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Workshop: Linking CGE and TIMES Models

Overview of current macroeconomic modelling situation:

Why might linking CGE and TIMES models be important for UK policymakers?

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EPSRC EUED project 'Energy saving innovations and economy-wide rebound effects'
http://cied.ac.uk/research/impacts/energysavinginnovations

Project partners: EUED CIED centre at Sussex; CEP and Fraser of Allander Institute at Strathclyde; external collaborators on different WP

Today's workshop: a joint event with Scottish Government CXC programme

And put together with the assistance of colleagues I reached out to at or after this year's IAEE conference in Bergen….

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Starting from a CGE point of view…..

- Multi-sector economy-wide models increasingly commonly used in policy analysis and evaluation ***where focus is on/includes economic impacts***
- Energy Saving Trust – input-output (IO) models to estimate ripple or multiplier effects in economic output and job creation resulting from investment in *making* energy efficiency improvements
- Scottish Government – wider use of IO models to consider multiplier effects of range of investments and demand changes
- Scot Govt. and HM Treasury – embed IO data in more sophisticated computable general equilibrium (CGE) models to consider fuller economic and fiscal implications of wider range of changes in economic conditions
- **Our current project** – CGE modelling to consider economy-wide impacts of increased energy efficiency

How did the CGE-TIMES question arise?

- CGE simulations: nature and magnitude of economy-wide impacts of increased energy efficiency sensitive to what we assume about energy supply
- Specifically, capacity (and price) decisions when demand for energy supply sector outputs reduces as a result of increased efficiency
- Our current CGE model – competitive energy supply and smooth adjustment in capital stock
- Need to improve to consider issues of imperfect competition, market structure
- Crucially, timing of decisions to ‘disinvest’
- Reconsider the economic specification within the CGE?

And/or…..

Can TIMES (alone) give us information on an ‘energy supply curve’?

From the other side….

- TIMES increasingly commonly used to consider the energy system requirements to deliver on policy targets
- Tells us about contribution of different technologies etc. required in different time periods.

- **But doesn't really tell us how we get there**

- **Crucially, <u>the wider economy is typically 'exogenous'</u>**

Linking TIMES and CGE?

- Use of TIMES to develop scenarios
- Then simulate the wider economic impacts of these in CGE?
- Problem – CGE not really informing TIMES……

- **One focus of our project – REBOUND EFFECTS**

- **Key point: when something changes in energy supply, there will be responses, not only in energy demand**
- **Which will then impact back on energy supply….**

An example - CCS

- UK context: cancellation of the CCS Commercialisation Competition
- Questions about this and HMRC/HMT CGE model more generally in UK Parliament Environmental Audit Committee enquiry on ‘HM Treasury and Sustainability’
- One issue?
- Two government departments (DECC and HMT) using different models to inform decisions

- In TIMES – CGE a costly technology (often with consideration of reduced costs through learning etc.) to be turned on or off
- High start-up costs reflected in costs over time
- Benefits? Often unquantified benefit of reduced carbon

- Is this the whole story?
- Costs of CCS will develop over time depending on how implemented, uptake, how economy responds
- Wider economic benefits through consideration of carbon capture, transport and storage elements as ***economic service activities***
- ***Plus, to stand a chance against competing policy/spending priorities – needs to be considered in CGE model?***
- Considered in posters and presentation at recent UKCCSRC conference…

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Evaluation of an economic model for Carbon Capture and Storage systems

University of Strathclyde Engineering

Sagnik Ghoshal, Karen Turner* & Julia Race***

** Centre for Energy Policy, University of Strathclyde; **Department of Naval Architecture, Ocean and Marine Engineering*

EVALUATION OF CCS USING EXISTING ENERGY MODELS

The **DECC 2050 Energy Calculator** is an user-friendly model that allows consumers and professionals to engage in the climate change debate by considering implications of energy security, demand and other wider impacts.

Energy models used by the government (e.g. Markal, ESME) consider CCS as an add-on system for power generators and industries, ignoring benefits due to economics of scale and sharing of costs through industry-generator 'clusters'.

CCS should be considered as an economic activity with multi-sectoral benefits.

As per the Stern Review Report[2], tackling climate change is a prudent macroeconomic strategy, with the benefits of a strong, early action far outweighing long-term costs due to inaction.

Existing energy models fail to consider –

- The cost of doing nothing or **the damage cost of carbon**
- The **macroeconomic effects** of setting up large infrastructural energy systems and the **multiplier or ripple-effects** created in the economy due to the system or their accompanying supply-chain.

The effects maybe in the form of increased economic growth, increased employment, establishment of a service sector, etc.

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Changing the narrative: CCS as an economic service activity?

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We need to think about CCS as more than a costly technology: Can we look at capture, transport and storage as economic service activities? Economic sector(s) where CCS treated as a 'cleansing' industry.

CCS as a form of **waste disposal for CO2**

* How do capture, transport and storage activities link to each other and other industries (inputs to/outputs from CCS sectors)?
* Input-output model of Leontief (1970) – applied to waste disposal by Allan et al (2007)
* Distinction – waste collection, management and disposal of an existing industry. Standard industrial classification (SIC)
* Further potential analogy – recycling of waste ↔ utilisation of CO2?

The big challenge: motivation for investing in (transport and storage) infrastructure for CCS
Waste disposal infrastructure motivated by human health concerns

The Role of Economical-Technical System Modelling in Considering the Value of CCS

Karen Turner[1] and Julia Race[2]
[1]Centre for Energy Policy, University of Strathclyde International Public Policy Institute
[2]Department of Naval Architecture, Ocean and Marine Engineering, University of Strathclyde

> "HM Treasury raised concerns about the merits of the carbon capture and storage competition given fiscal constraints"
> 'Briefing for the House of Commons Environmental Audit Committee' by the National Audit Office, July 2016 (page 7)

Analysis:

It is considered that this decision was reached because there were key omissions in the information provided to Treasury:

- The wider economic and fiscal case not made
- The near-term benefits were not argued *e.g.* employment in developing infrastructure
- The longer term benefits of establishing an economic service activity were not considered

How can we do this:

- Need to consider case for CCS via ***social*** cost benefit analysis
- Need to include carbon capture, transport and storage as economic service activities
- Need to inform wider economy models with techno-economic data of the CCS system

Conclusions?

- Certainly in the case of CCS, CGE-TIMES may not provide the full answer
- Need to inform capture, transport and storage 'sectors' with information from other, more focused/specialised techno-economic models
- But resulting CGE outputs could better inform TIMES about potential development paths (and impacts on costs) for CCS

- More generally, for different problems, need to ask the question

- **WHY DO WE THINK THAT LINKING CGE AND TIMES WILL HELP PROVIDE BETTER INFORMATION FOR POLICY?**