The economic, environmental and social impact of new marine technologies for the production of electricity

Peter McGregor, Kim Swales, Karen Turner, Grant Allan and Michelle Gilmartin

Fraser of Allander Institute, Department of Economics

University of Strathclyde

12th October 2007 – Royal Museum, Edinburgh

The need for research

- International sustainable development commitments subscribed to at national level, but delivery required at the regional level
  - specific targets for renewable electricity in Scotland and UK (40% and 20% by 2020 respectively)
  - EU target for 20% of energy from renewables by 2020
- Importance of integrated energy-economy-environment analysis (and therefore data)
- Quantify system-wide impact of variety of energy-economy-environment policies

The objectives

- Develop a set of national, regional and inter-regional economic, energy, environment databases for the UK

- Develop and implement an interregional Computable General Equilibrium (CGE) model of the UK with energy details

- To use the databases and modelling frameworks for extensive simulations of energy policy issues, focusing on marine and renewables

What has happened in year 4

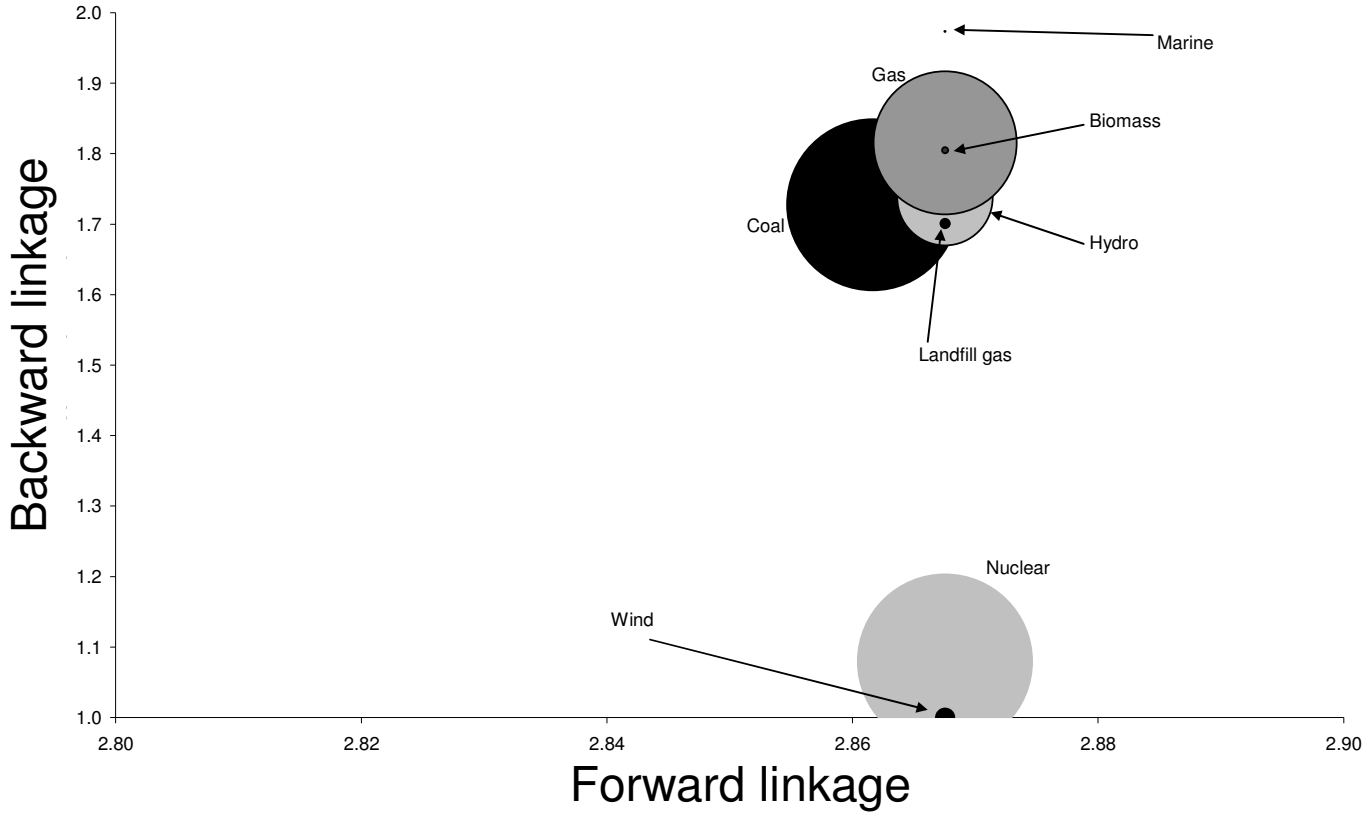
- Application of completed set of regional, national and interregional databases to UK national and regional energy issues
- Linkage analysis of alternative electricity generation technologies
- Analysis of consequences of major changes in electricity generation (e.g. nuclear)
- Extensive work on environmental indicators, including Ecological Footprint and alternatives

