

UCL ENERGY INSTITUTE

The UK TIMES model

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Introduction

- Why have we built a new model?
- What have we learned from UK MARKAL?
- What are the requirements for UK TIMES?
- How might we want to develop UK TIMES in the future?
- What (new) features do we want in UK TIMES?

- Model reputation and outreach

Process, not outputs

Why have we built a new model?

- TIMES features that are not available in MARKAL
- Flexibility of TIMES
- Transparency of inputs

- Re-calibrate UK model
- Implement improvements across the RES
- Add new features

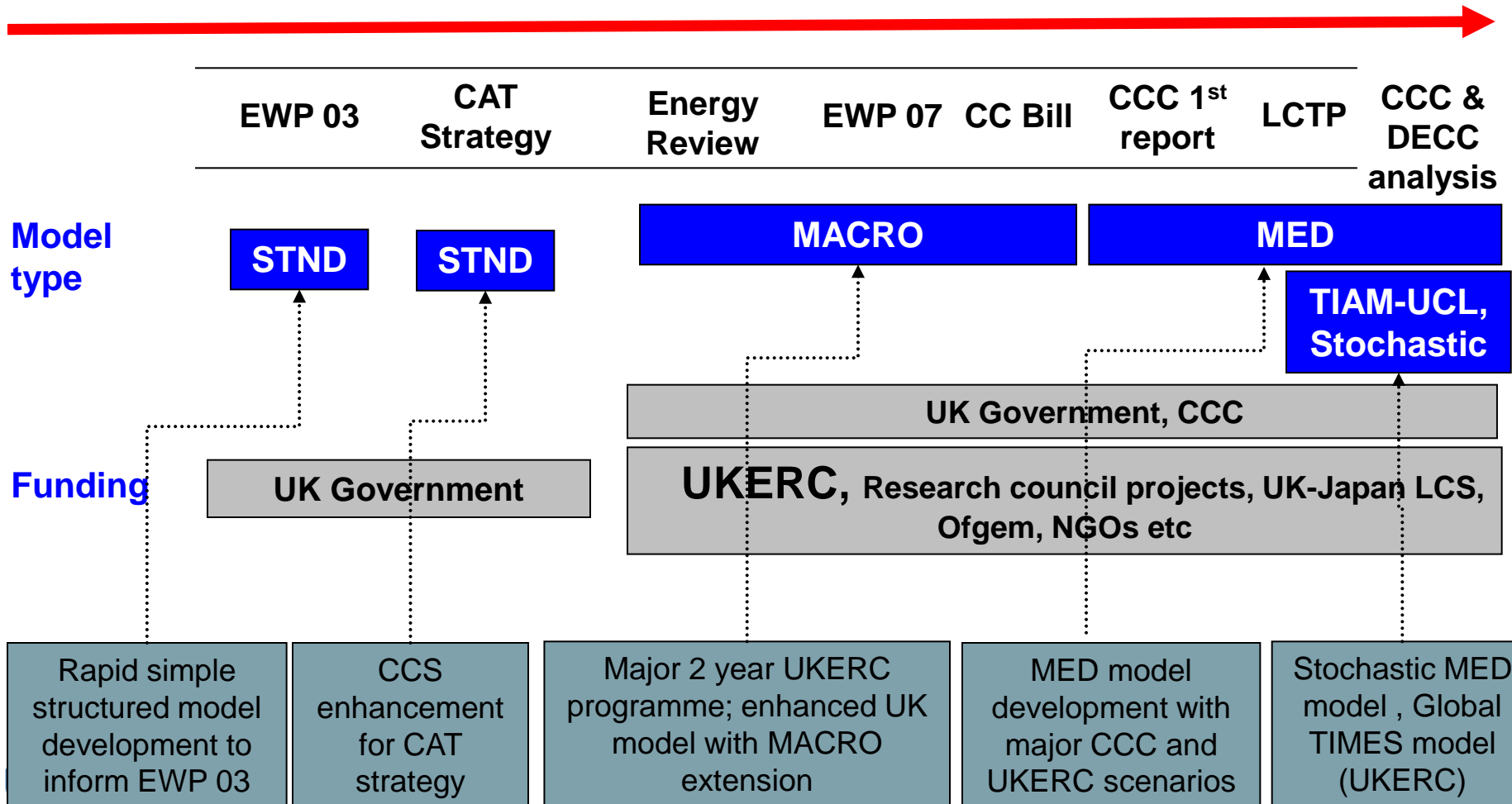
- Availability of international support

What have we learned from UK MARKAL?

