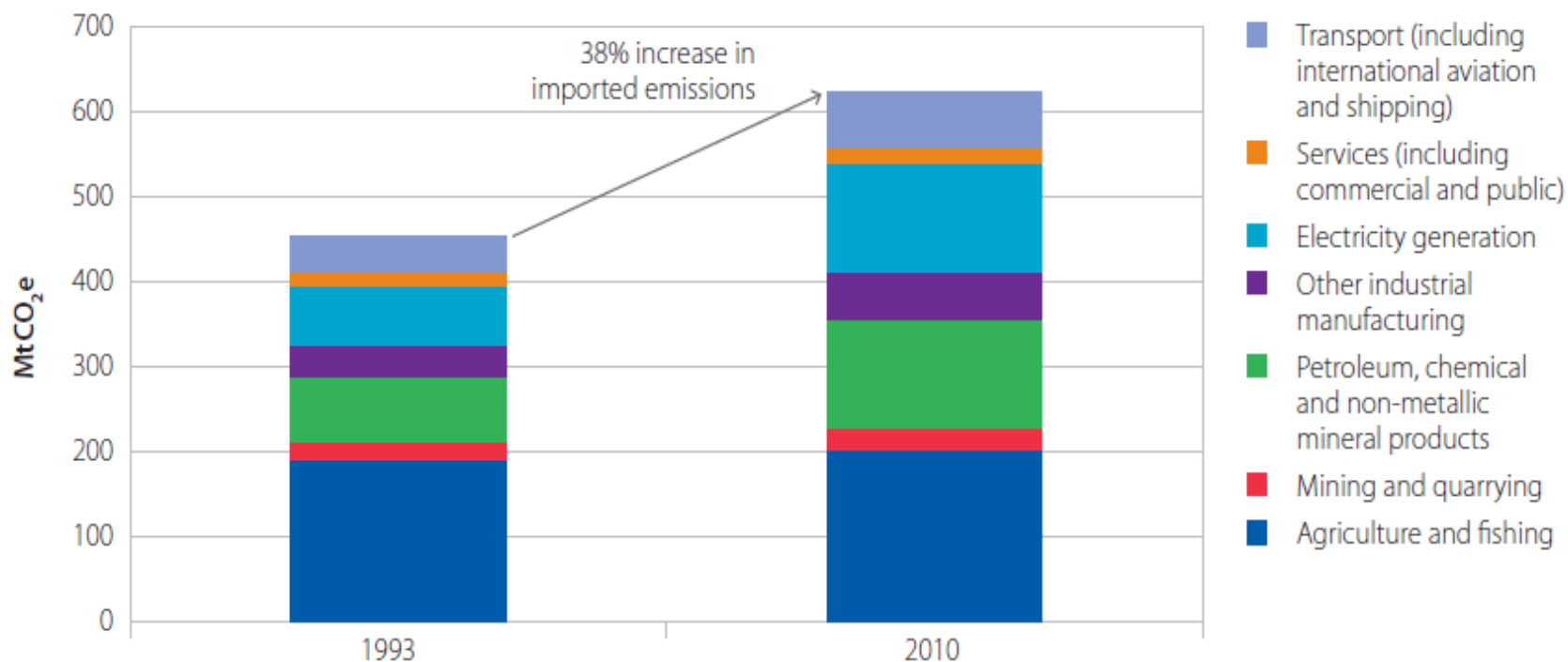
# Emissions intensities of production in UK trading partners have fallen over time

Greenhouse gas emissions intensities by region/country (1993-2010)



