

TIMES Energy System Models at UCL

WholeSEM – DECC Stakeholder Workshop

March 6th 2014

Dr. Hannah Daly



Energy Systems Modelling Team in UCL EI



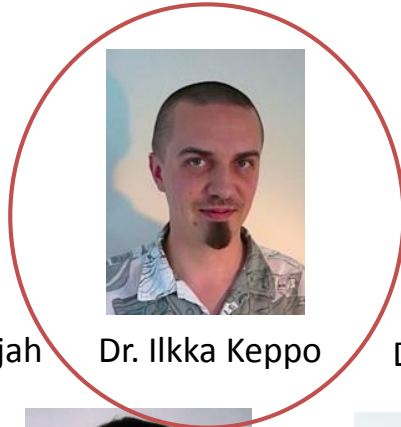
Prof. Paul Ekins



Prof. Neil Strachan



Dr. Gabriel Anandarajah



Dr. Ilkka Keppo



Dr. Paul Dodds



Mr. Steve Pye



Dr. Christophe McGlade



Mr. Baltazar Solano



Ms. Marianne Zeyringer



Dr. Olivier Dessens



Mr. Will McDowall



Dr. Evelina Trutnevyte



Mr. Will Usher



Dr. Matthew Winning



Ms. Nagore Sabio



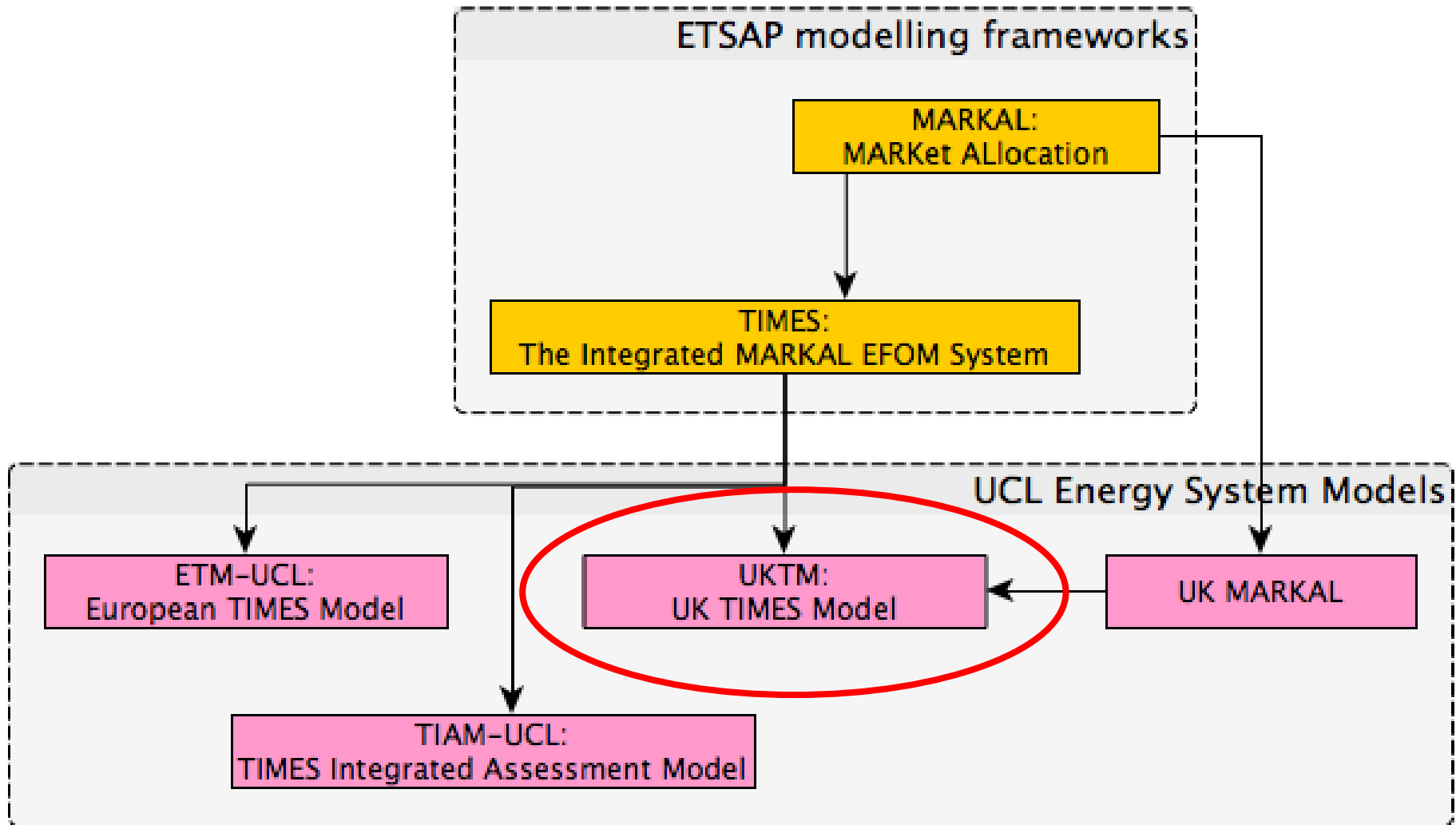
Dr. Hannah Daly



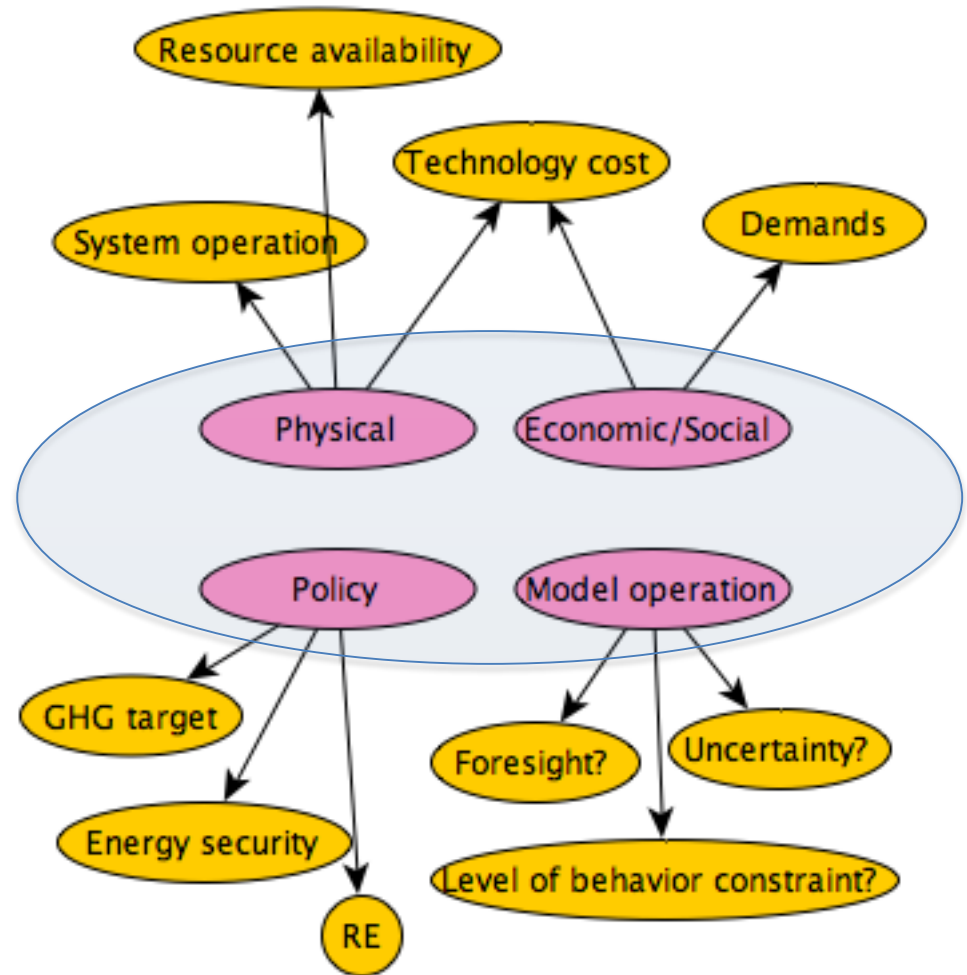
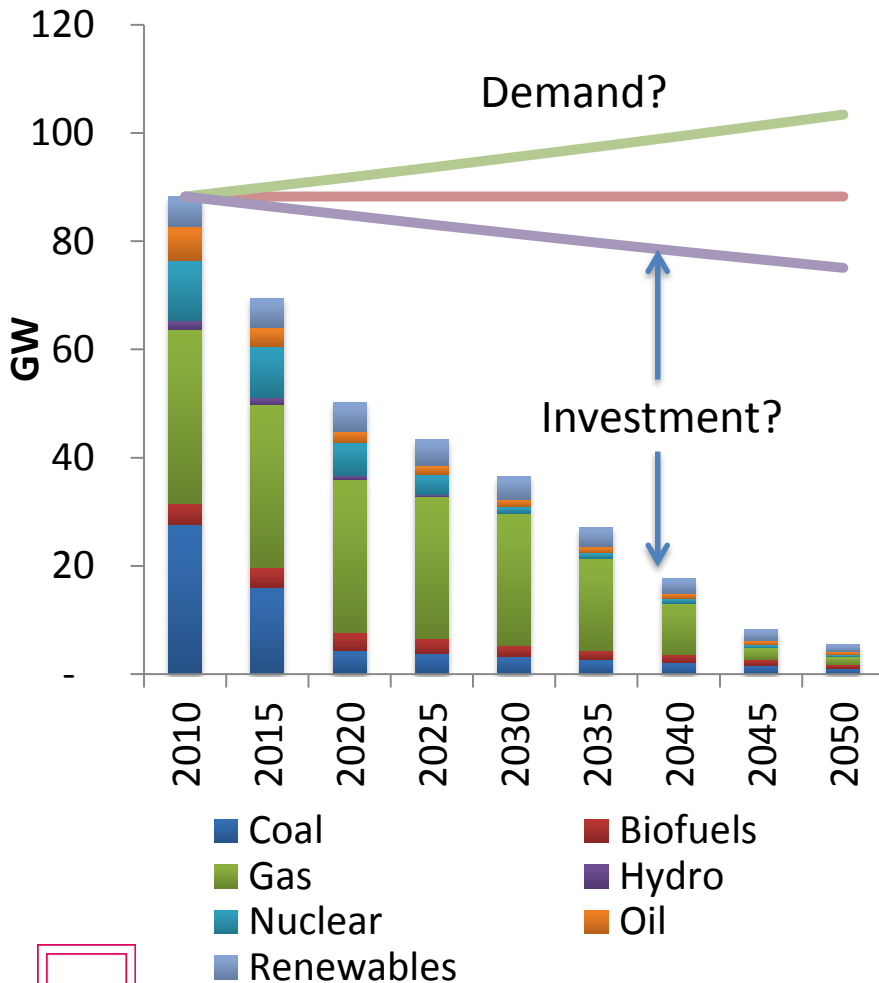
Ms. Birgit Fais