2000

2007

2010



Reputation of UK MARKAL

- Very strong input to the UK policy process
 - Better regarded by government economists than engineers
 - Transparency issues, despite the availability of a comprehensive manual
 - Other tools are now also being used for policy (DECC 2050 Calculator, ESME Monte Carlo model)
- Mixed reputation among academics
 - Unique in the UK research community
 - Many energy scientists feel it has too much influence – “A simple solution to a complex problem”

Review of UK MARKAL

- Model archaeology
 - Examined input and output changes between UK MARKAL versions
 - Concluded that:
 - Model data has been continuously updated over time
 - Maintained a balance between model detail and overall complexity
 - Some errors introduced through mis-understandings between teams
 - Inconsistencies from using data from different sources with different underlying assumptions
 - Inconsistencies from only updating some technologies in a sector
 - No long-term vision
- Research versions of UK MARKAL

What are the requirements for UK TIMES? Govt

1. **Least cost pathways:** what is the least cost pathway to 2050?
2. **Targets:** what is the effect of a more ambitious 2050 GHG target on costs and technology use?
3. **Scenarios:** if, say, CCS fails, what is the implication for cost and technology use? Or, say, “what if the UK fails to reduce energy demand across the economy – what are the implications for how much nuclear/CCS/renewables we may need?”
4. **Decision points:** if we want, say, a hydrogen network when do we have to start building the infrastructure? What would the impact be of a delay in starting the build the network?
5. **Cost uncertainty:** what impact does uncertainty about future costs have on our pathway choices?”
6. **Emission projections:** what are projected emissions in 2050 as a result of existing and planned policies?
7. **Impact assessment of a policy package:** what is the cost of a more ambitious 2050 target?
8. **Technology policy:** what is the effect of UK RDD&D on the cost of, say, electric cars? Or, what is the value of early deployment of, say, offshore wind in order to bring costs down for later cost-effective deployment?
9. **Spatial implications:** what are the spatial implications of building more, say, nuclear?
10. **Embedded emissions:** what are the process / embedded / lifecycle emissions associated with a given pathway?
11. **Energy balancing:** how robust is a given pathway to troughs and peaks in energy supply and demand?

What are the requirements for UK TIMES? Policy

- Clearly separate technology from policy

UK climate change mitigation policies:

1. **command and control regulation** (minimum standards, banning things);
2. **economic instruments** (eco-taxes, emission trading);
3. **information-based approaches**; and,
4. **negotiated agreements** and voluntary approaches to agree emission reductions.

Ideally, UK TIMES would be able to examine the impacts of as many of these policies as possible.

How might we want to develop UK TIMES in the future? Internal workshop

- Interseasonal and other storage on different spatial and timescales
- Demand response disaggregation
- Materials (industrial goods, food, water)

- Myopia and path dependency
- Stochastic modelling
- Macro and CGE modelling – WholeSEM project
- Behavioural modelling – ADVANCE project

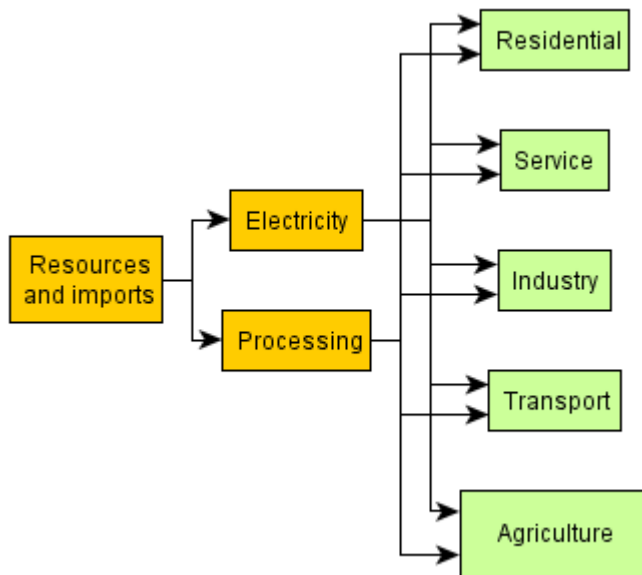
- 2-region model for Scotland autonomy
- Link to larger TIMES and other models (e.g. network models)

