Development of GHG emission projections - experience of UK

LTES Webinar

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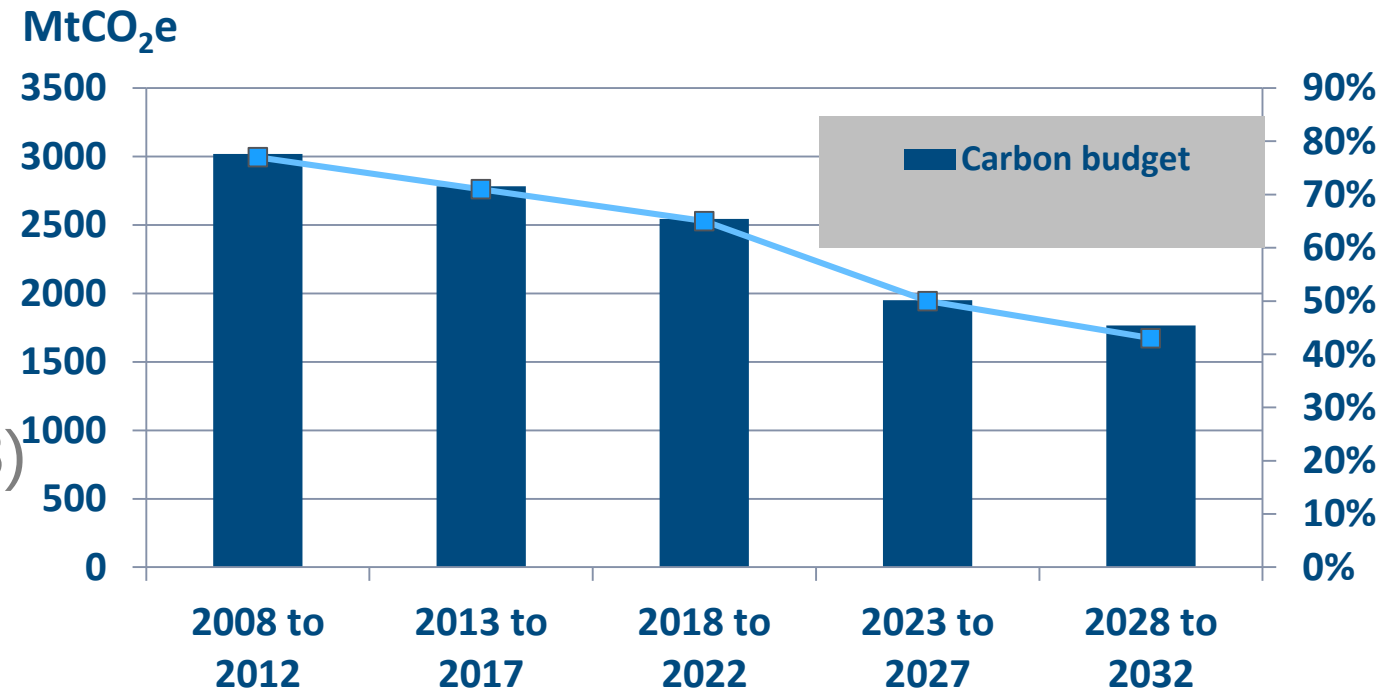
Department for Business, Energy & Industrial Strategy

Carbon budgets

- The UK signed international agreements to tackle climate change (Kyoto Protocol, UNFCCC)
- The Climate Change Act (2008) sets the government plan to reduce GHG emissions
- Carbon budgets are set to meet the targets



Note: Many policies which will affect the 2020s and beyond have not yet been developed to the point at which they can be included in these projections

Projections published annualy…

Updated energy and emissions projections: 2017

Projections of greenhouse gas emissions and energy demand from 2017 to 2035.

Published 2 January 2018
From: Department for Business, Energy & Industrial Strategy

Documents

Updated energy and emissions projections 2017

PDF, 614KB, 49 pages

This file may not be suitable for users of assistive technology. Request an accessible format.

