

Modelling the impact of the implementation of response measures

Presentation to the workshop on Matters relating to Article 2, paragraph 3, and Article 3, paragraph 14, of the Kyoto Protocol

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Introduction

- **Background**
 - Cambridge Econometrics (CE) is an economics consultancy specialising in economic modelling
 - CE has developed three integrated models (MDM-E3, E3ME and E3MG) which can be used as tools to assess the impacts of response measures
 - CE has experience in impact assessment of response measures in the UK, the EU and globally
 - CE was asked to undertake a project for UNFCCC to classify and document models suitable for analysing response measures

Terms of reference

- In this presentation, modelling refers to socio-economic modelling and not climate modelling
- In terms of socio-economic modelling most research on response measures is in mitigation
- Modelling is not a one-stop shop - other approaches are important:
 - case studies
 - surveys
 - non-modelling quantitative approaches eg cost effectiveness analysis
 - qualitative assessment

Overview of presentation

- How can modelling approaches assist policy-makers?
- What makes a model suitable for assessing the impact of response measures?
 - UNFCCC model database
- What is the current model-based evidence on the impacts of response measures?
- What are the state-of-the-art modelling developments?
- How can modelling research be shared across parties?
- What to do if you want to learn more

Why is modelling relevant to this issue

- **Uncertainties**
 - energy sector is uncertain (technologies, supply shocks, etc)
 - economy is uncertain (stock bubbles, market confidence, etc)
- **New policies implemented**
 - expected impact of new policies is unknown
 - socio-economic impact assessment of policy needed to inform policy process
- **Multiple factors**
 - policy area is complex mix of:
 - behaviour and technology
 - low carbon energy, renewables and energy efficiency
 - non-energy GHG emissions
 - tax, subsidy, trading systems, standards, etc
 - demand and supply interactions
 - temporal and spatial interactions

How can modelling approaches assist policy-makers: methods

- *Ex ante* (forward-looking) forecasts
 - to provide forecasts of energy consumption and emissions
 - to provide reference and ‘business as usual’ projections
- *Ex ante* (forward-looking) scenario/policy analysis
 - to provide impact assessments of policy proposals
 - sensitivity analysis, for example to consider different fossil fuel price assumptions
- *Ex post* (backward-looking) policy appraisal
 - give insight as to the relative success of a particular policy, so that successful policies can be identified and replicated

How can modelling approaches assist policy-makers: Outputs

- **Direction**
 - overall is there an economic and/or environmental gain or loss
- **Scale of policy impact**
 - what scale of impact
- **Distribution of impacts**
 - who wins, who loses
 - spatially, sectorally, producers or consumers, etc.
- **Temporal impacts**
 - when are the impacts felt, gradual or shock?
 - today's loss for tomorrow's gain or vice-versa?

What makes a model suitable for assessing response measures?

- **Energy-environment (direct impacts)**
 - energy models
 - lots of technical detail
 - no economy interactions
- **Economic and social linkages (indirect impacts)**
 - e.g. impact of a proposed carbon tax on low-income households
 - requires either integrated energy-environment-economy (E3) models or Integrated Assessment models
- **Unintended consequences**
 - e.g. demand and supply interactions; spatial and temporal considerations
 - model needs to provide framework for specific policy assessment in the wider context

UNFCCC model database: Overview of model database

- UNFCCC project brief was to provide a database of **established** modelling resources
- The database contains:
 - model name
 - organisation(s) contact details
 - brief description
 - summary of particular relevance
 - geographical and sectoral detail and coverage
 - recent papers (at the time)

UNFCCC model database: Overview of model database

- The database can be accessed on the UNFCCC website:
 - http://unfccc.int/cooperation_support/response_measures/items/5112.php
- Why is it useful?
 - directory of models and modelling organisations
 - links to recent published research
 - allows the user to compare models and modelling approaches
 - classifies models between
 - energy technology models
 - integrated energy-environment-economy (E3) models
 - Integrated Assessment models

What is the current model-based evidence on response measures?

- Consensus based modelling research of the IPCC
 - considerable GHG reduction is achievable
 - mitigation costs are ‘likely’ to range between -1% and 5.5% of GDP depending on scale of GHG reduction
- Non-consensus based research
 - considerable GHG reduction is achievable, but...
 - scale of economic/social impacts is widely contested, depending on:
 - modelling approach and assumptions
 - policy mechanisms
 - inputs, e.g. fossil fuel price assumptions or economic growth
 - spatial considerations, temporal considerations, sector considerations
 - distribution and scale of impacts is contested – even within academia
 - while some ‘win-wins’ exist for individual sectors and countries, this is sometimes at a cost to other sectors and trade partners
- A more regular, consensus based approach to supplement the IPCC work could be helpful

State-of-the-art developments in modelling response measures

- **Regional coverage**
 - expansion of models to cover countries and regions in more detail, particularly non-Annex I parties where data is improving
- **Sector coverage**
 - increasingly detailed economic sector coverage
 - extending emissions sources beyond energy, e.g. waste and forestry
- **Hybrid modelling**
 - technology based 'bottom-up' models supplement top-down macro-modelling frameworks
 - helps to understand problems of technology uncertainty, non-linearities and irreversibility
 - more detailed links to climate models to understand climate pathways
- **Uncertainty modelling**
 - risk, rather than cost, minimisation models

UNFCCC model database: how could it be more useful?

- Updated with recent research
- Portal for all modelling papers
 - modelling groups encouraged to upload research
 - Parties who commission research using these models could publish it openly through portal to share with other parties
 - peer review process
 - synthesis process
- Central information point for a consensus based modelling forum/group?
- Further standardization of assessment of modelling approaches
 - synthesised meta-analysis

How can model-based research be shared among parties?

- A good approach could be a coordinated modelling forum/platform?
 - similar to the Energy Modelling Forum (EMF)
 - run through Stanford University
 - purpose is to test policy proposals consistently across a variety of models
 - for more details, see:
<http://emf.stanford.edu/>
 - could bring the EMF (or an extended EMF) into the UNFCCC process
 - consisting of a wide range of modelling organisations
 - representation from parties in forming research questions and assumptions
 - modelling groups to provide research working papers on a regular basis
 - regular synthesis reports for parties
 - integrated with UNFCCC model database

How can modelling groups assist policy-makers?

- What, specifically, can international research and consultancy modelling organisations provide, as opposed to model-based research within ministries/departments?
 - independent analysis
 - expertise of personnel (easier to retain)
 - experience and case studies
 - organisational capacity
 - multiple party collaboration/coordination
 - independent organisations can cover maintenance costs more efficiently

Want to learn more? Next steps

- Look at the UNFCCC database
 - consider modelling needs
 - consider potential suppliers, recent papers, model suitability
- Discussion with us
 - at Cambridge Econometrics we are happy to engage with all policy-makers to discuss:
 - policy research topics
 - required modelling approaches
 - potential suppliers/approaches
 - recent modelling research in the policy area
- Discussion with modelling researchers
 - modelling groups are usually objective
 - modelling groups should tell you whether their approach is relevant and suitable to inform the policy topic debate

Want to learn more? Contact us

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