What are the requirements for UK TIMES? Practical

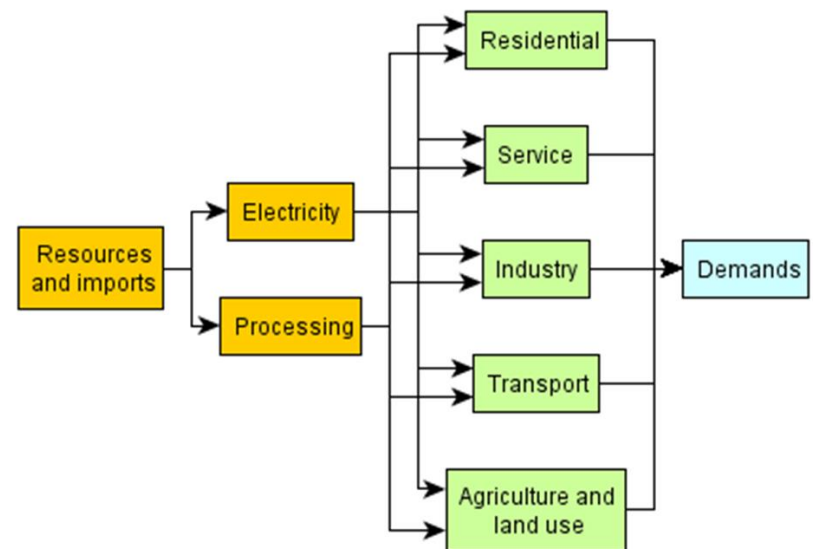
- Transparent
 - Input data
 - Assumptions
 - Strengths
 - Weaknesses
- Properly documented
- Quality assurance – e.g. version control
- Used appropriately – training for users