Annex A: Greenhouse gas emissions by source

MS Excel Spreadsheet, 546KB

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Related content

Published by
Department for Business, Energy & Industrial Strategy

Collection
Energy and emissions projections

Policy
Greenhouse gas emissions

Energy and climate change: evidence and analysis

Emissions: methodology

Historic emissions come from the Green House Gas Inventory

Projecting emissions:
Energy (combustion) related GHG emissions projections are calculated within the EEP

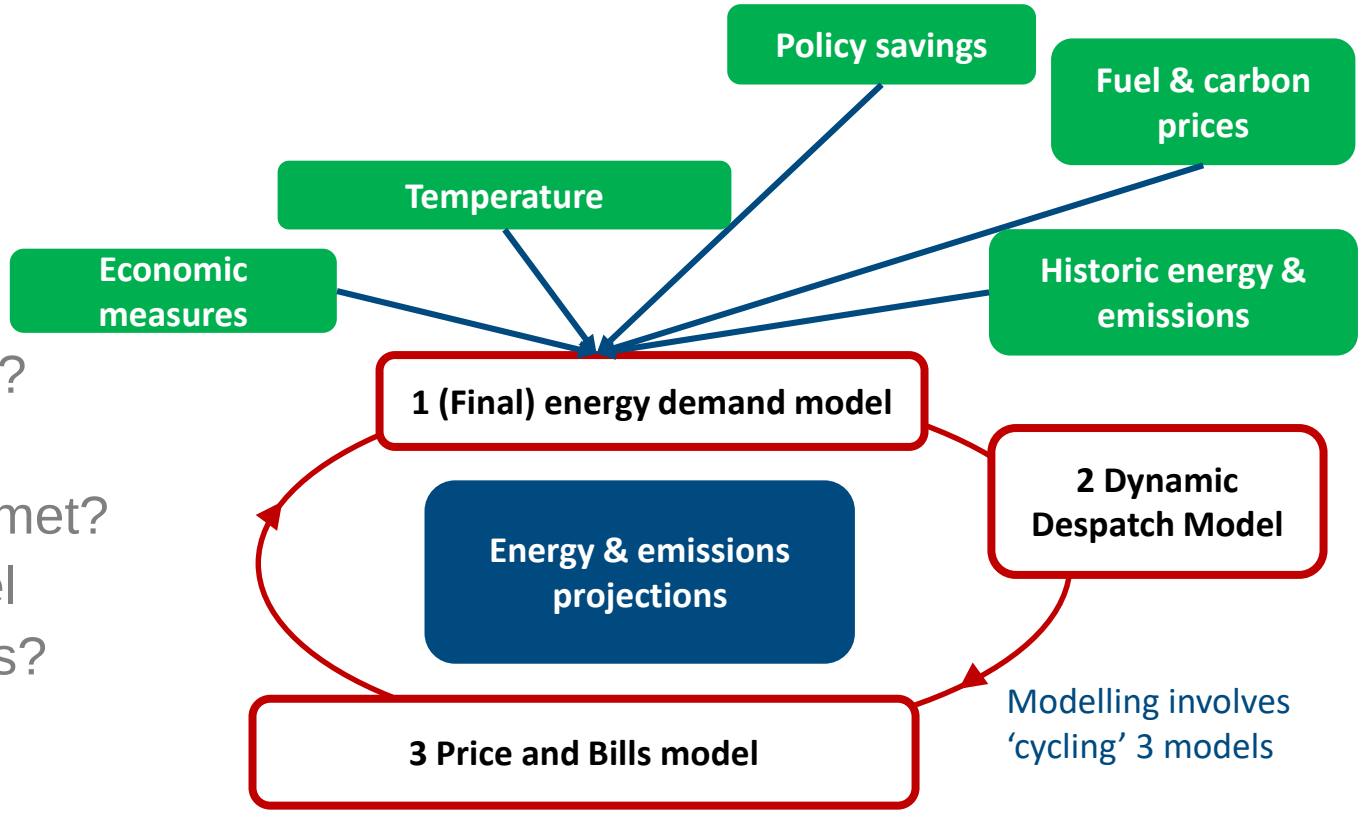
However some emissions are calculated exogenously and incorporated into projections:

- DEFRA and the Centre for Ecology and Hydrology (CEH) provide projections for agriculture, waste and LULUCF for all GHGs
- Non-energy non-CO_2 projections (e.g. commercial refrigeration) are provided by the non-CO_2 team

