Science meets Politics: The International Art of Accounting for Greenhouse Gas Emissions

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Topics for today

- Overview of climate science in Government
- What is a GHG Inventory, and why is it needed?
- How is the UK's Inventory calculated and verified?
- How are GHGs accounted for worldwide?

Take home messages

1. Estimating a country's GHG emissions is complex and highly reliant on the quality and availability of the input data
2. The nature (and quality) of GHG emissions reporting varies widely worldwide
3. Reporting GHG emissions is a scientific act; accounting for them is political

BEIS' Climate Science Team has many roles

BEIS' Climate Science Team:

- Advises ministers and policy teams around Government – latest science and climate implications of policy
- Advises on engagement with the public on climate science issues
- Liaises with international bodies and advises international negotiations
- Funds research; Met Office Hadley Centre and the GHG Inventory

A GHG Inventory meets several international reporting obligations

- An annual calculation of a country's GHG emissions, compliant with:
  - The UN Framework Convention on Climate Change;
  - The Kyoto Protocol;
  - The EU's Monitoring Mechanism Regulation; and,
  - The UK's Climate Change Act.

  - **The IPCC's Reporting Guidelines for Inventories**
    - Transparent, Accurate, Consistent, Comparable, Complete

A GHG Inventory covers a wide range of gases

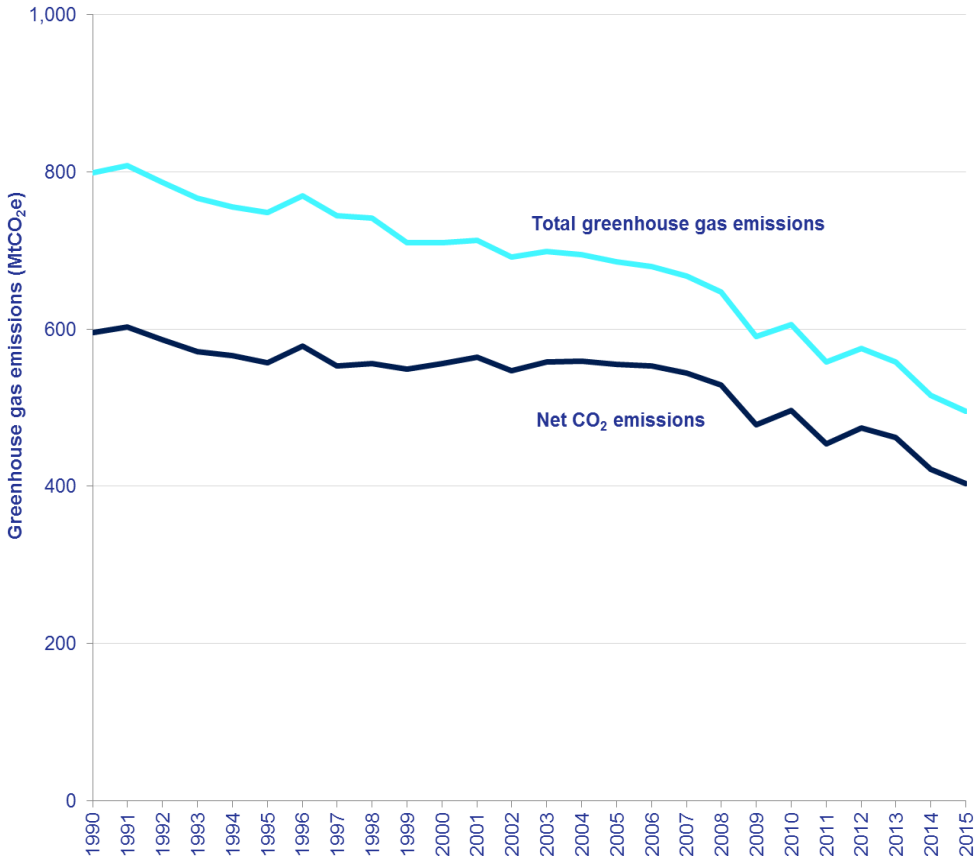
Direct GHGs:

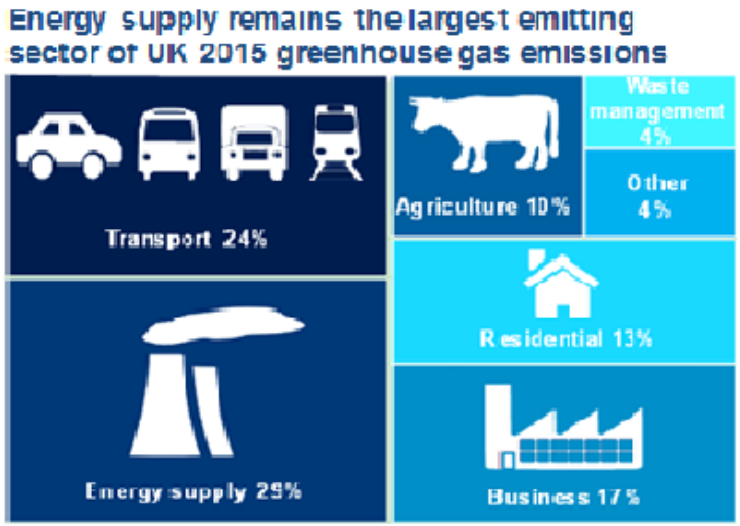
- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs);
- Sulphur hexafluoride (SF_6); and
- Nitrogen trifluoride (NF_3).

Indirect GHGs:

- Nitrogen oxides;
- Carbon monoxide;
- Non-Methane Volatile Organic Compounds (NMVOC); and
- Sulphur oxides (reported as SO_2).

UK GHG emissions are declining





Other includes Public and Industrial Process sectors (the Land Use, Land Use Change and Forestry (LULUCF) sector is excluded from the sector statistics above as it acted as a net sink of emissions). Please note the percentages above do not sum to 100% due to rounding

Calculation methods are based in 'tiers'

Tier 1 – Simple methods with default emission factors

Tier 2 – Similar to tier 1, but with country specific emission factors and other data

Tier 3 – more complex approaches (such as models)

At the simplest level, an emission is calculated by multiplying an activity with an emission factor:

Emission = Activity data x Emission factor

- CO_2 = Fuel carbon content x 44/12 x fuel use
  (different Carbon factors for different fuels)
- CH_4 = Methane EF per cow x Number of cows
  (different methane factors for different livestock: weight, feed, manure management practices)

The scale of the calculation is huge

Input Data

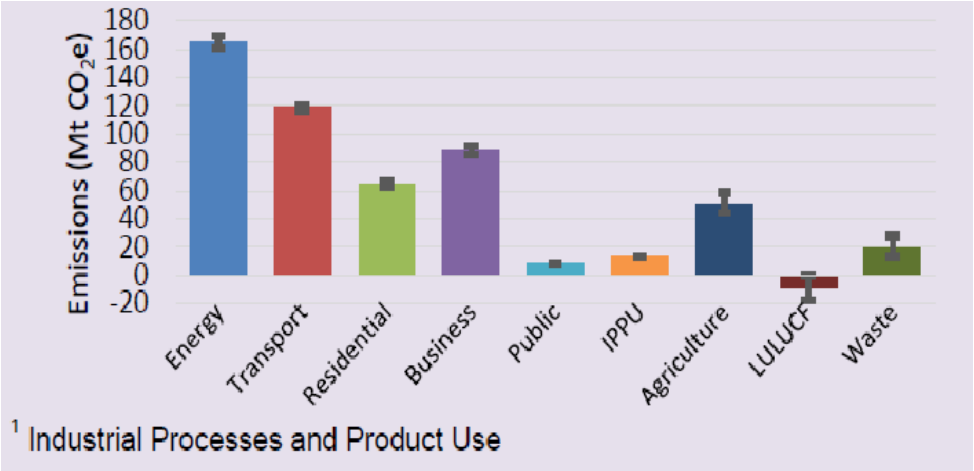
- 874 data source references, 504 sources of emissions factors
- ~60,000 data points in the UK National Energy Statistics
- 306,789 records from 7,387 Pollution Inventory authorisations
- >1000 EUETS installations
- >600 bespoke models