Overview of Platforms & UCL Models



Investment Decisions in UKTM

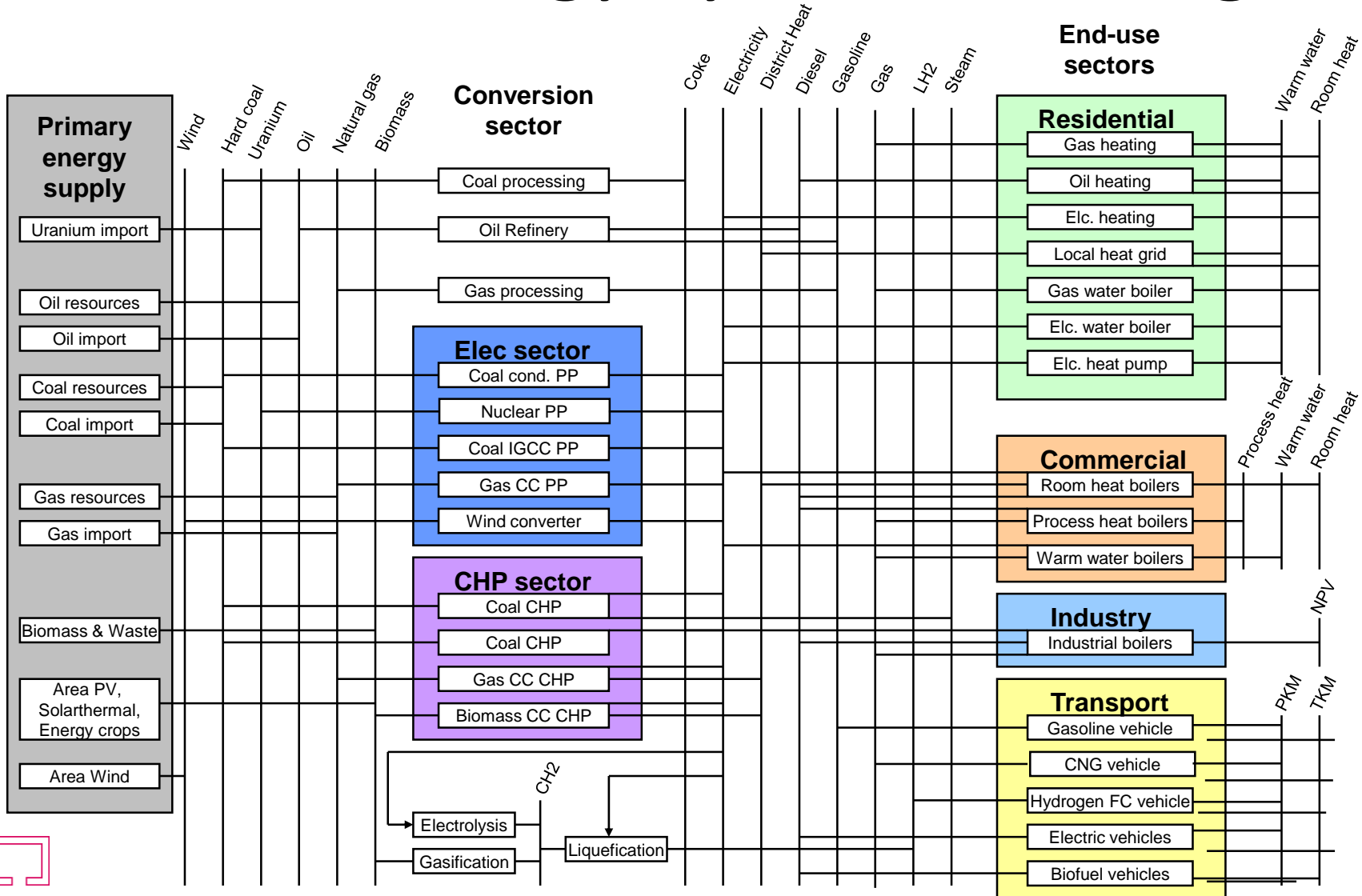


UKTM Model Paradigm

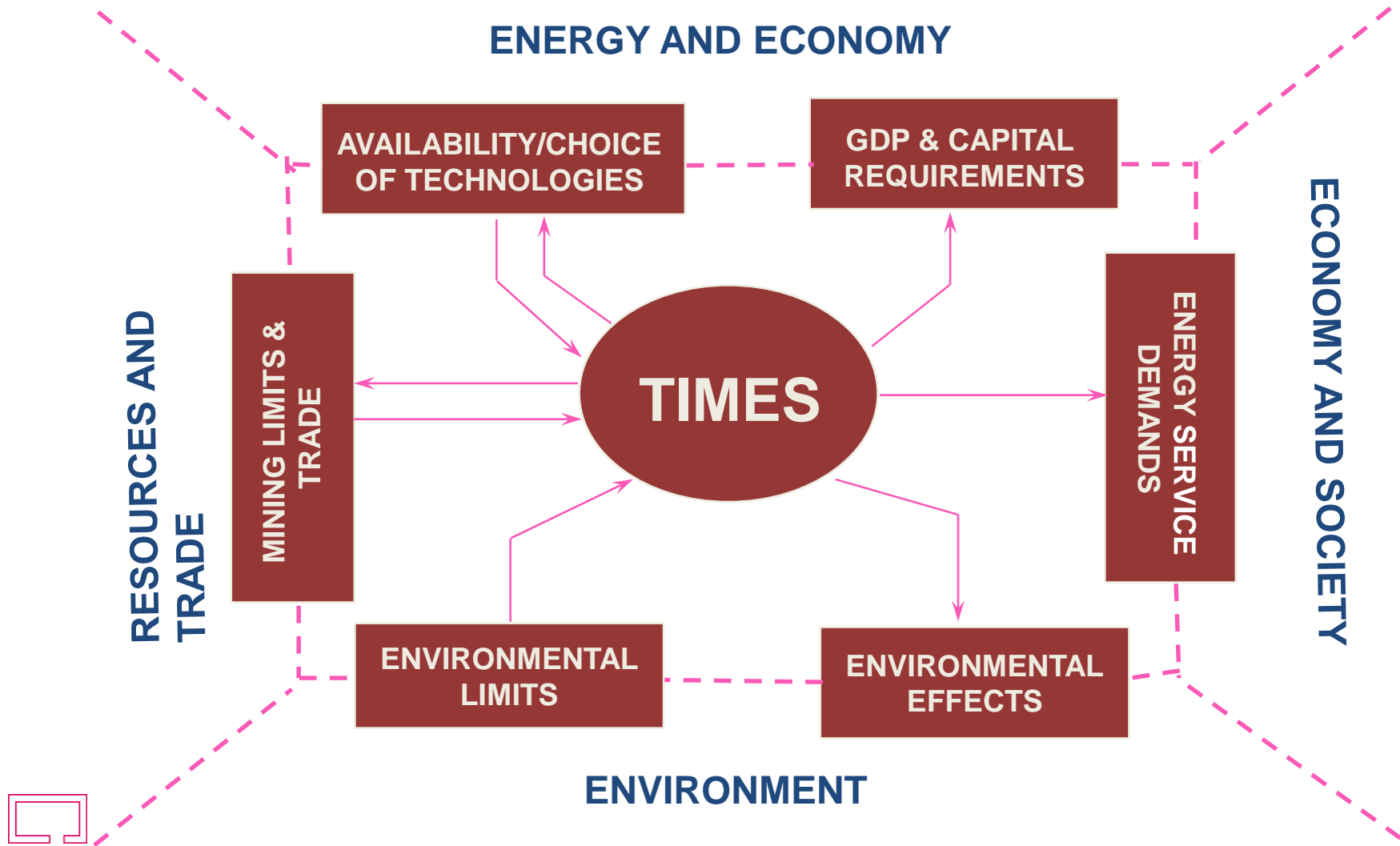
- A **least cost optimization** model based on life-cycle costs of competing technology pathways (to meet **energy demand services**)
- **Partial equilibrium** model assuming “rational” decision making, perfect information, competitive markets, perfect foresight
- **Technology** rich bottom-up model
- An **integrated energy systems** model
- Physical, economic and policy **constraints** to represent UK energy system and environment
- Model and data **validation**
- Emphasis on **sensitivity and uncertainty analysis**
- **Extension** to TIMES-Macro, elastic demand (ED), stochastic, mixed integer, endogenous learning, multi-region, etc.