Emissions: methodology

Model inputs are shown in green
These are updated each year

Models are shown in red
1 How much energy will we need?
Energy Demand Model
2 How will electricity demand be met?
Dynamic Despatch Model
3 How much will it cost customers?
Prices and Bills Model



Projection of energy demand – inputs

Assumptions	Source
Retail Fuel prices	Fossil fuel prices modelling
Carbon prices	Carbon price model for EU, UK Government announcements on Carbon Price Floor
Exchange Rates	Office of Budget Responsibility (OBR)short term forecast
Economic growth	OBR: medium term growth (EFO, 2014-18) and long term trend growth (FSR, 2019-35). IMF: world growth (for industry sub-sector growth)
Weather	Meteorological Office projections
Population and household projections	Scenarios generated by ONS (population), modified MHCLG and Devolved Administrations (households).

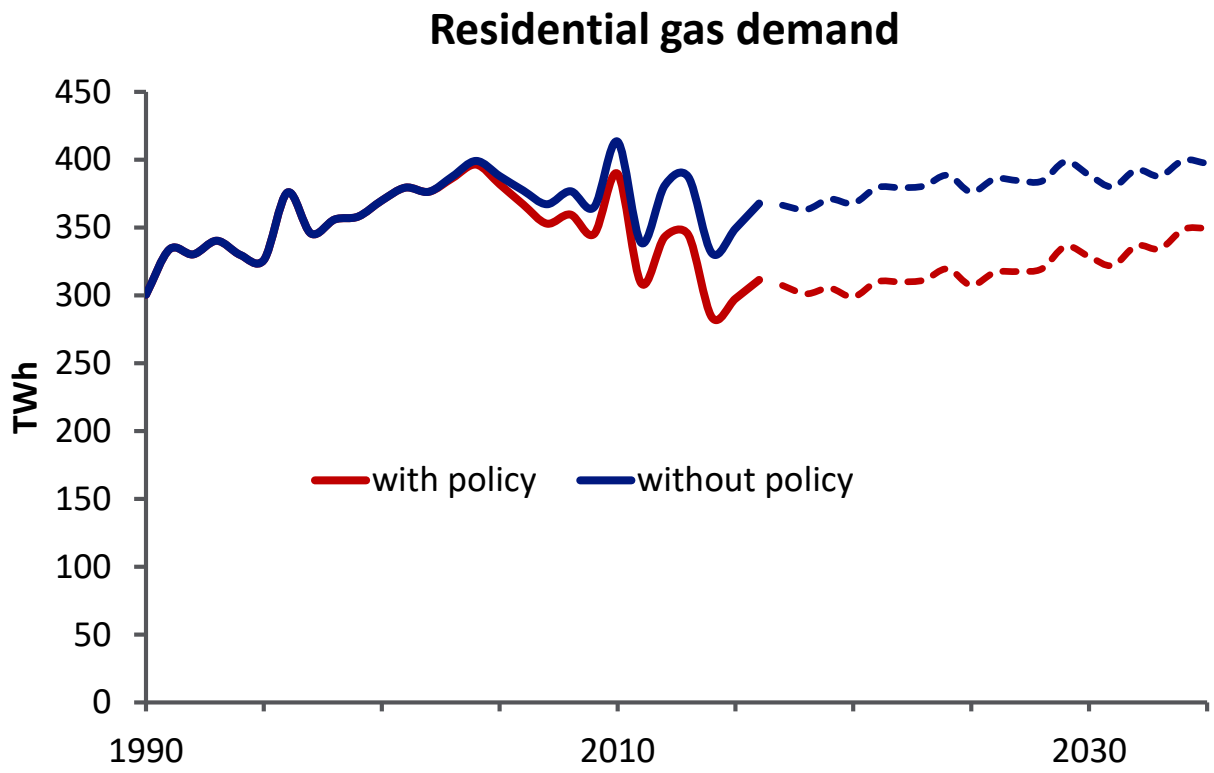
Projection of energy demand - modelling

- There are over 2500 equations in the EDM
- Regression analysis using historical data to explain trends
- Projections from elsewhere, e.g. household are used to project demand
- Temperature correction in equations where regression analysis shows it to be useful
- Inputs also contain an
    - industry growth model and
    - simplified version of Department for Transport National Transport Model
- Equations have to be revised regularly as trends change
    - We use “back casts” to select the poorest performing equations for revision
    - Occasionally we engage third parties to update the equations, mostly done in house
    - Industry equations were revised by academics at UCL