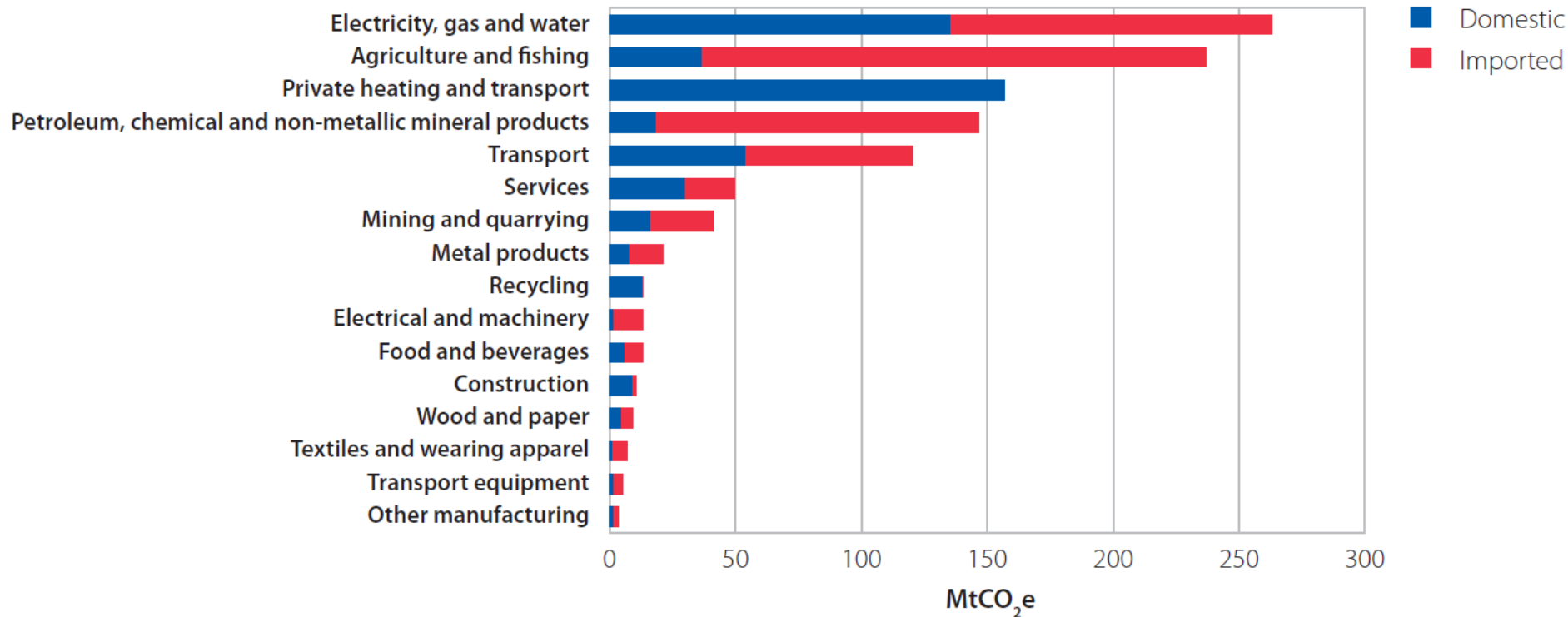
Source: Eora World MRIO database (2012)

# UK imported GHG emissions by sector



- UK demand for goods and services result in significant production emissions overseas, particularly in agriculture (1/3 of imported emissions), power generation, and direct emissions in production of petroleum, chemicals, non-metallic mineral products
- Together, with overseas transport emissions (e.g. freight), these account for over 80% of the UK's imported footprint, and majority of growth in imported emissions

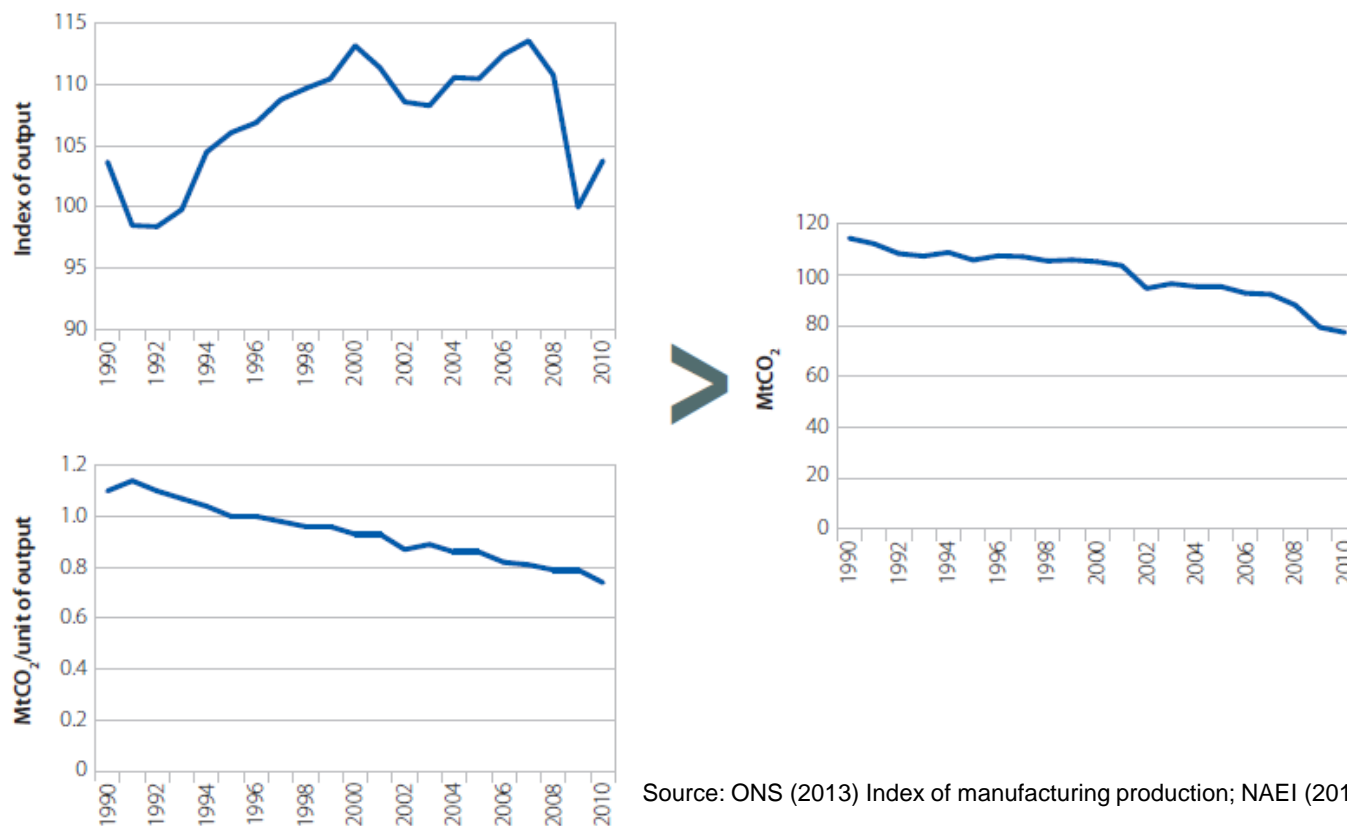
# UK imported versus domestic consumption emissions by sector of origin (2010)