Structural differences between UK TIMES and UK MARKAL

UK MARKAL



UK TIMES



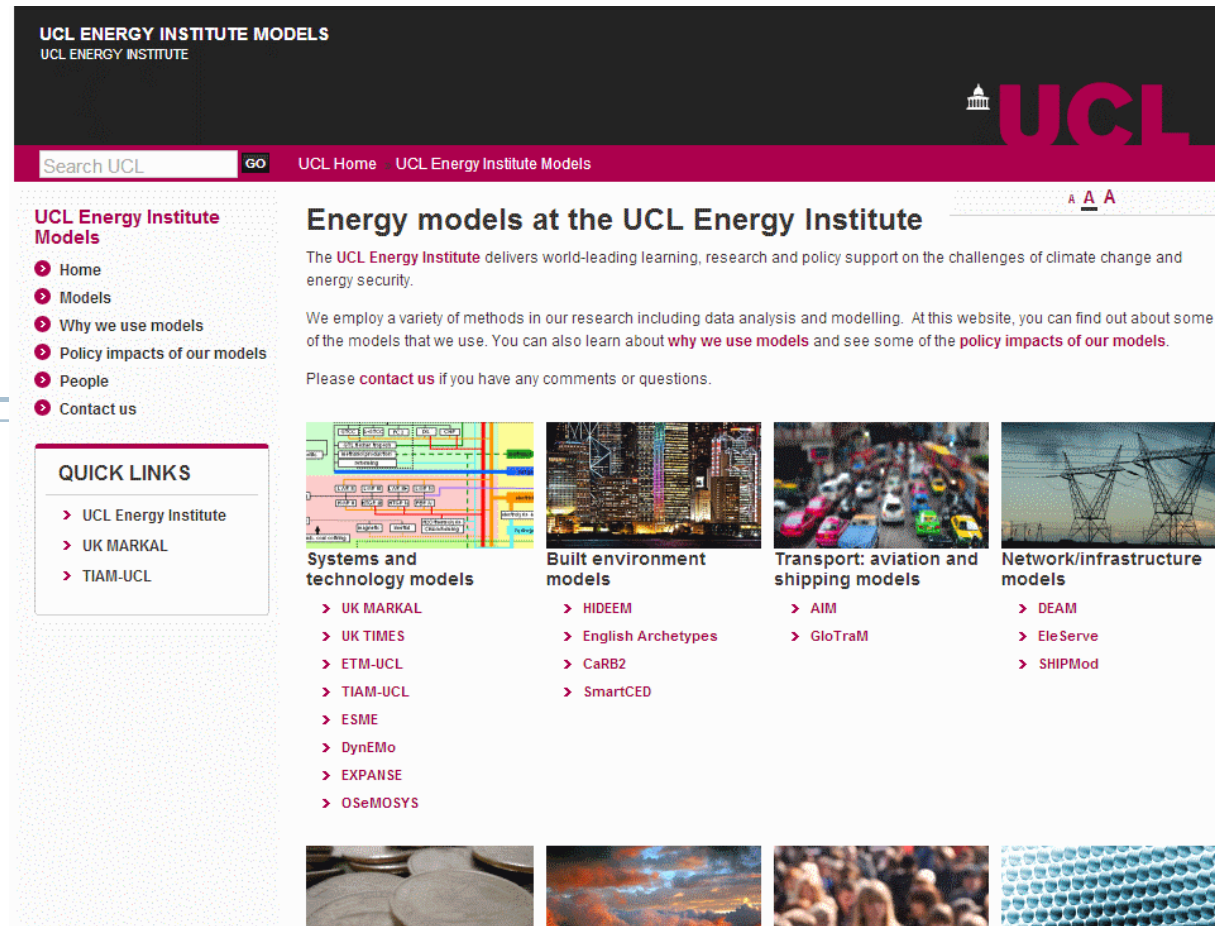
What new features are in UK TIMES?

- Interseasonal and other energy storage
- Other energy infrastructure
- New time slices (4 intra-day x 4 seasonal)

- Non-CO₂ greenhouse gases
- New CO₂ re-calibration: all energy and non-energy emissions accounted by matching technologies to UK NAEI statistics
- Non-energy mitigation options
- Non-energy atmospheric CO₂ removal and sequestration

Model reputation and outreach

- More transparent
- Better documentation
- New website: www.ucl.ac.uk/energy-models
- Training government scientists
- Better QA



The screenshot shows the website for UCL Energy Institute Models. The header includes the UCL logo and navigation links for 'UCL Home' and 'UCL Energy Institute Models'. A search bar is present with a 'GO' button. The main content area is titled 'Energy models at the UCL Energy Institute' and contains introductory text about the institute's research and a list of models categorized into Systems and technology models, Built environment models, Transport: aviation and shipping models, and Network/infrastructure models. A sidebar on the left provides navigation options and quick links.

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QUICK LINKS

- > UCL Energy Institute
- > UK MARKAL
- > TIAM-UCL

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The UCL Energy Institute delivers world-leading learning, research and policy support on the challenges of climate change and energy security.

We employ a variety of methods in our research including data analysis and modelling. At this website, you can find out about some of the models that we use. You can also learn about **why we use models** and see some of the **policy impacts of our models**.

Please **contact us** if you have any comments or questions.

Systems and technology models

- > UK MARKAL
- > UK TIMES
- > ETM-UCL
- > TIAM-UCL
- > ESME
- > DynEMo
- > EXPANSE
- > OSeMOSYS

Built environment models

- > HIDEEM
- > English Archetypes
- > CaRB2
- > SmartCED

Transport: aviation and shipping models

- > AIM
- > GloTraM

Network/infrastructure models

- > DEAM
- > EleServe
- > SHIPMod

Conclusions

- UK TIMES has been created for a number of reasons
 - New features
 - More general improvements over UK MARKAL
 - International support
- Consultation process to facilitate a good design
 - Discussions with stakeholders, particularly government
 - Internal discussions
 - Short- and long-term model requirements considered
- Transparency, QA, reputation important – “a new start”

Thank you for listening

Questions?



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