Output Data

- 59,215 activity data records
- 547,626 emission factors
- >2500 source/activity/pollutant combinations for the UK, for each year
- >5000 point source installations

The Inventory has inherent uncertainties

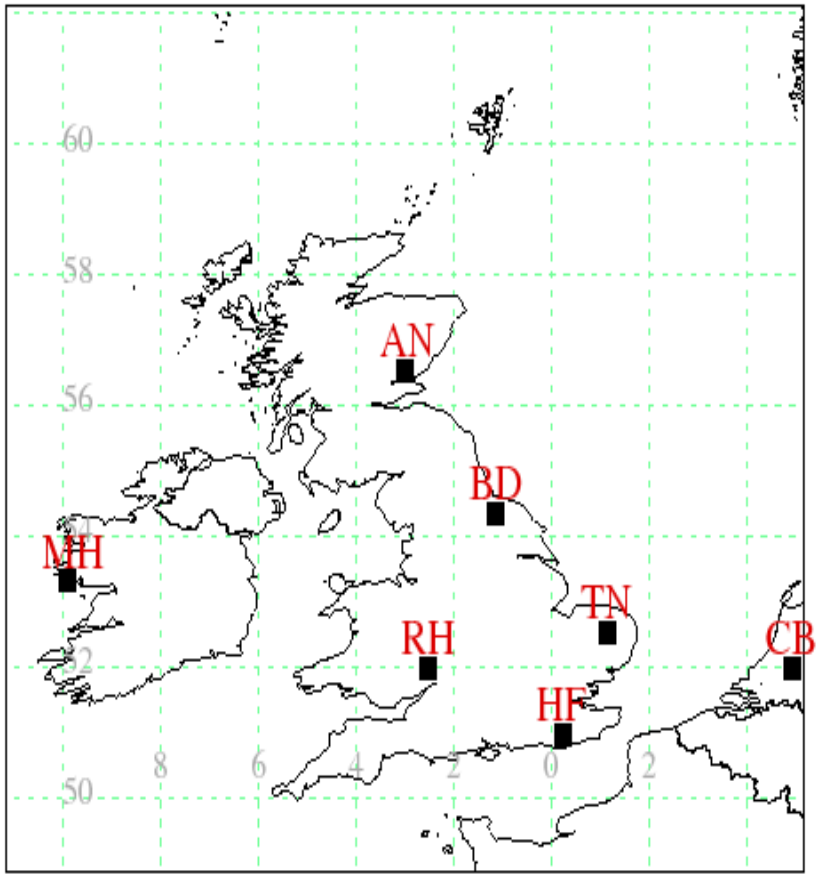
- The estimated uncertainty in total net GHG emissions in 2015 was +/- 2.8%, at a 95% confidence level
- The trend in the total expressed as the fall between 1990 and 2015 is -38%, with a 95% confidence interval of between -35% and -41%
- Uncertainties are estimated using a Monte Carlo simulation