Source: CCC estimates developed by the University of Leeds (2013).



# Emissions intensity of UK industry has decreased over time while output has increased



Source: ONS (2013) Index of manufacturing production; NAEI (2012); CCC calculations.

- Offshoring of industry in response to low-carbon policies has had (at most) a minor impact in reducing production emissions
- UK carbon footprint would have increased more had production emissions not been reduced
- Increase in imported emissions largely result of rising incomes, which increased demand for manufactured goods, which due to globalisation, are mostly produced elsewhere

# Structure of presentation

- Historical estimates of UK consumption emissions
- Scenarios for future UK consumption emissions
- Policy implications

# Future consumption emission scenarios – key assumptions



Our scenarios incorporate scenarios for UK production emissions, together with scenarios for demand, imports and emissions intensity in other countries

## 1. Final demand by sector

- **Import growth**
  - Reference to historic trends/long-run GDP growth
  - Shift in UK imports towards emerging economies
  - Shift away from fossil fuels for energy-use
- **Domestic demand:** adjusted to balance net trade in line with historical levels

## 2. Industrial structure

- The inputs (both domestically produced and imported) that each sector uses to produce goods and services held constant

## 3. Carbon intensity (emissions/output)

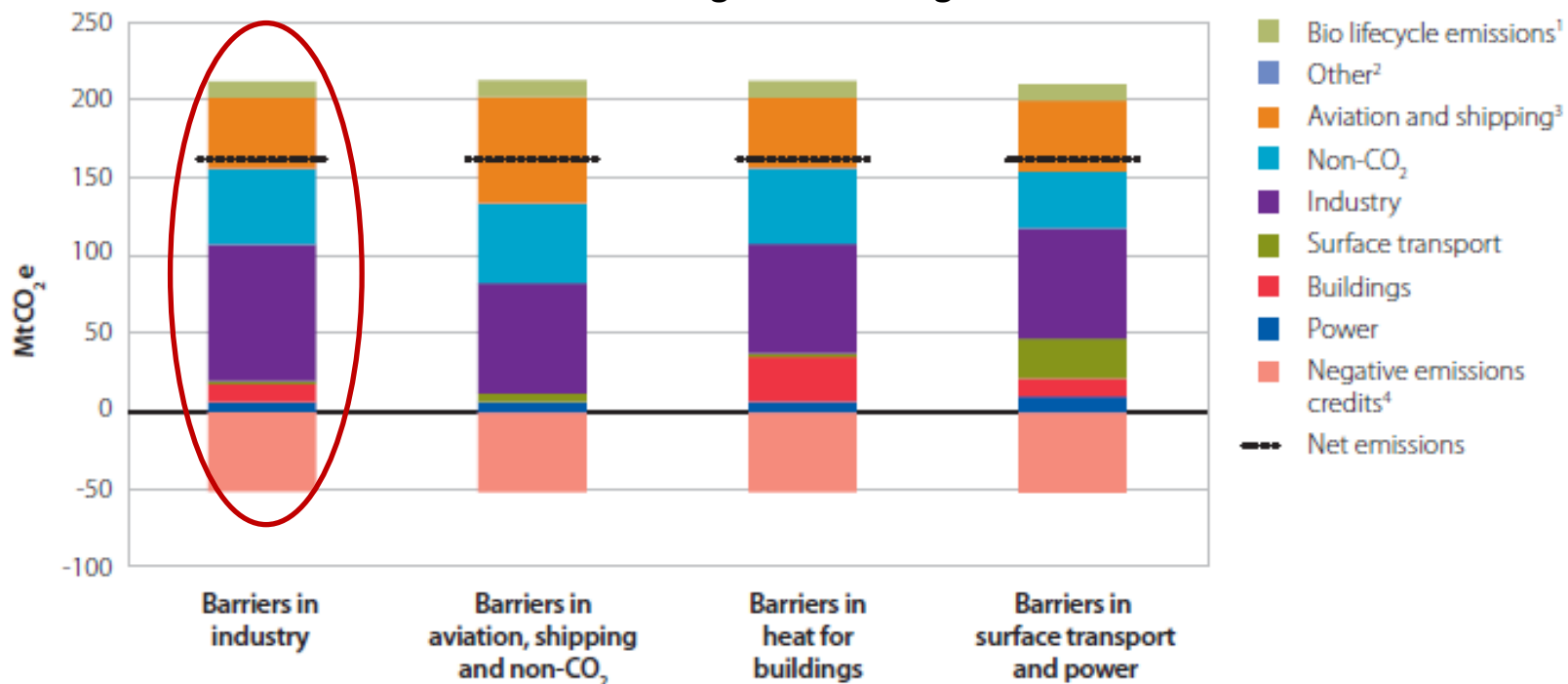
- **Emissions:** CCC and IEA scenarios to 2050
- **Economic output:** IMF, OBR, DECC projections