Inclusion of policies and measures

Most sectors project without policy savings:

1. Take historical energy demand by fuel from DUKES (UK energy statistics)
2. Add the estimated impact of historical policy savings to get counterfactual demand without quantified policies
3. Project counterfactual demand using econometric models
4. Subtract estimated future policy savings



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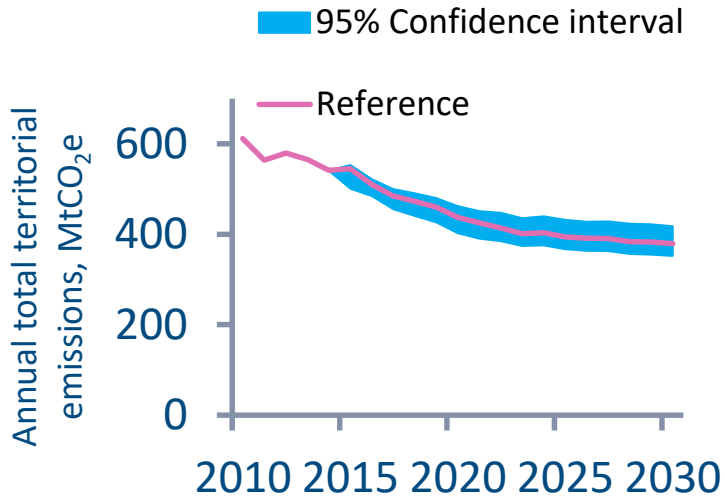
Uncertainty

Medium term

- Confidence interval is produced by Monte Carlo using sets of some EDM input variables.
- Need care with strongly correlated with each other, e.g. population and GDP growth

