

# Mapping UK's energy modelling expertise

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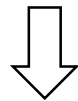
UCL Energy Institute

A wide range of models is required to support UK's energy policy:

- Renewable energy targets + Greenhouse gas emission reduction targets
- Security of supply

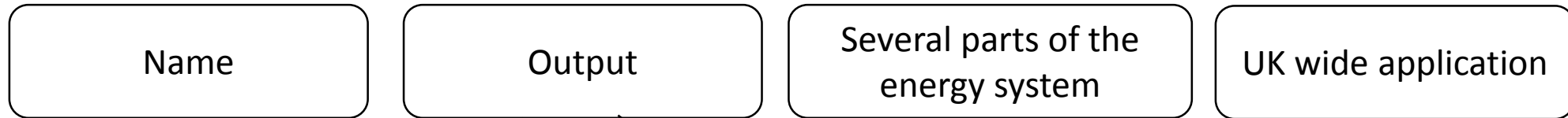
BUT

- 2003: Only 6 academic research groups held energy modelling capacity (Berkhout et al., 2003)
- 2011: Challenges remain in sustaining consistent funding of energy modelling teams (Strachan, 2011)



What is UK's current energy modelling expertise?  
Is it ready to perform the energy modelling and analysis required?

## Our Model Definition:



**Energy Policy**  
Journal homepage: www.elsevier.com/locate/enpol

**Modelling generation and infrastructure requirements for transition pathways**  
M. Barnacke<sup>a,\*</sup>, E. Robertson<sup>a</sup>, S. Galloway<sup>a</sup>, J. Barton<sup>b</sup>, G. Ault<sup>a</sup>

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**ABSTRACT**  
With national targets to reduce carbon emissions outlined by international accords, the UK's energy system will need to transition to low carbon faster through political, societal and technological drivers. Three Transition Pathway scenarios have been developed to show the different realisations of the UK energy system out to 2050. This paper details how each has been constructed to assess the likelihood and timing of low-carbon energy systems. The MARKAL energy system optimisation model tool is used to identify pathway specific large-scale generation mixes that meet expected demands on both a steady and hourly time-scale. The multi-objective evolutionary optimisation planning (MOEPP) tool is used to generate a set of electrical network plans for the assessment of expected electric infrastructure requirements. The results obtained through this paper demonstrate that the combination of EEA's detailed temporal analysis and MOEPP's comprehensive generation analysis provides a high-quality holistic realisation of the Transition Pathway scenario, covering the need for national infrastructure realisation with the changing demand and generation patterns.

**1. Introduction**  
In a global age of concern regarding the environment and human induced climate change, international treaties and accords such as Kyoto (United Nations, 1997) were signed that globally governments and their peoples would reduce their greenhouse gas emissions. The UK Government's commitment to the negative environmental and economic impacts of climate change (Starr, 2007) paved the way for the 2008 Climate Change Act which sets a target of an 80% reduction of the basket of six Kyoto greenhouse gases from 1990 levels by 2050. To ensure these emission reduction could be achieved, along with the problems associated with this task, the Transition Pathways to a low carbon economy construction<sup>1</sup> has developed three pathway scenarios which depict different socio-technical scenarios describing different visions of the future realisation of the UK's energy system in 2050. As described by Franey et al. (2011) the pathways are derived by determining the social, economic and political drivers on the system and the balance that is struck between them as the system progresses.

**AEA**

**Pathways to 2050 – Key Results**  
MARKAL Model Review and Scenarios for DECC's 4th Carbon Budget Evidence Base Final Report

**A report for the Department of Energy and Climate Change**  
Restricted Commercial  
E059009  
Issue Number 1  
11<sup>th</sup> May 2011