# CCC scenarios for 2050 UK emissions obtained from our 2012 IAS advice

We explored various 2050 scenarios, including deploying different levels of abatement in each economic sector



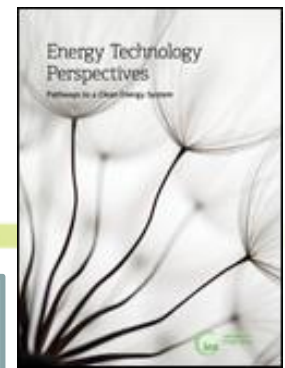
Scenarios for meeting the 2050 target



Source: CCC (2012)

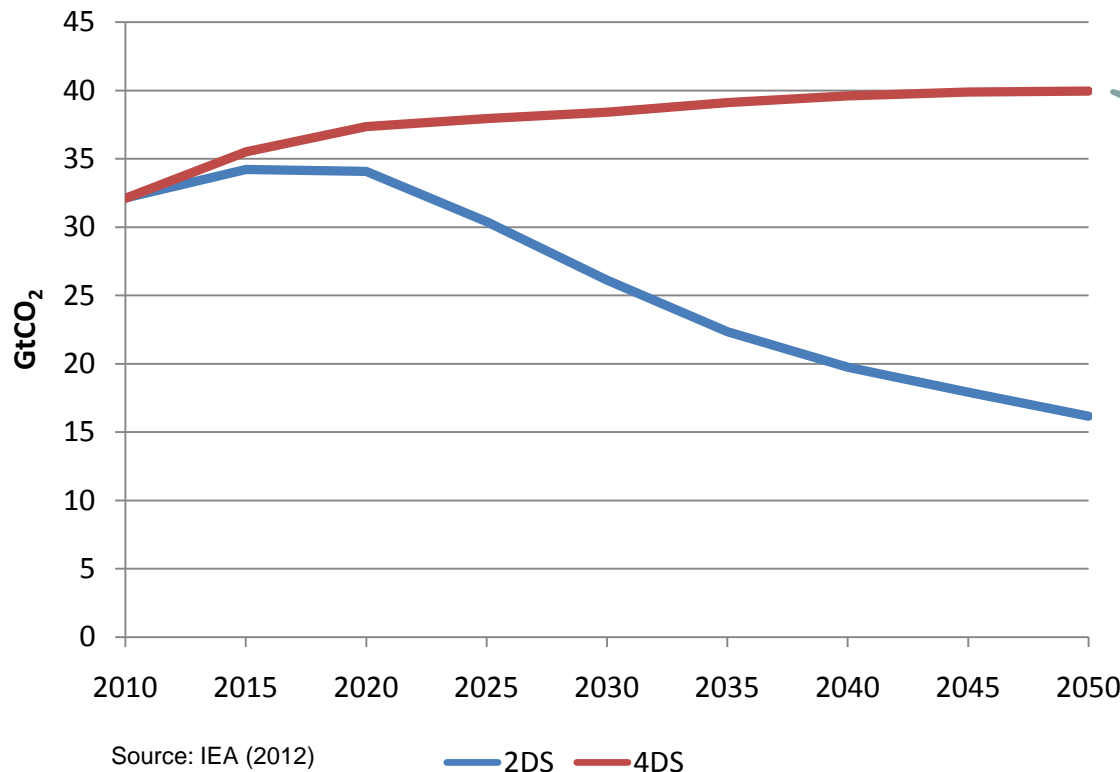
Our “Barriers in industry” scenario more “realistic” as required maximum deployment of abatement in just one sector (transport) – we explored this scenario + a sensitivity with no CCS

# Global emissions reductions compatible with climate objective obtained from IEA



## Global climate objective:

To keep central estimates of global temperature rise by 2100 close to 2°C above pre-industrial levels, and limit likelihood of a 4°C rise to very low levels (e.g. 1%).