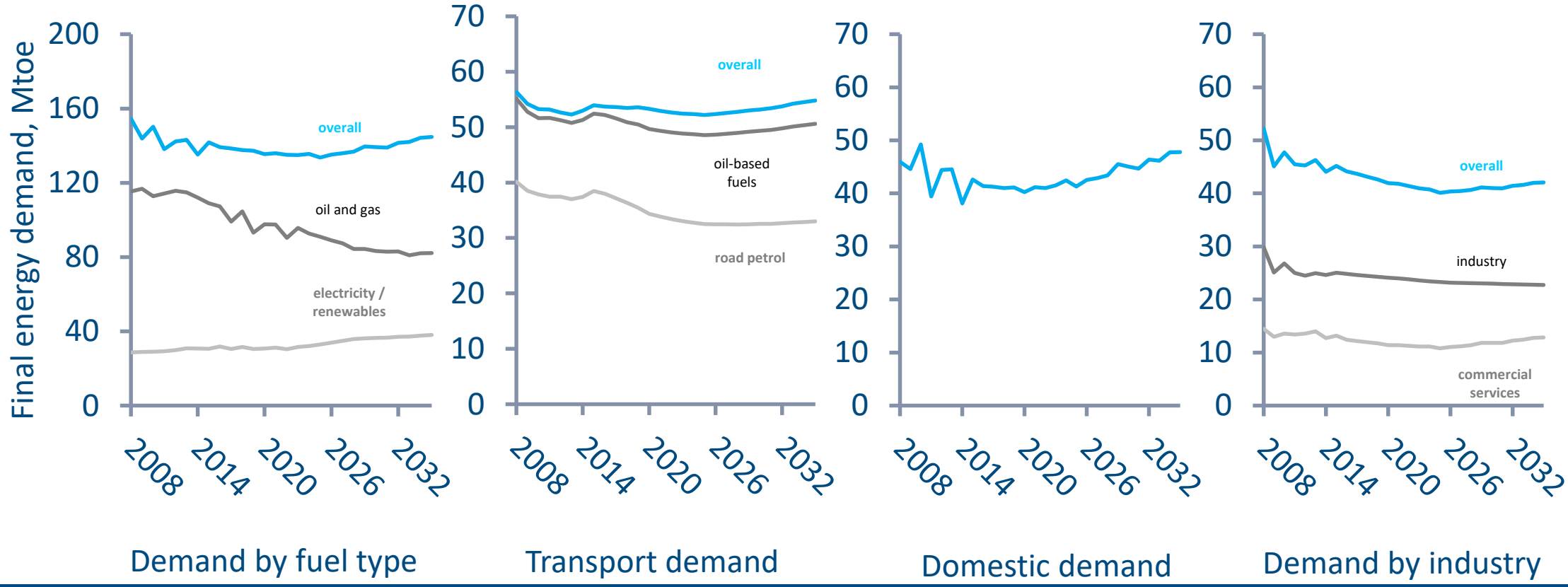
Long term

- Scenario analysis e.g. effect of tightening interim budgets on overall cost



Projection of energy demand - results

From Updated Energy and Emissions Projections 2015



Demand by fuel type | Transport demand | Domestic demand | Demand by industry

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Beyond 2035 – modelling scenarios

We use UK TIMES:

- A least cost optimization model for the whole UK energy system (2010-2060)
- Regularly updated
- Part of a global network of nearly 70 national teams
- Developed by the IEA's Energy Technology Systems Analysis Program (ETSAP)
- Extended by UCL and modified by BEIS

Given that:

- Future (assumed) demand for energy must be met
- This must be done at the lowest possible cost
- Technology constraints have to be respected, e.g. build rates
- There is perfect knowledge of the future energy system

What can UKTM do well?

It helps to answer these questions:

What is the least cost way to configure the UK energy system

Explore sensitivity to changes in input assumptions

How different energy vectors change over time

Almost certain our actual pathway will not be the one set out in the least cost pathway

UK TIMES can tell us:

…key technologies that are important for reaching 2050 in a wide range of scenarios

…the broad order of actions to decarbonise the economy

…assess consistency with developing key technologies and decarbonising order

… sensitivity of the least cost path to changes in assumption

What can't UKTM do well?

UK TIMES cannot tell us…

…which precise Carbon Budget level best balances costs and risks. UKTM always seeks to delay action for as long as possible subject to constraints

… exact costs - better to examine relative differences

…which precise pathway is most likely to be cheapest

… the effect of learning rates on technology deployment

…the impact that barriers to deployment could have, as it is a model of technical potential

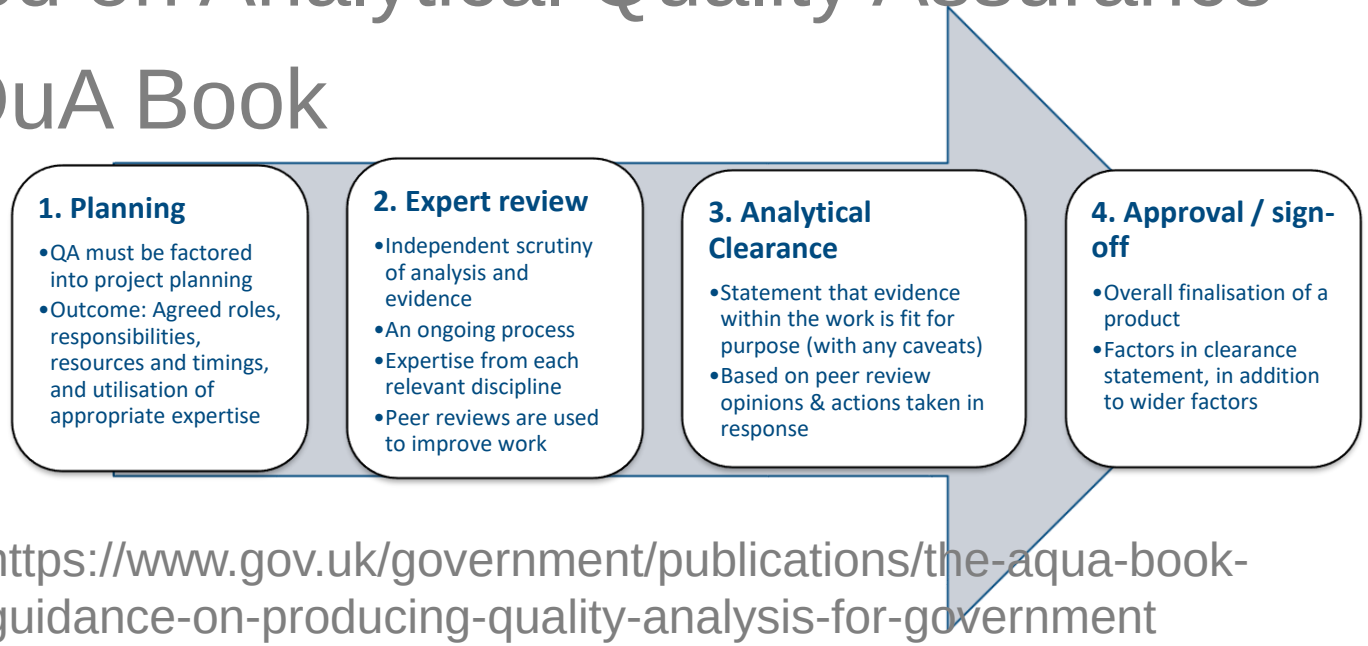
…how technology costs might change with uptake of measures