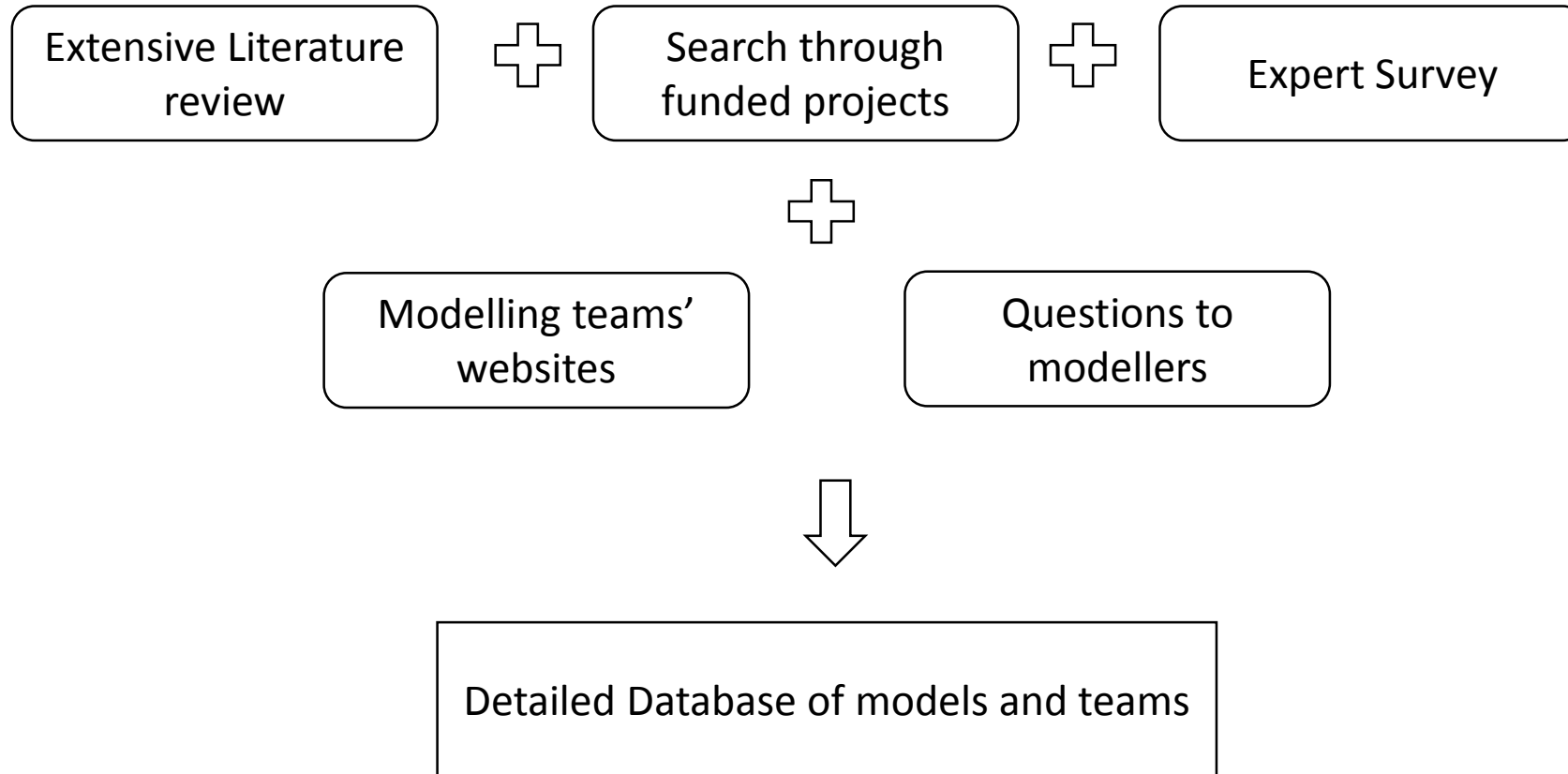


## Model coverage

- Energy system
- Electricity system
- Electricity and Gas
- Grid
- Transport sector
- Aviation
- Buildings and Household sector
- Hydrogen Oil and Gas
- Climate Change
- Macro- economy