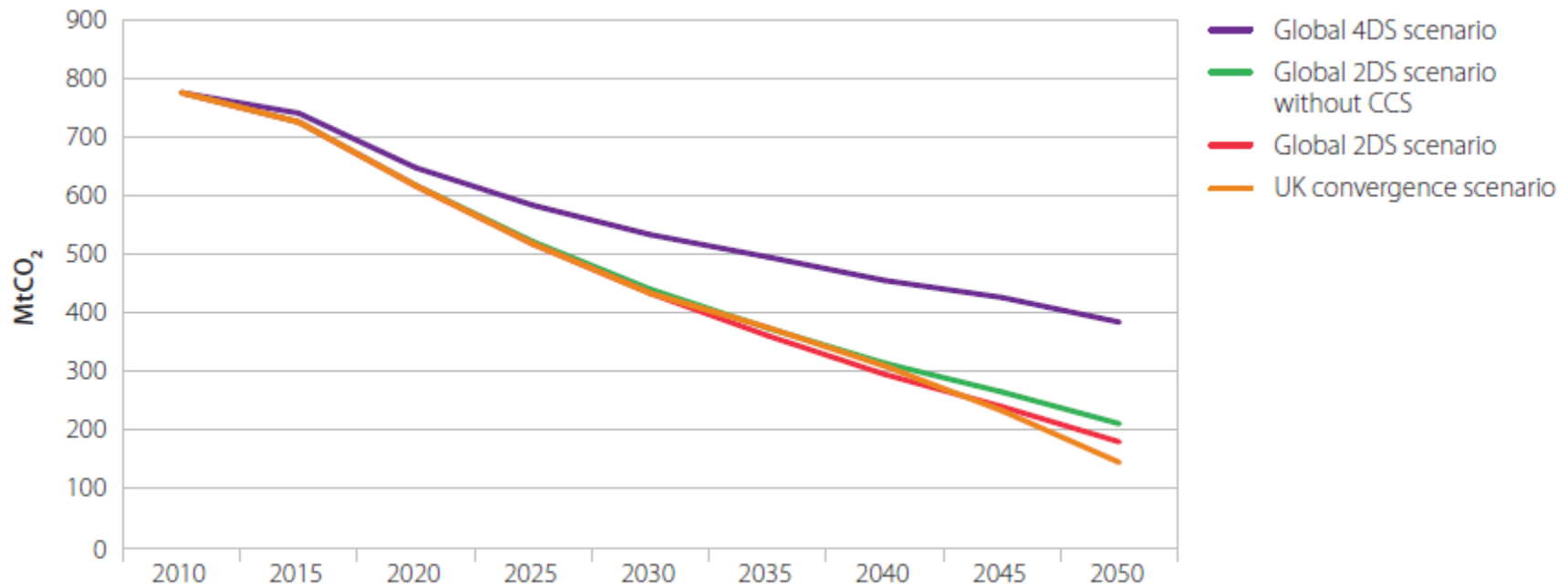


As a sensitivity, we analysed UK consumption emissions in a world where international actions do not go beyond Copenhagen (projected to lead to a long-term temperature rise of 4°C (4DS scenario)).

# We commissioned Leeds University to translate emissions and demand scenarios into projections of the UK's carbon footprint to 2050



Scenarios for UK consumption emissions to 2050 (CO<sub>2</sub>)