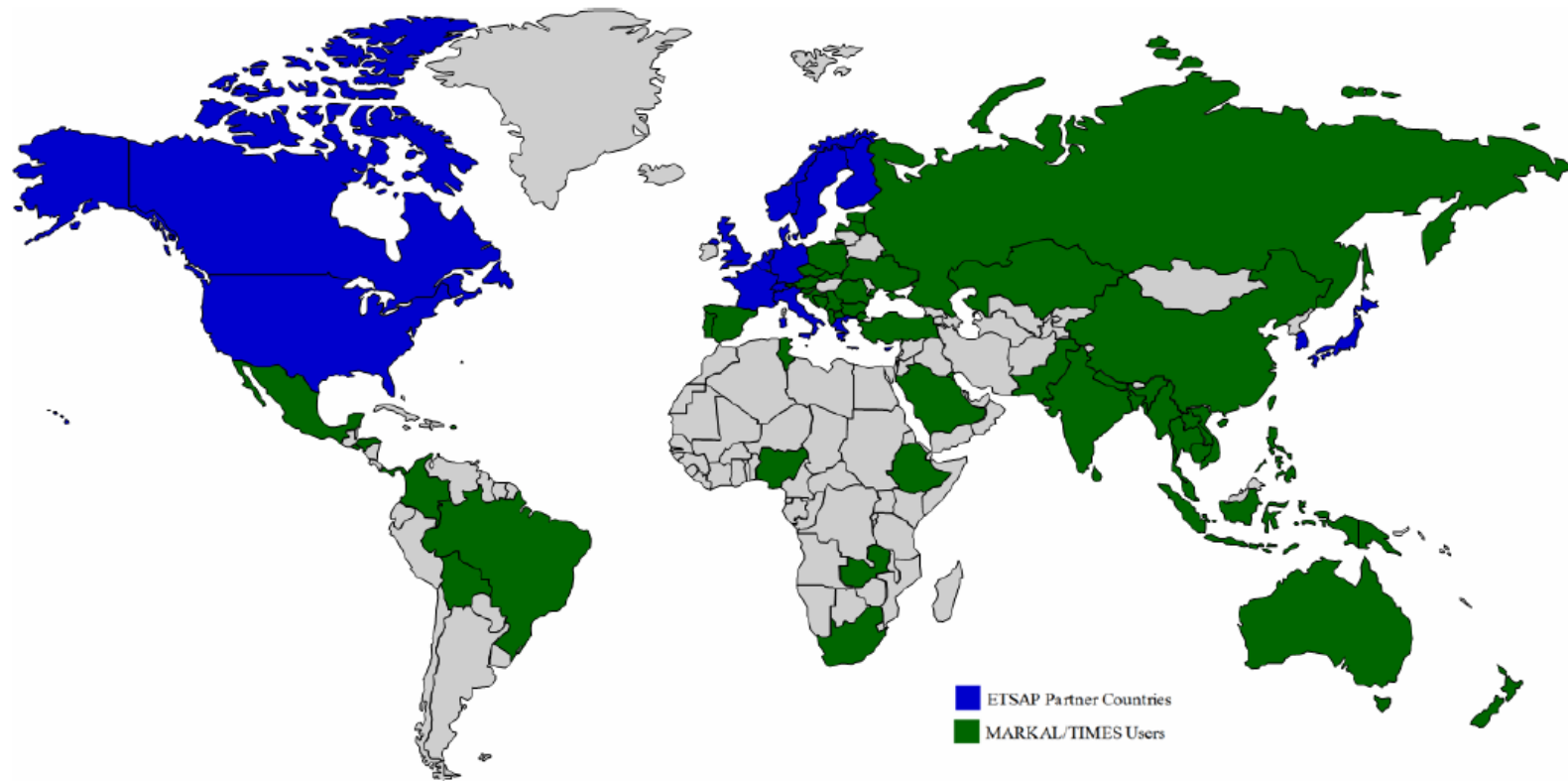
Whole Energy System Coverage



Energy, Economy, Engineering & Environment (E4) Interactions



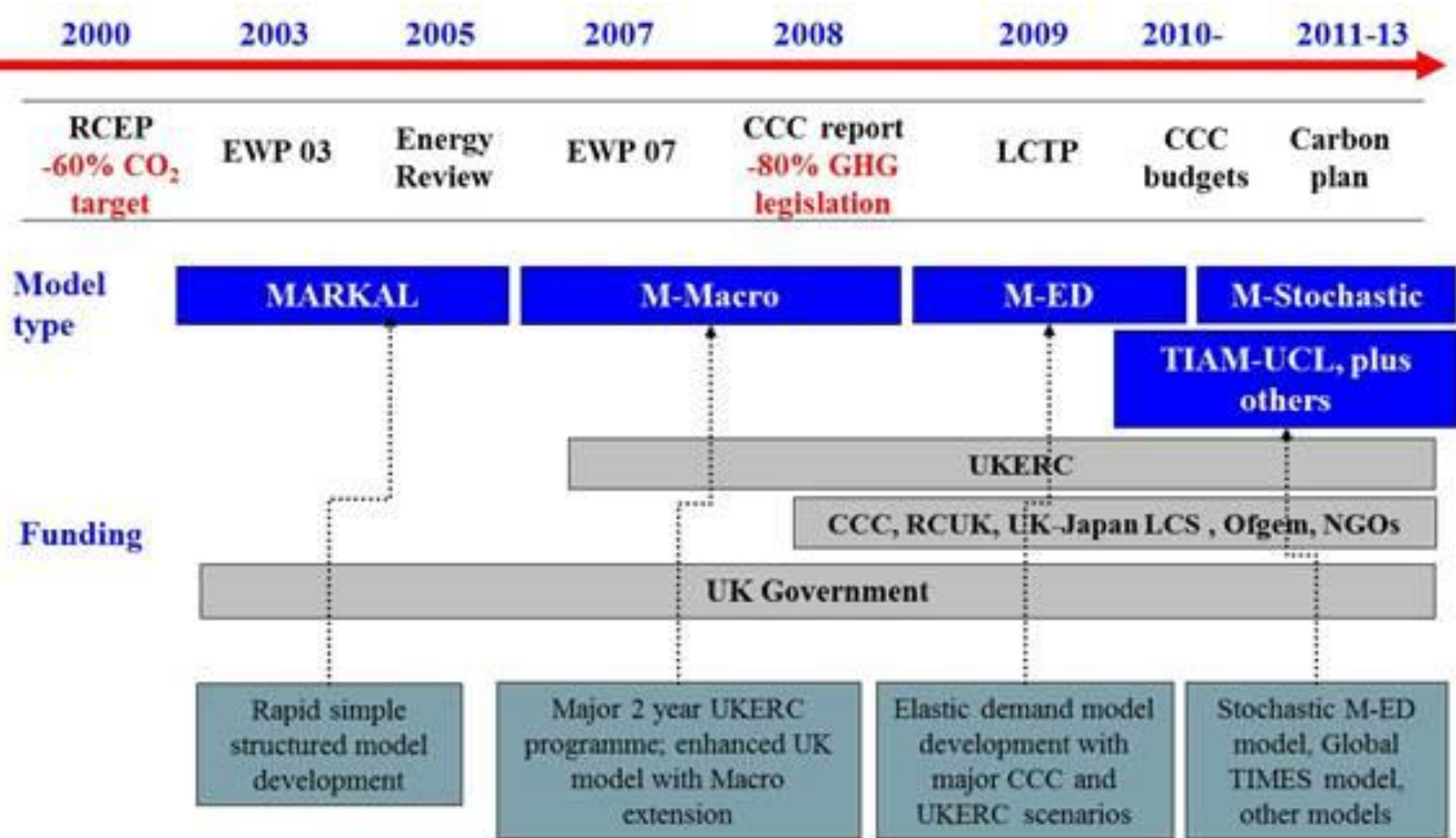
Established international TIMES model platform



Only those countries with at least one MARKAL/TIMES modelling team active during the Annex are "painted."



Strong lineage: UK MARKAL & policy



Why move from UK MARKAL to UKTM?

- **New functionality** of UKTM
 - All **GHG** accounting
 - **Time-slicing** for intermittency and storage across different time slices
 - Improved **industrial sector**: Process based subsectors and mitigation options
- **Comprehensive revision and review** of MARKAL
 - **Transparency** at the forefront of development
 - Data, assumptions, structure is **clear and traceable**
 - Full **replicability of results**
 - **QA processes** implemented to trace model development
 - Revise all **inputs**
 - Using up-to-date, consistent data calibration to 2010
 - User constraints categorized & explicit
- Many **advantages of TIMES** platform
 - MARKAL tool has been superseded internationally
 - TIMES offers much greater **flexibility**