## Model types

	Optimization	Simulation
Stock model		
Integrated Assessment		
Spatial		
Input Output		
CGE		
Accounting		
Resource		
Agent based		

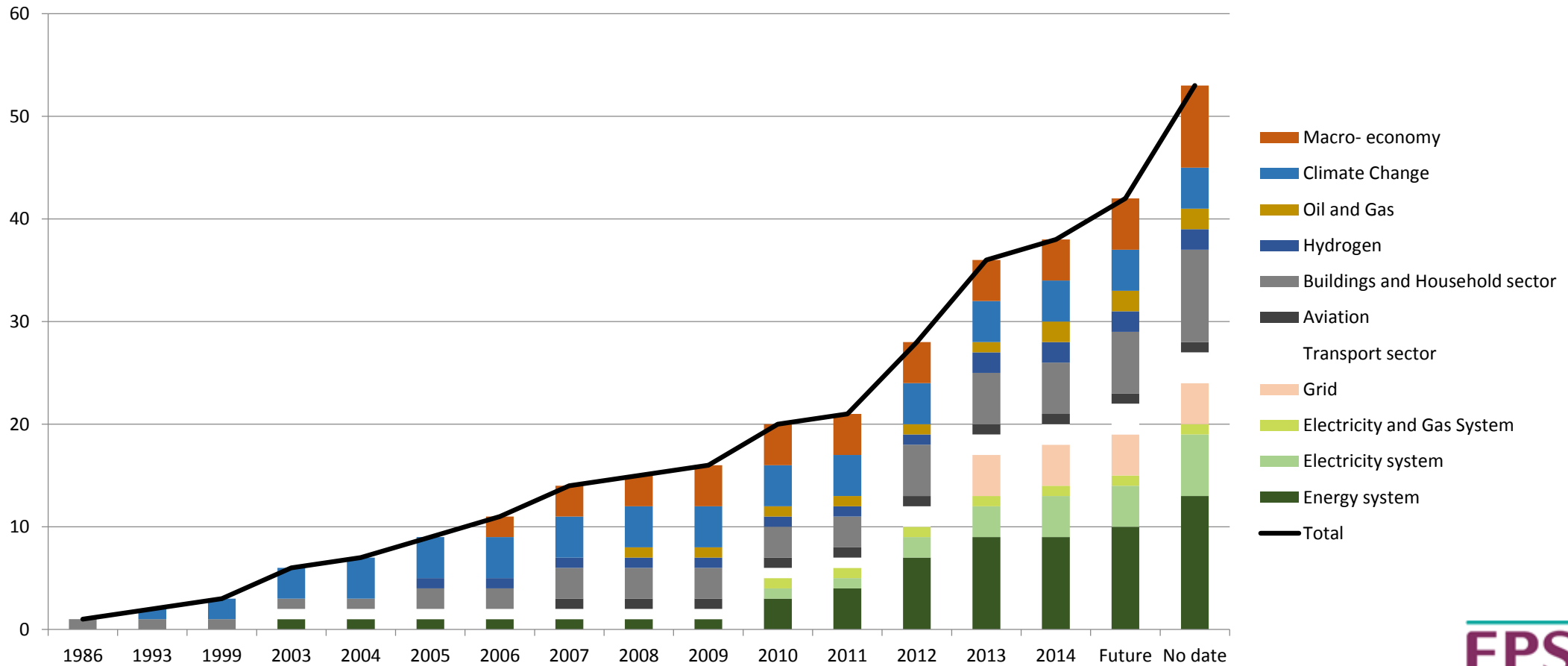


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