What has happened in year 4

- Regional and national CGE models used for examination of impacts of development of wave and tidal sector
- Development and use of interregional CGE to supply- and demand-side issues
- CGE simulation contributions made to energy efficiency debate in UK
- Preliminary analysis of economic and environmental effects of UK Climate Change Levy package

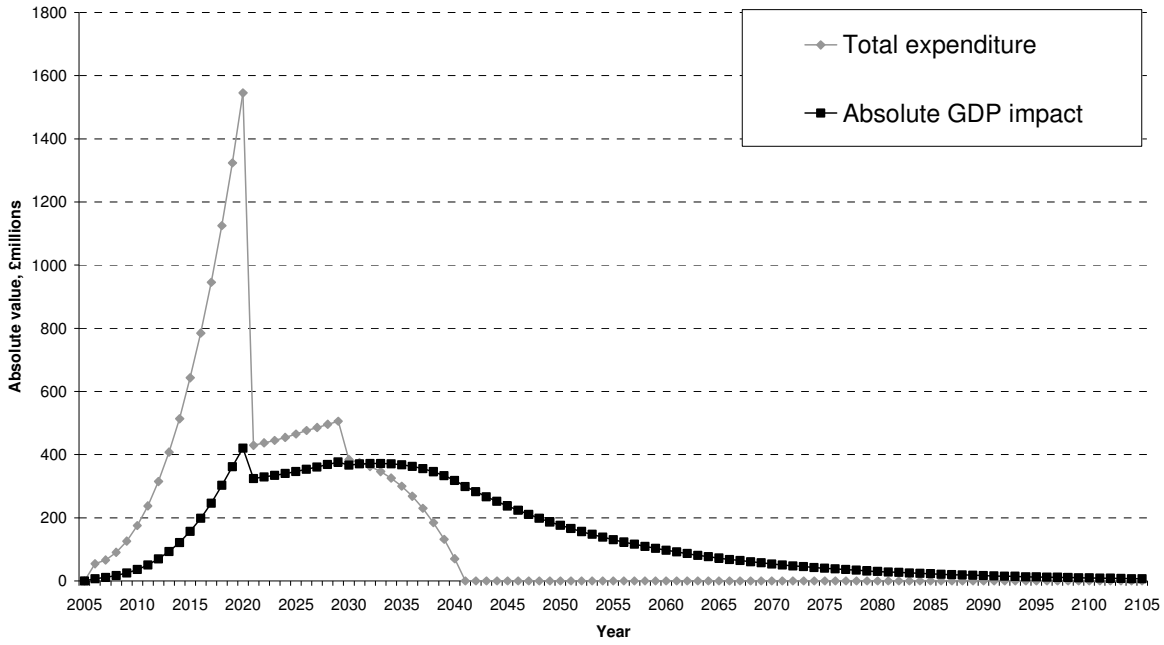
Databases and linkage analysis

- Impacts of different electricity technologies differ, and can be quantified



Marine impacts & CGE models

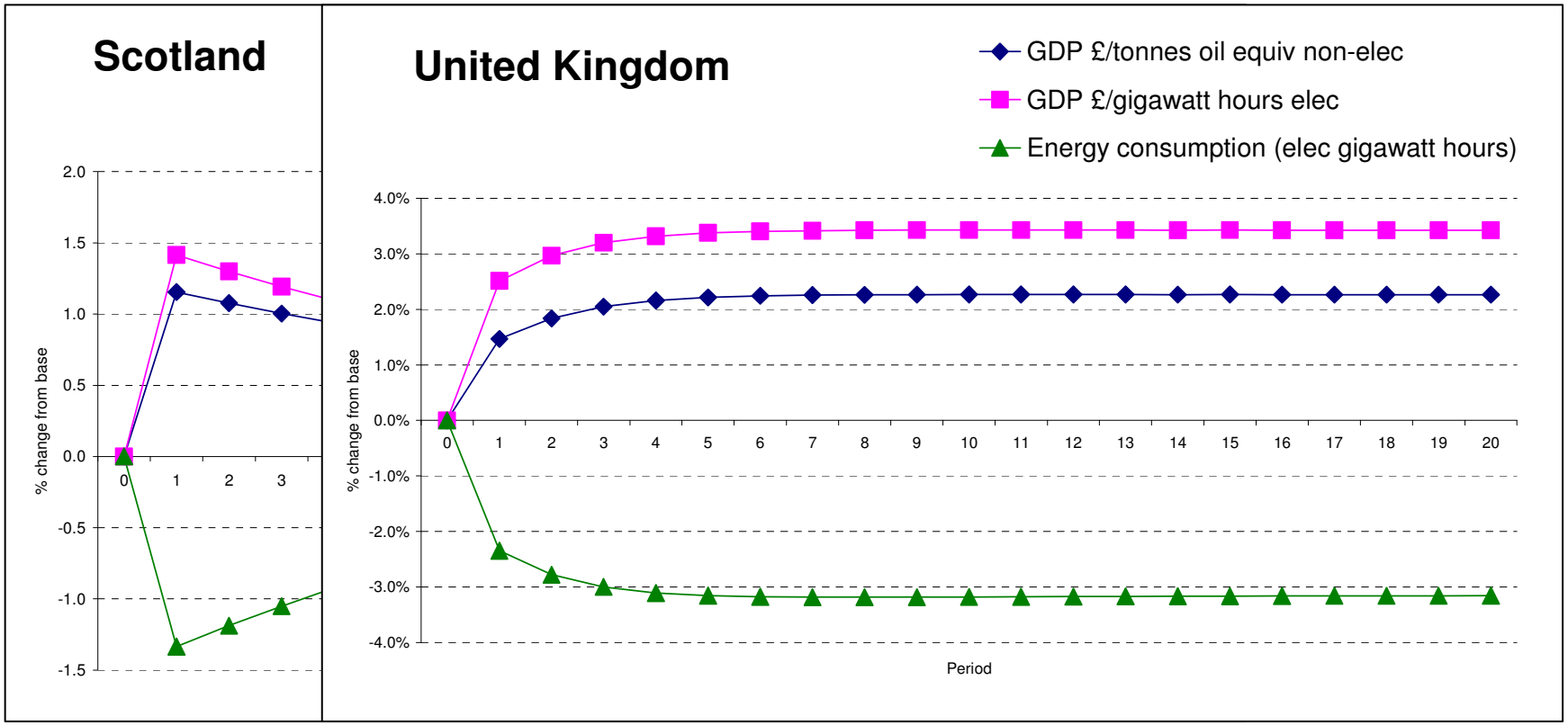
- Expenditures required during the installation of a first generation of marine technologies will have significant legacy effects



Energy efficiency

- Application of CGE models for Scotland and UK
- Analysis of importance of scale of ‘rebound’ and ‘backfire’ effects
- Crucial for understanding of energy, economy, and environmental impacts of policy aimed at stimulating energy efficiency
- Identified key conditions and assumptions for these results in review of CGE modelling for UKERC TPA on the Rebound Effect

Energy efficiency vs Energy Use



- Scotland = Backfire, UK = Rebound (c.40%)
- Clarify theory and try to quantify rebound effect
- Role for co-ordination of energy, and non-energy, policy

Key achievements and findings

- Creation of new energy-economy-environment databases
- Analysed how renewable technologies differ in their economic linkages to the regional and national economies of the UK
- Major contribution to the literature on environmental indicators and an alternative methodology developed
- Development of a range of CGE models with treatment of renewable and non-renewable energy
- Assessed the scale of ‘rebound’ and ‘backfire’ effects using these CGE models

Continuation of research

- Workstream 9 in Phase 2 of SuperGen Marine
- “Economic analysis of variability and penetration”

- Can the pattern and timing of future uptake of marine energy be predicted?
- How does increased penetration of marine renewable systems impact upon:
  - the electricity network, the system costs and the price of electricity?
  - crucially, what are the macroeconomic system-wide impacts of this?