Modelling the impact of the implementation of response measures

Presentation to the workshop on promoting risk management approaches on the specific needs and concerns of developing countries

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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

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Overview of presentation

- What is the role of modelling in this context?
  - identification of risks
  - understanding the impacts
  - scenario analysis – an example on South Africa
- What are the limitations of modelling in this context?
- What is the current evidence?
- Which models listed in the UNFCCC database are suited to this analysis?

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How can modelling approaches assist policy-makers in this context: methods

- *Ex ante* (forward-looking) forecasts
  - to provide forecasts of energy consumption and emissions
  - is falling coal demand in the EU offset by increasing demand in China?
- *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
  - are policies and pathways certain, or are there many pathways to low carbon economies?
  - technology pathways are key to the socio-economic effects

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How can modelling approaches assist policy-makers: outputs

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

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What makes a model suitable for assessing response measures?

- Energy-environment (direct impacts)
  - technology pathways are critical to this analysis
- Economic and social linkages (indirect impacts)
  - in this context, the better models have lots of energy technology detail, as well as in depth regional/country coverage of socio-economic factors
- Unintended consequences
  - e.g. the decision not to continue with nuclear technology in some countries will have substantial implications for the development of other technologies

Scenario analysis, an example on South Africa

- Policy detail matters
  - eg Jooste et al, undertook a study using GTAP-E which reports that coal exports from South Africa will reduce substantially following reductions of 25% by Annex I countries, but…
  - this assumed that the major policy to reduce GHG emissions does not lead to, or aim to deliver, large scale coal CCS
  - how does this fit alongside recent decisions to not build new nuclear?
  - mis-interpretation of modelling studies and policy details can lead to mis-leading conclusions

What type of modelling analysis could inform this process?

- Detailed policy scenario analysis, which:
  - includes a wide variety of plausible pathways to low carbon economies in Annex I Parties
  - the models used require sufficient energy sector detail to identify the role of new technologies, alongside the relevant socio-economic and trade relationships
- but, there are still limitations with this approach
  - probabilities cannot easily be attributed to scenarios; dialogue and qualitative analysis is needed to inform the research
  - data on non-annex I countries is not always available
  - solutions are not explicitly offered by modelling results, although they can be both inferred and in some cases tested

What is the current model-based evidence?

- In this specific context the evidence is limited
  - there is analysis which assesses the impact of single instruments, eg cap and trade schemes
  - there is no comprehensive analysis which looks at the impact of different policy/technology pathways on **developing countries**
- but, there is still modelling information which could inform the debate
  - individual countries undertake low carbon 'pathways' analysis
  - work of the IEA published in the 'World Energy Outlook'

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Which models listed in the database could inform this policy question?

- Arguably, all of them, but specifically:
  - energy models can inform the low-carbon pathway analysis, eg MARKAL, MESSAGE, SAPHIRE, WEM
  - global E3 and IA models with reasonable country data and detailed energy system analysis can also inform the low-carbon pathway analysis, set within the wider socio-economic context, eg E3MG, FAIR, PACE, TIAM
- Model development is necessary which:
  - integrates bottom-up energy technology models with detailed top down socio-economic models
  - expands the regional/country coverage to non-annex I parties

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