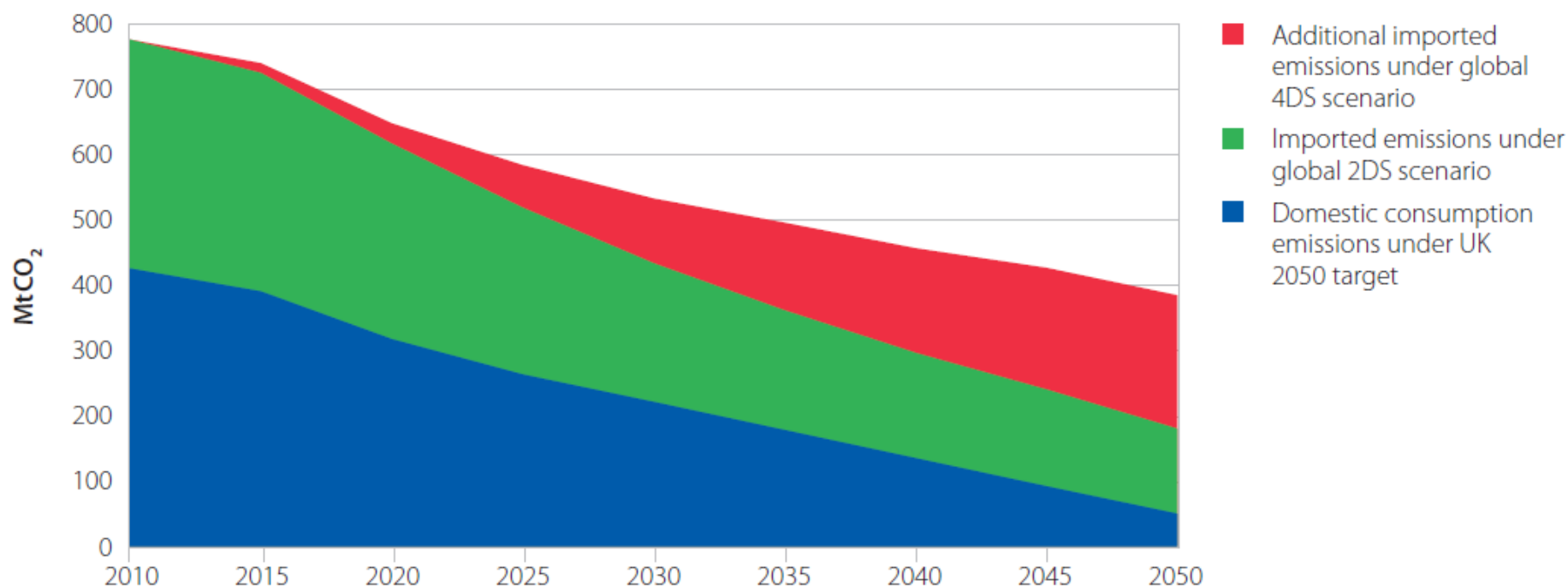


Source: CCC modelling (2012); University of Leeds (2013); IEA (2012) *Energy Technology Perspectives*.

- Under a scenario where **UK meets its 2050 target and global emissions fall in line with the climate objective**, the UK's carbon footprint (CO<sub>2</sub> only) could fall up to 80% below current levels
- Under a scenario where the **UK meets its 2050 target but rest of the world does not go beyond current pledges**, the UK's carbon footprint (CO<sub>2</sub> only) could be reduced by only 50% from current levels

# Key finding 1: The need to reduce both production and imported emissions, and to monitor the UK's carbon footprint

Scenarios for domestic and imported UK consumption emissions to 2050 (CO<sub>2</sub>)

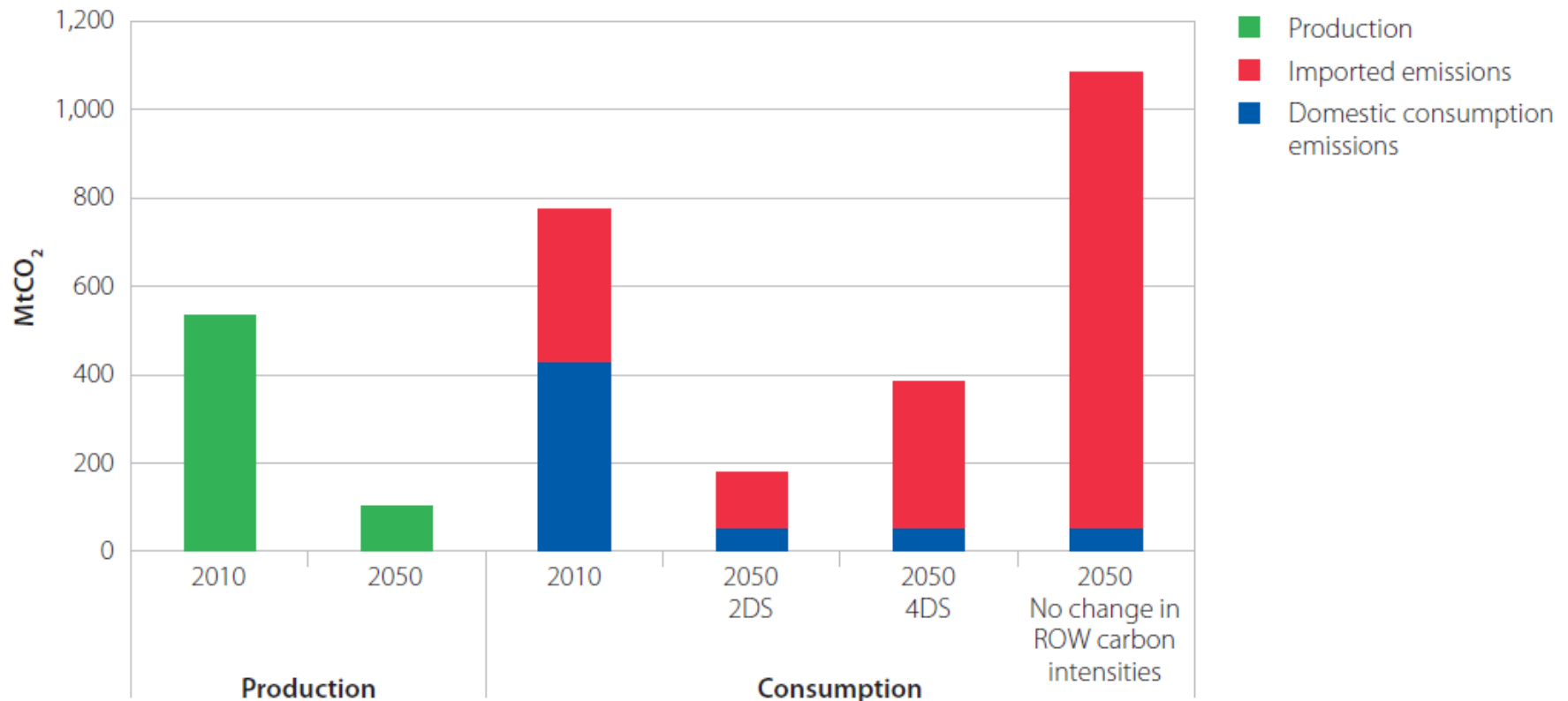


Source: CCC modelling (2012); University of Leeds (2013); IEA (2012) *Energy Technology Perspectives*.