…about specific regional impacts

…what the policy cost implications are

Assurance in BEIS

Based on Analytical Quality Assurance – AQuA Book

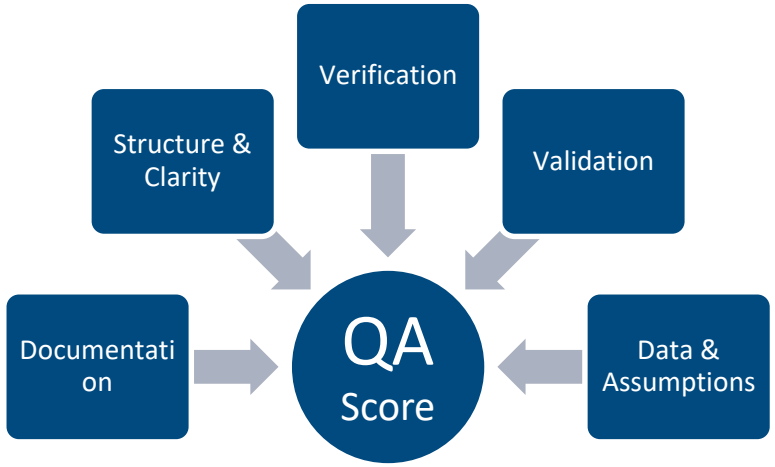


https://www.gov.uk/government/publications/the-aqua-book-guidance-on-producing-quality-analysis-for-government

Commissioner	• Holds overall **accountability** for the success • **Responsible** for considering the advice provided in the QA Clearance Statement
Assurer	• **Responsible** for: advising the Commissioner of the evidence requirements and on the quality of the evidence and risk • **Accountable** for the advice they provide and the clearance statements
Lead Analyst	• **Responsible** for planning the development and **QA** provide.
Peer Reviewers	• **Responsible** for providing their expert views and agreeing appropriate mitigating actions for issues identified

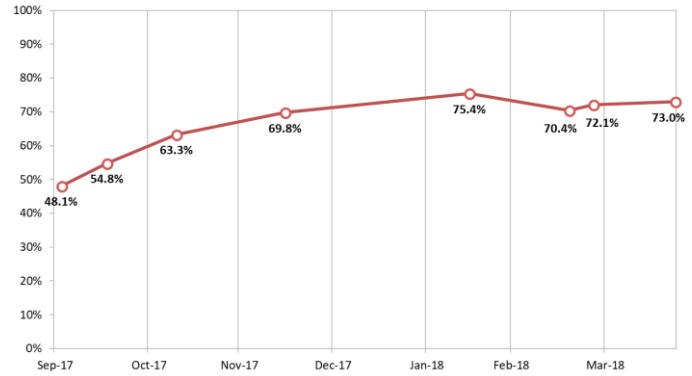
Modelling Quality Assurance

The QA Log is the key document – it produces a % score from 5 categories



Facilitated by:

- Model Report introduces the model, collecting key information in one place
- Assumptions log often essential to understand risks and uncertainties
- Excel Model Template integrates good spreadsheet practices



Learning points

- Keep models as simple as possible – start with minimum and build
- Ensure model inputs are aligned between models
- Build in quality assurance and time to iterate models
- Spend time working with customers to understand their requirements

The End