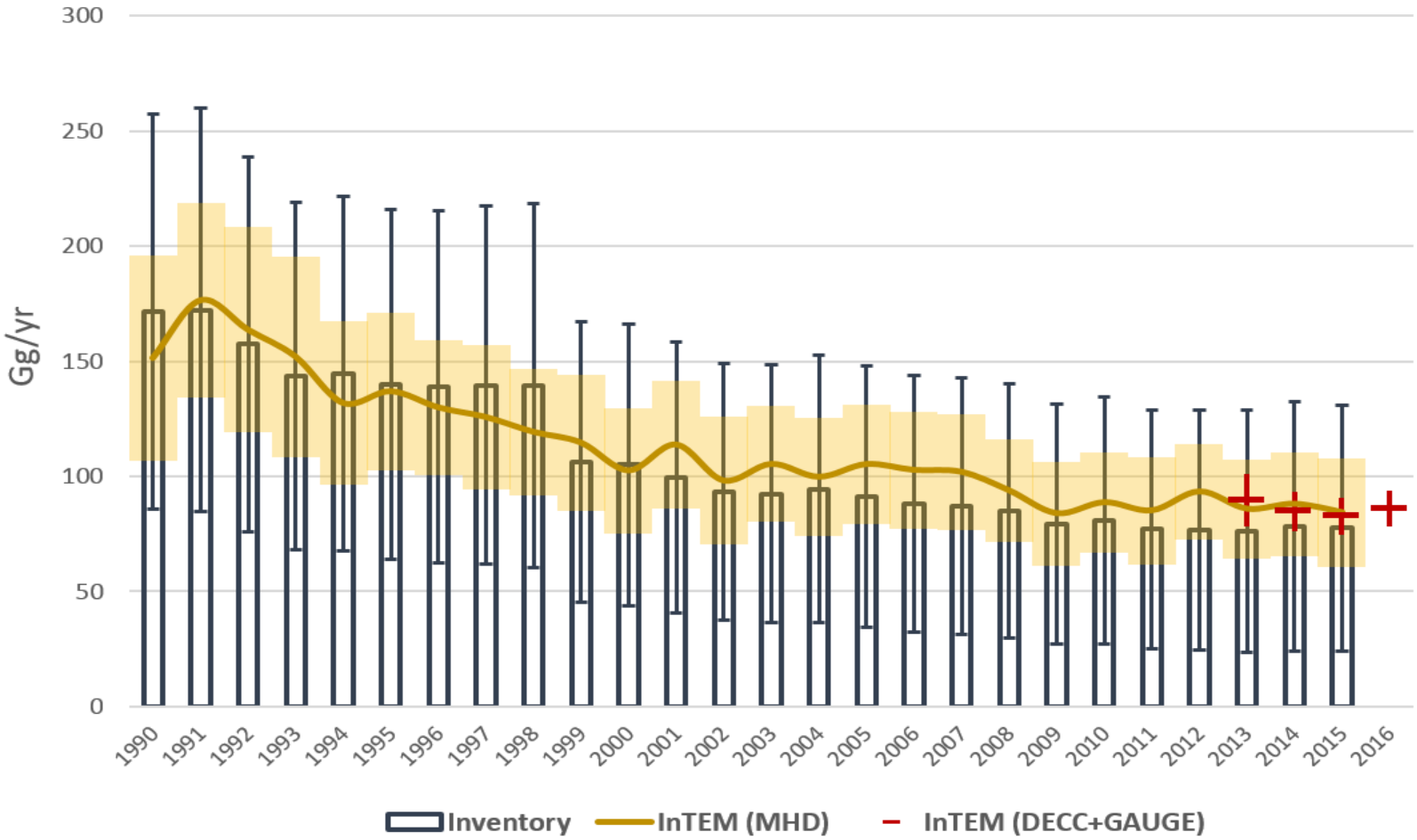
But uncertainty analysis only covers the known unknowns!

The Inventory is verified using atmospheric measurements

- BEIS funds 4 measurement stations across the UK and Ireland
- Inverse modelling answers the question – *what must UK emissions have been over this time period to result in these atmospheric concentrations?*
- Measurements are used for wider research purposes