The UK's carbon footprint could be reduced by up to 80% in 2050 compared to current levels, with production emissions accounting for half of these reductions

# Key finding 2: The need for action beyond current global policies

UK production emissions and scenarios for UK consumption emissions to 2050 (CO<sub>2</sub>)



Source: CCC modelling (2012); University of Leeds (2013); IEA (2012) *Energy Technology Perspectives*.

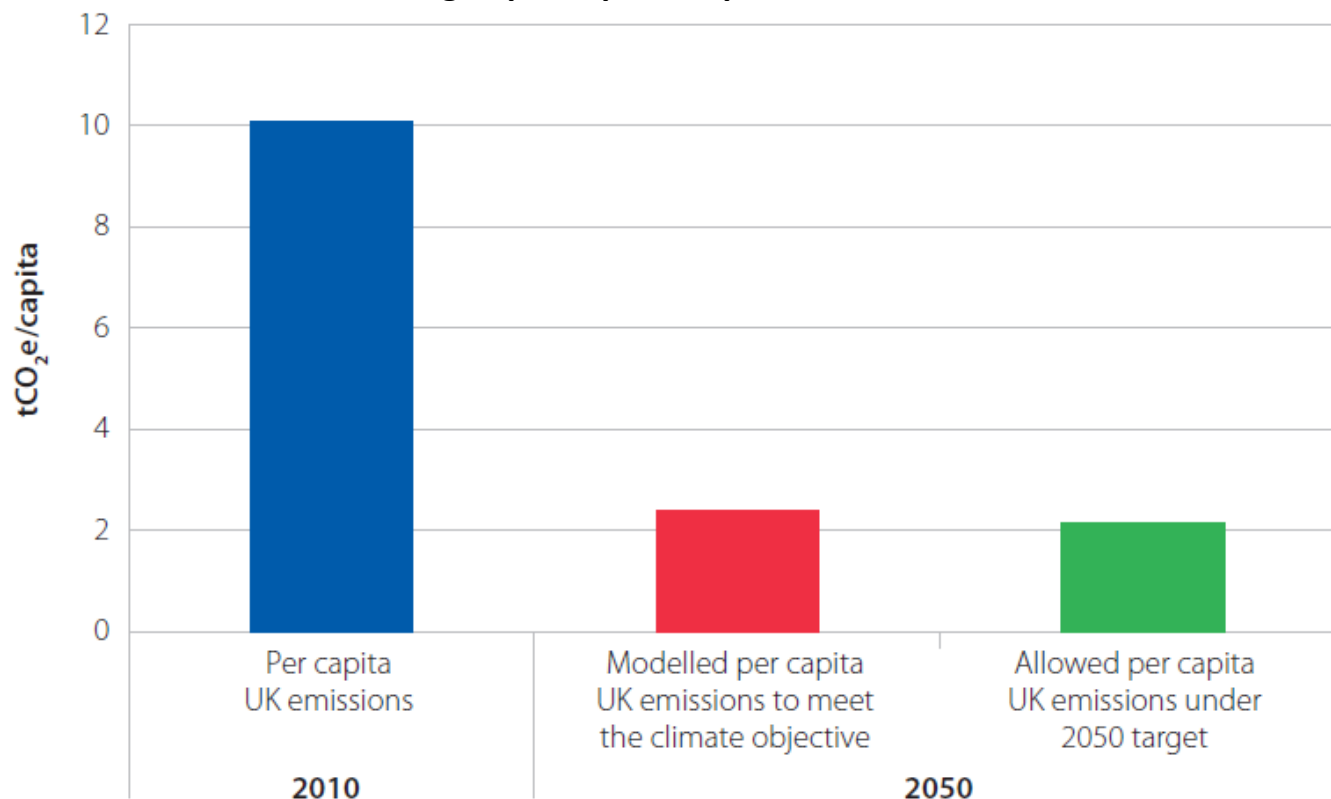
In world where global carbon intensities are reduced based on Copenhagen pledges only, the UK's imported carbon footprint could be 3x production emissions in 2050



# Key finding 3: The UK is likely to remain a net importer of carbon...

...implying it will be more challenging for our trading partners to meet targets  
This has implications for how UK should plan to meet 2050 target (e.g. through domestic emissions reductions rather than purchase of expensive credits)

Global modelling of per capita UK production emissions in 2050



Source: CCC analysis; UCL-TIAM (2012)

# Challenges, caveats, and uncertainties



## 1. Emissions

- CCC and IEA future emissions trajectories needed to be aligned with historic emissions data by sector in the Eora datasets. As for some sectors there was no 1:1 alignment, we aggregated some CCC/ IEA sectors in order to better align with Eora emissions data.