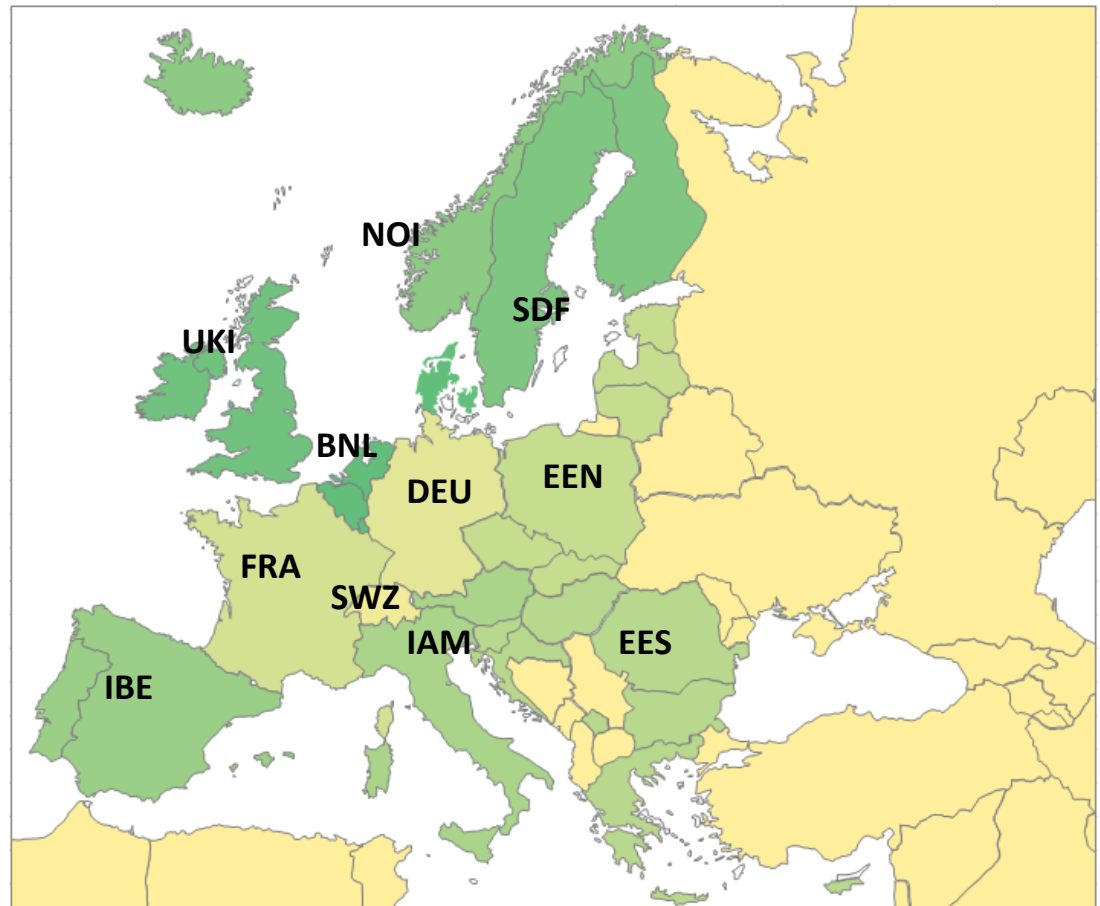
The future of UKTM in research

- **Technological change:**
 - Endogenous technology learning & diffusion of technologies
 - What role does technological change play in the transition of the energy system?
- **Spatial and temporal disaggregation:**
 - Multi-region version of UKTM to address spatial and temporal issues in long term transitions
 - UKTM has linkage points to power market model, multi-regional Forsee tool.
- **Behaviour modelling:**
 - Improving behavioural realism beyond own price elasticities
 - What are the mitigation opportunities for the energy system in behaviour change?
- **Modelling to generate alternatives**
 - What are the near-optimal but most different pathways to reaching targets?
- **Macro-economic modelling:**
 - Hybrid Macro version: Endogenous general equilibrium model; link to multi-regional model
 - What is the impact of the energy system on the economy?
- **Bioenergy:**
 - Linking bioenergy resources to land use in the new agriculture and land use sector
 - Land will become a fundamental resource from which bioenergy resources are derived