The verification of N_2O is very encouraging…



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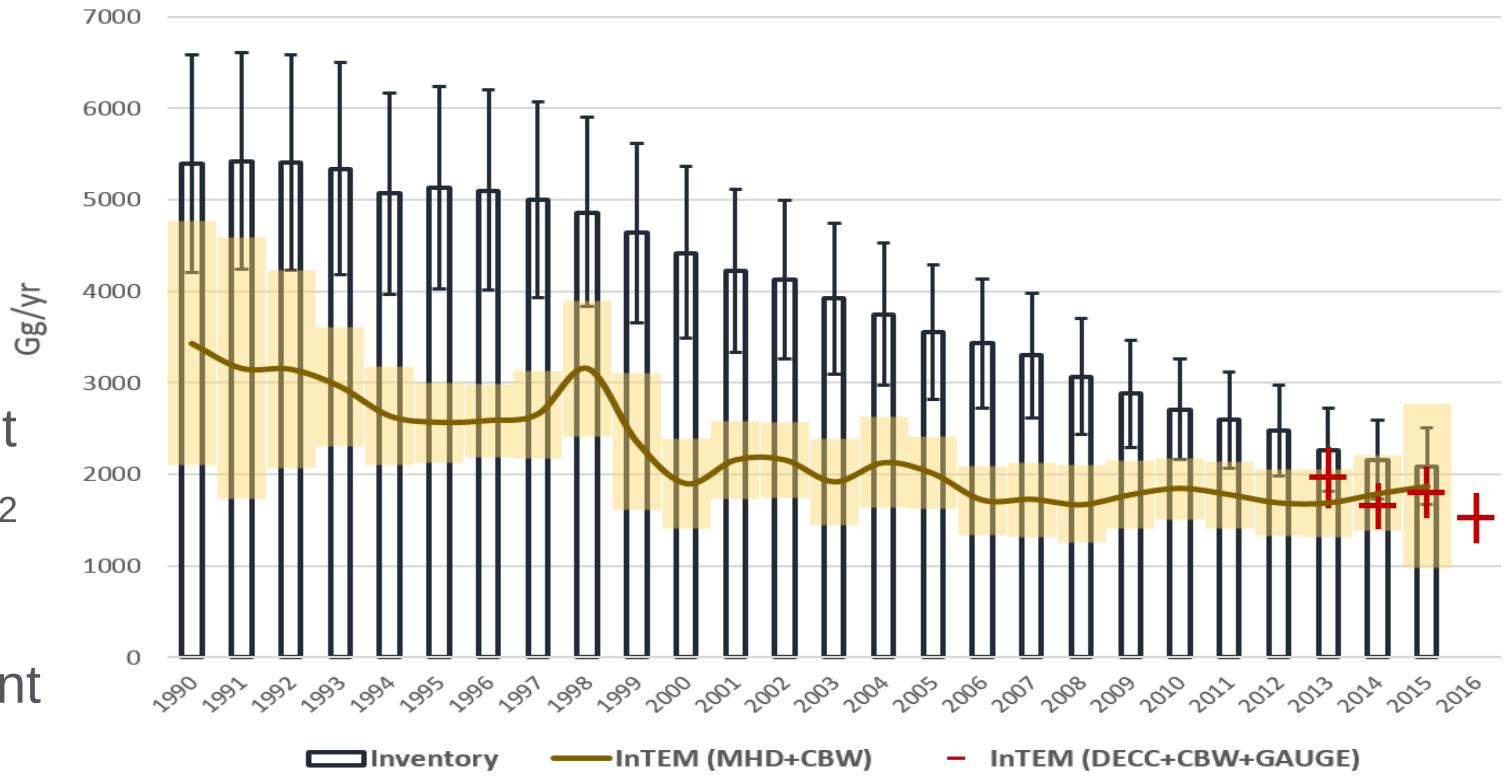
…the verification of CH_4 somewhat more challenging

We do not verify CO_2 due to its biogenic component



The Paris Agreement will need to widen these processes to developing countries

- Countries will submit Nationally Determined Contributions
- System designed to ramp up ambition
- Details of monitoring, reporting & verification are now being negotiated
- What do we expect of countries just beginning to report GHGs, facing:
  - Lack of data collection systems?
  - Cultural barriers?
  - Lack of expertise?

Reporting GHGs is scientific; Accounting is political

- What is measured and reported becomes a country's responsibility
- Complicates GHG accounting for:
  - International shipping and aviation
  - Road transport fuels & fuel tourism
  - Land use, land use change & forestry
- The current system assigns responsibility for GHG emissions **to those who have the influence to reduce them**
- Another perspective is to assign GHG emissions **to those who are responsible for their creation**
  - Embedded, or consumption based, emissions calculations are very uncertain

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Thank You

Any Questions?

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