## 2. Economic output

- We used IMF and OBR projections which may not be necessarily aligned with bottom-up projections for output in the IEA analysis

## 3. Production structure

- We've held these constant at 2010 levels

## 4. Import / domestic demand projections

- Highly speculative

Given the exploratory nature of the scenarios and uncertainties, we focus on broad conclusions rather than specific detailed results

# Structure of presentation

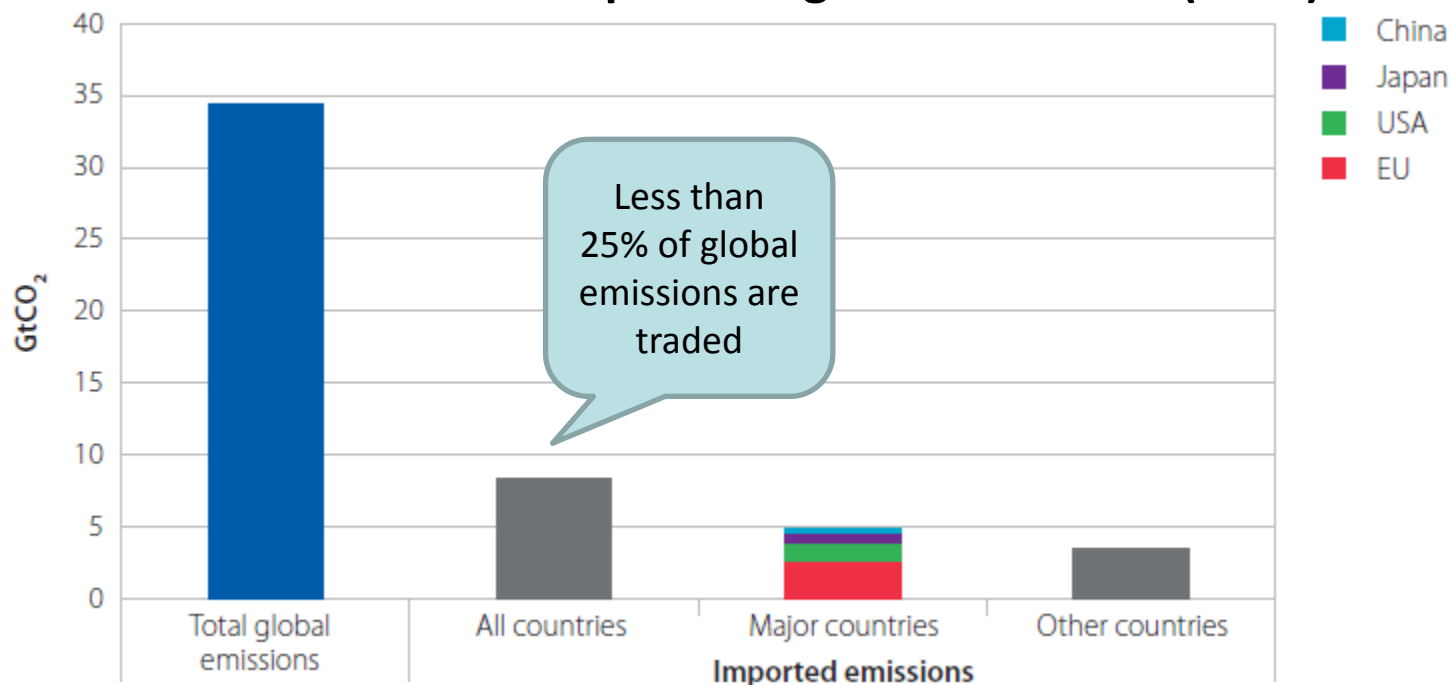
- Historical estimates of UK consumption emissions
- Scenarios for future UK consumption emissions
- Policy options

# Policy options

- ◌ An ambitious and comprehensive **global deal** driving new policies is essential so that global emissions are reduced in a manner consistent with the climate objective, as a consequence of which UK imported emissions would fall
- ◌ Supporting policies could help to reduce the UK's carbon footprint
  - Sectoral agreements
  - International climate finance
  - Carbon footprinting
  - Consumer information
  - Regulation
  - Reuse, recycling, resource efficiency

# Border carbon adjustments: There is no real alternative to a global deal

## Traded emissions compared to global emissions (2010)



- Could not substitute for a global deal given limited potential coverage and need for other policies in addition to a carbon price.
- Should not be ruled out as a possible transitional measure if there were to be slow progress agreeing a global deal

## Carbon budget accounting

- It remains appropriate to account for carbon budgets on basis of production emissions given accounting conventions and available policy levers
- Consumption emissions should be monitored to check whether these are falling in line with global action required to achieve the climate objective, or whether further action is required

CCC to report periodically on consumption emissions as part of our reporting on progress reducing emissions as part of broader monitoring of progress towards design and implementation of a global deal, identifying any further action as appropriate

- CCC “Reducing the UK’s carbon footprint and managing competitiveness risks” summary and technical reports, supporting data and consultancy work available at:  
<http://www.theccc.org.uk/publication/carbon-footprint-and-competitiveness/>
- Government estimates of UK carbon footprint available at:  
<https://www.gov.uk/government/publications/uks-carbon-footprint>