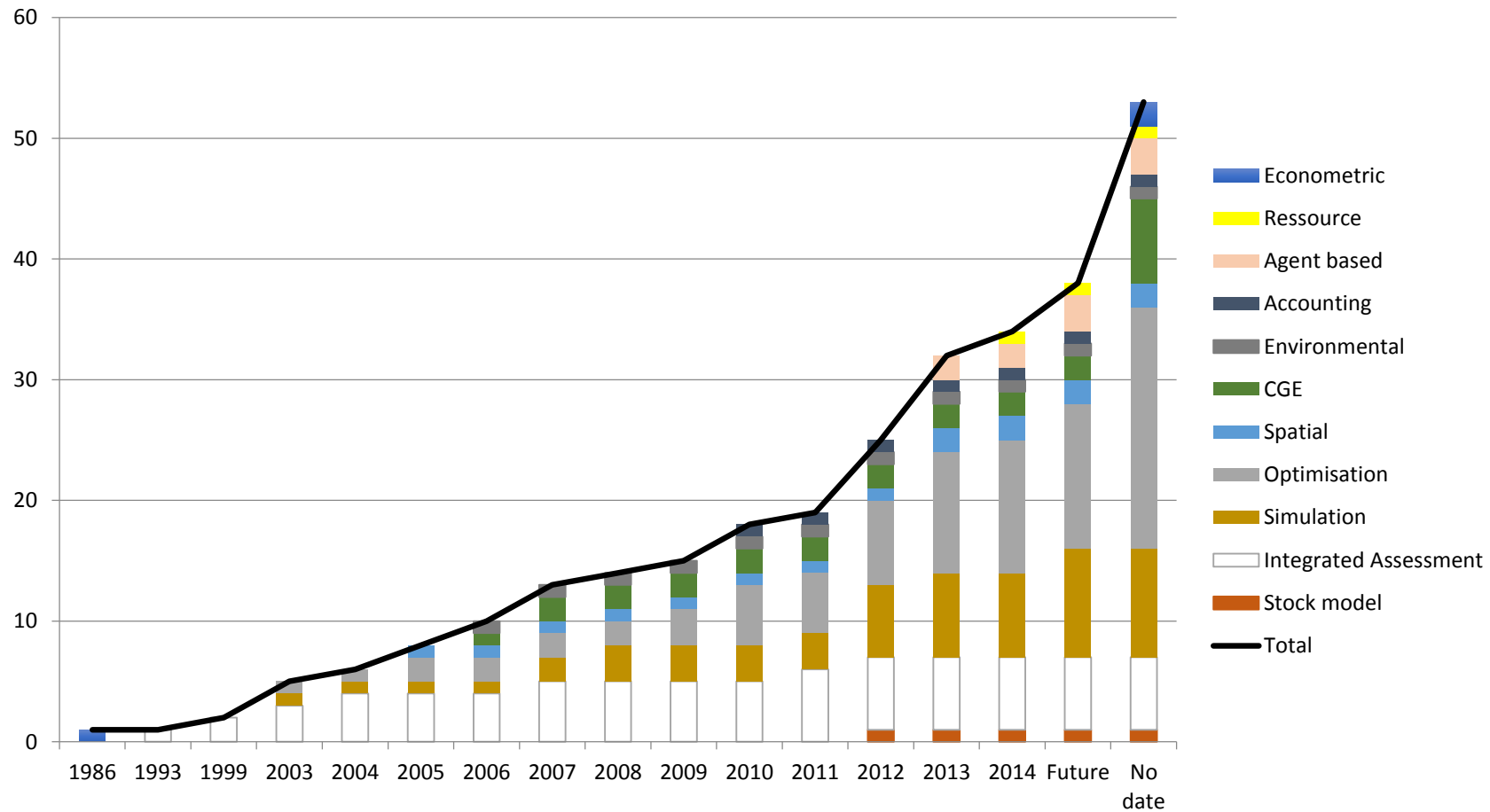
Type of Organisation	Number per Organisational Type	Number of models
Government	5	8
Company	1	1
Research	1	1
Consultancy	9	11
University	16	32
Departments	20	
<b>Total</b>	<b>32</b>	<b>53</b>