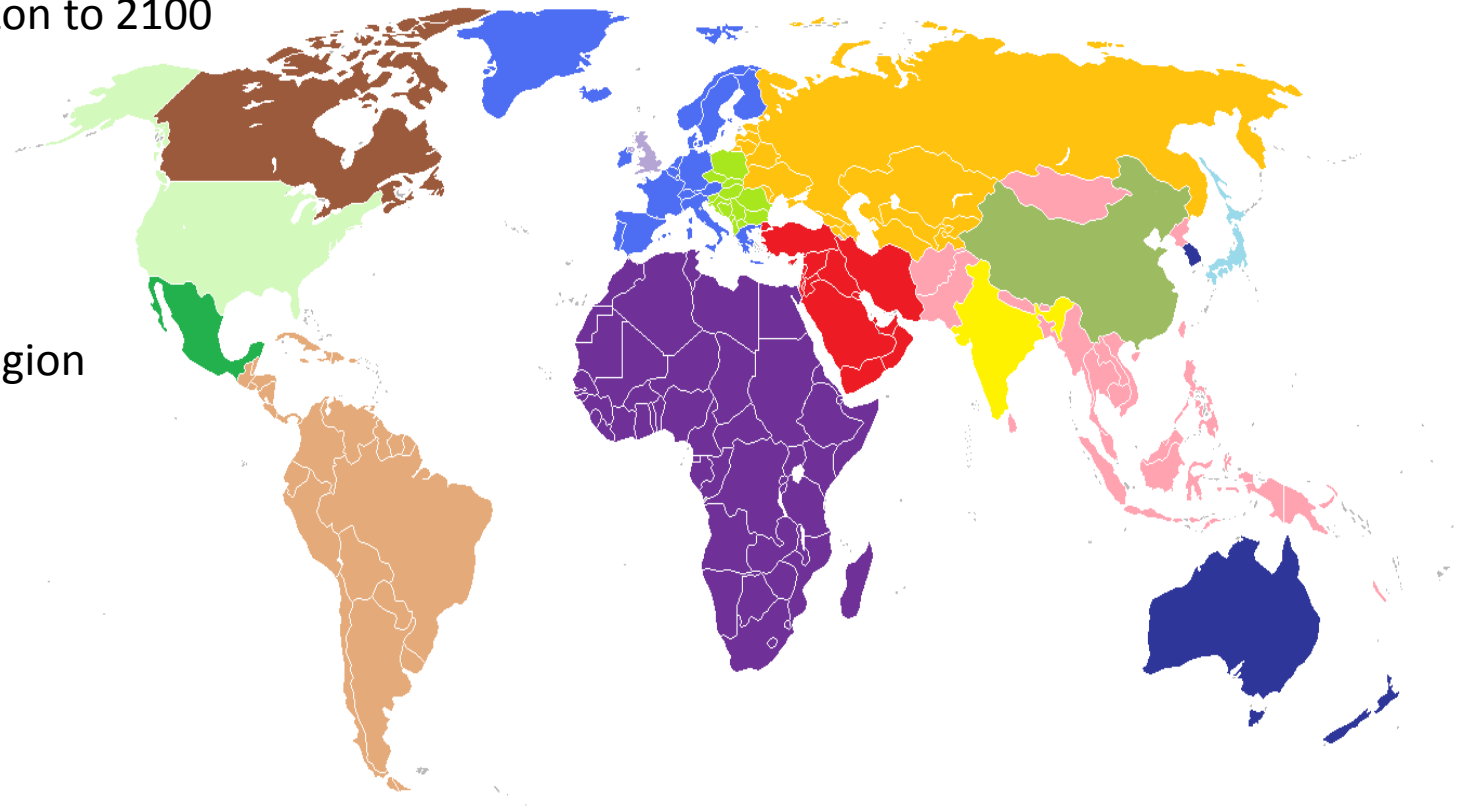
European TIMES Model (ETM-UCL)

- Multi- regional: 11 regions, EU28+3
- Each region is modelled as a separate energy system
- Regions are linked through trade in crude oil, hard coal, pipeline gas, LNG, petroleum products, biomass, electricity and emission permits.
- ETM-UCL designed for and currently used in two FP7 EU research projects
(<http://cecilia2050.eu/>,
<http://www.eminn.eu/>)

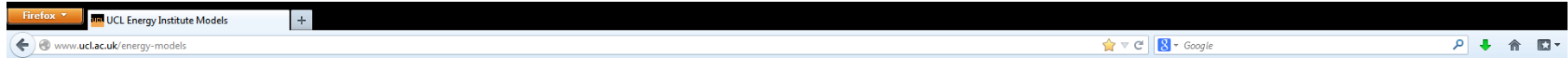


TIMES Integrated Assessment Model (TIAM-UCL)

- Multi-emissions, plus a climate module
- Flexible time horizon to 2100
- Global coverage
- 16 regions
- UK is an explicit region



UCL-Energy Models: www.ucl.ac.uk/energy-models



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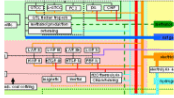



- > UCL Energy Institute
- > UK MARKAL
- > TIAM-UCL




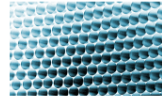
Energy models at the UCL Energy Institute

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	Built environment models	Transport: aviation and shipping models	Network/infrastructure models
<ul style="list-style-type: none"> > UK MARKAL > UK TIMES > ETM-UCL > TIAM-UCL > ESME > DynEMo > EXPANSE > OSeMOSYS 	<ul style="list-style-type: none"> > HIDEEM > English Archetypes > CaRB2 > SmartCED 	<ul style="list-style-type: none"> > AIM > GloTraM 	<ul style="list-style-type: none"> > DEAM > Ele Serve > SHIPMod

			
Economic models	Environmental models	Behavioural models	Other models
<ul style="list-style-type: none"> > TIMES-MACRO-Plus > CGE-UCL 	<ul style="list-style-type: none"> > TIAM-UCL-IAM 	<ul style="list-style-type: none"> > BLUE 	<ul style="list-style-type: none"> > BUEGO

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