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## Model coverage over time

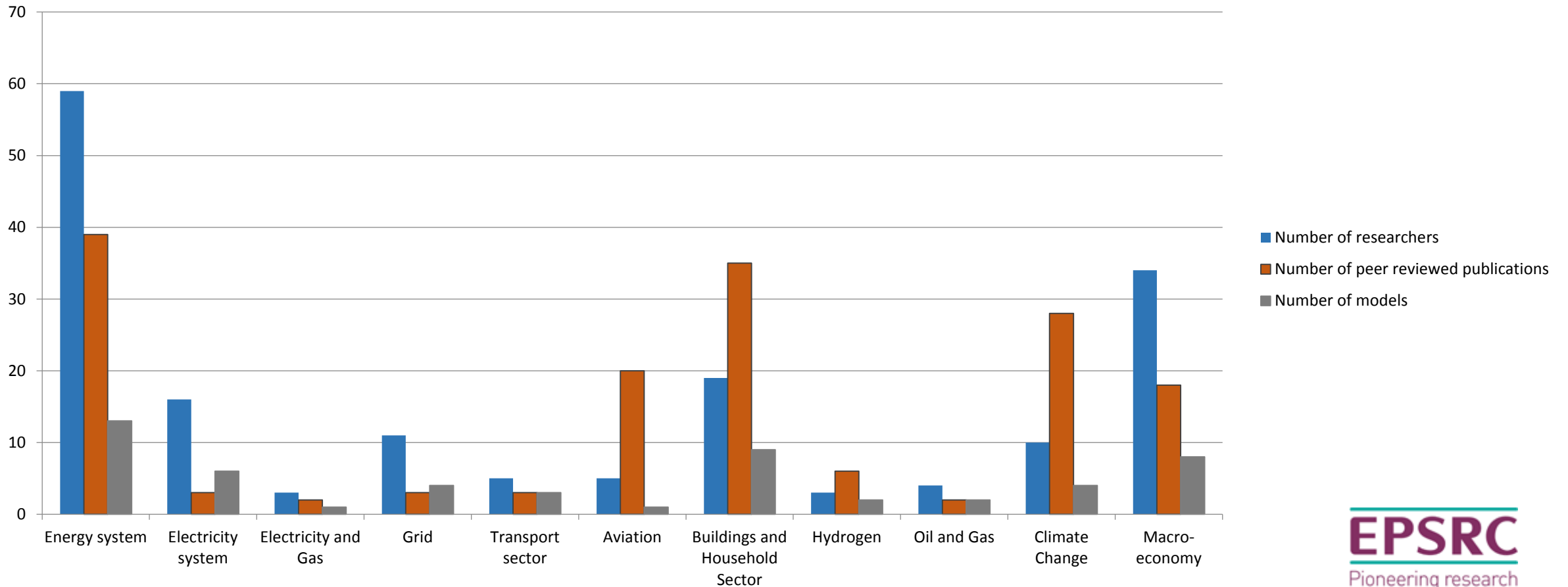


## Model types over time





## Number of researchers, models and peer reviewed publications



- Strong and persistent growth over last 5 years (more than doubling in model numbers)

## Strong areas

2 out of 3:

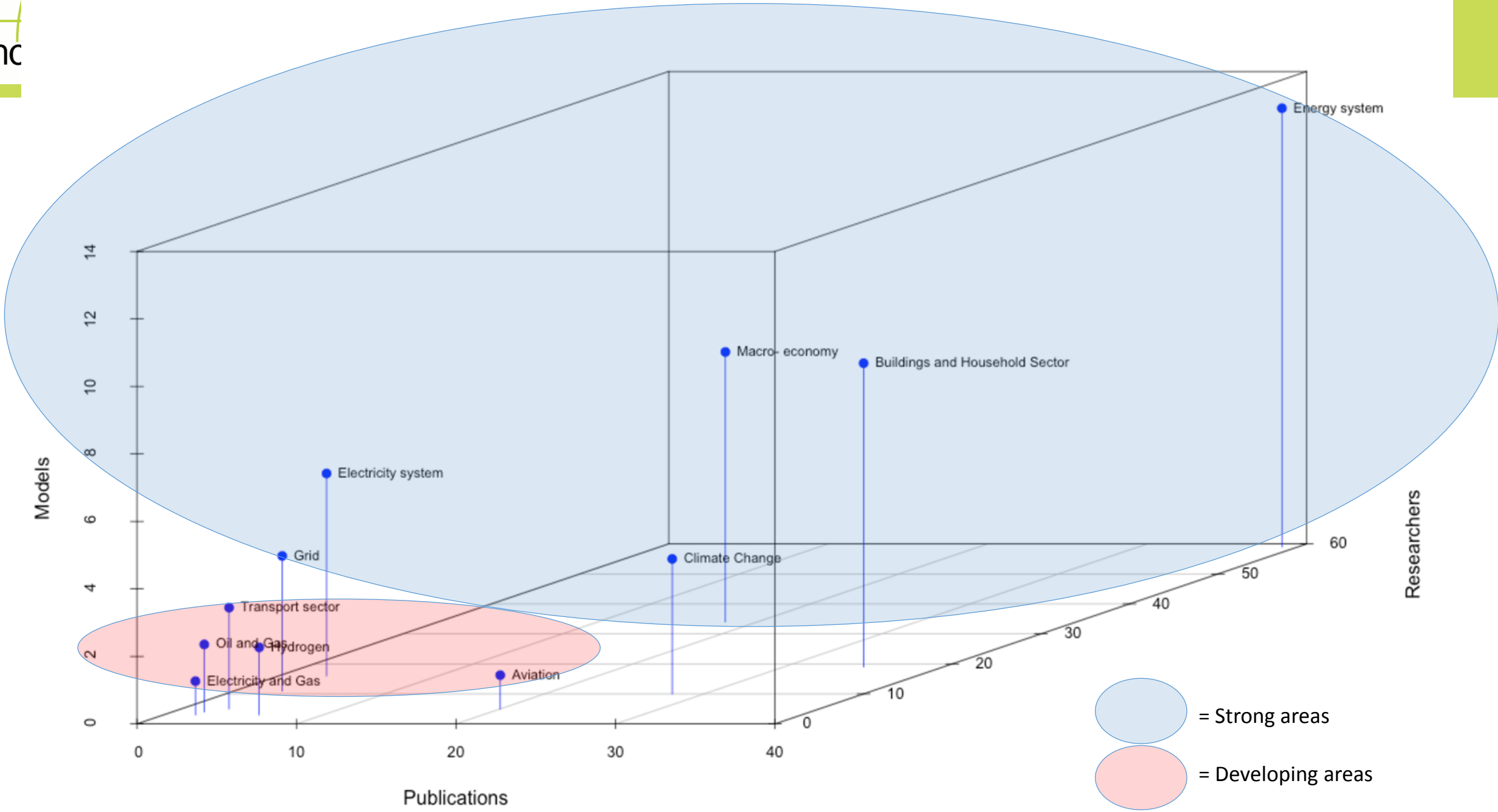
- Number of researchers:  $\geq 10$
- Number of publications:  $\geq 10$
- Number of models:  $\geq 3$

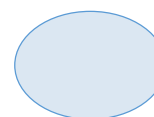
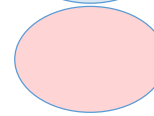
## Developing areas

- Number of researchers:  $< 10$
- Number of publications:  $< 10$
- Number of models:  $< 3$

## Weak areas

No models fulfilling our criteria



 = Strong areas  
 = Developing areas

## Strong areas

Energy systems  
Electricity Systems  
Electricity Grid  
infrastructure  
Buildings and Households  
Climate Change  
Macro -economy

## Developing areas

Electricity and gas  
Transport  
Aviation  
Hydrogen  
Oil and Gas

## Weak areas

Sector specific models:  
Industry  
Service sector  
Biomass  
Demand

→ Efforts required to maintain modeling capacity in strong areas and build up the developing and weak areas

→ Ongoing work on 2 papers

- Mapping UK's energy modelling expertise
- An international comparison of energy modelling capacities (together with international partners)