



Robert Gordon University



EPSRC

Engineering and Physical Sciences
Research Council

Research to reduce the risk & uncertainty in marine energy development

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

The Regional Impacts of a Developing Marine Industry for Electricity Production

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The need for research

- Policy push towards non-fossil fuel basis for electricity generation across world
 - International sustainable development commitments subscribed to at the national level, But:
 - Delivery required at the regional level
 - Considerable variation in regional impacts
- Importance of quantifying the system-wide (macroeconomic) perspective from analysis of growth of marine energy technologies
- Interdependencies between energy-economy and environment need to be acknowledged and modeled systematically if serious about policy to effect sustainable development

The objectives

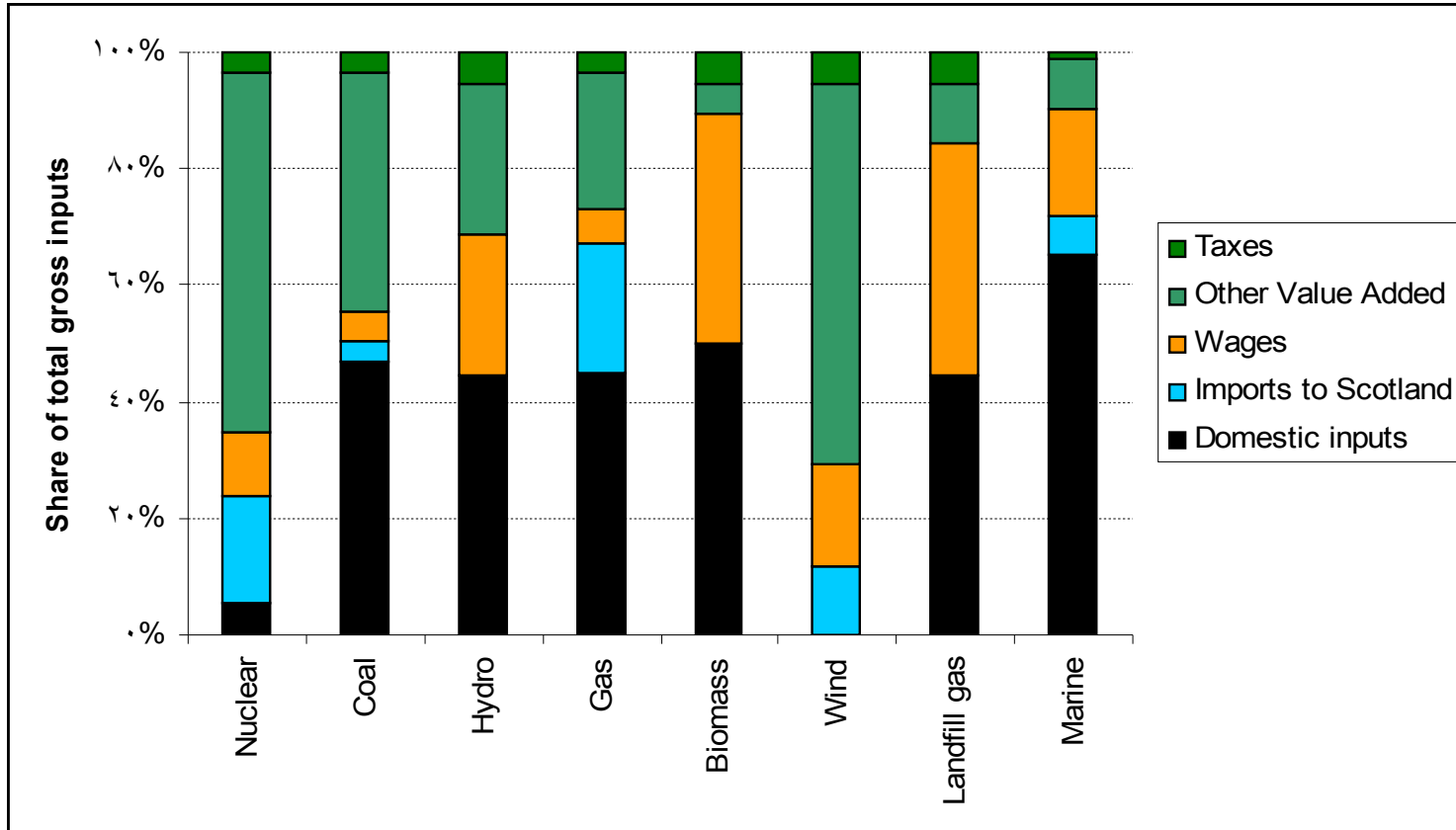
- To develop an interregional SAM for the UK – **implemented for Scotland/RUK**
- To develop and implement an interregional CGE model of the UK with appropriate energy disaggregation – **preliminary work done, new model in preparation**
- To use an interregional CGE model of the UK to estimate the economic, environmental and social impacts of policy and non-policy disturbances – **third year of our work package (year 4 of programme)**



Progress with modelling (1)

- Input-Output and Social Accounting Matrices: Developed and explored single and inter-regional IO and SAMs with energy technologies appropriately treated

Input-Output results for Scotland

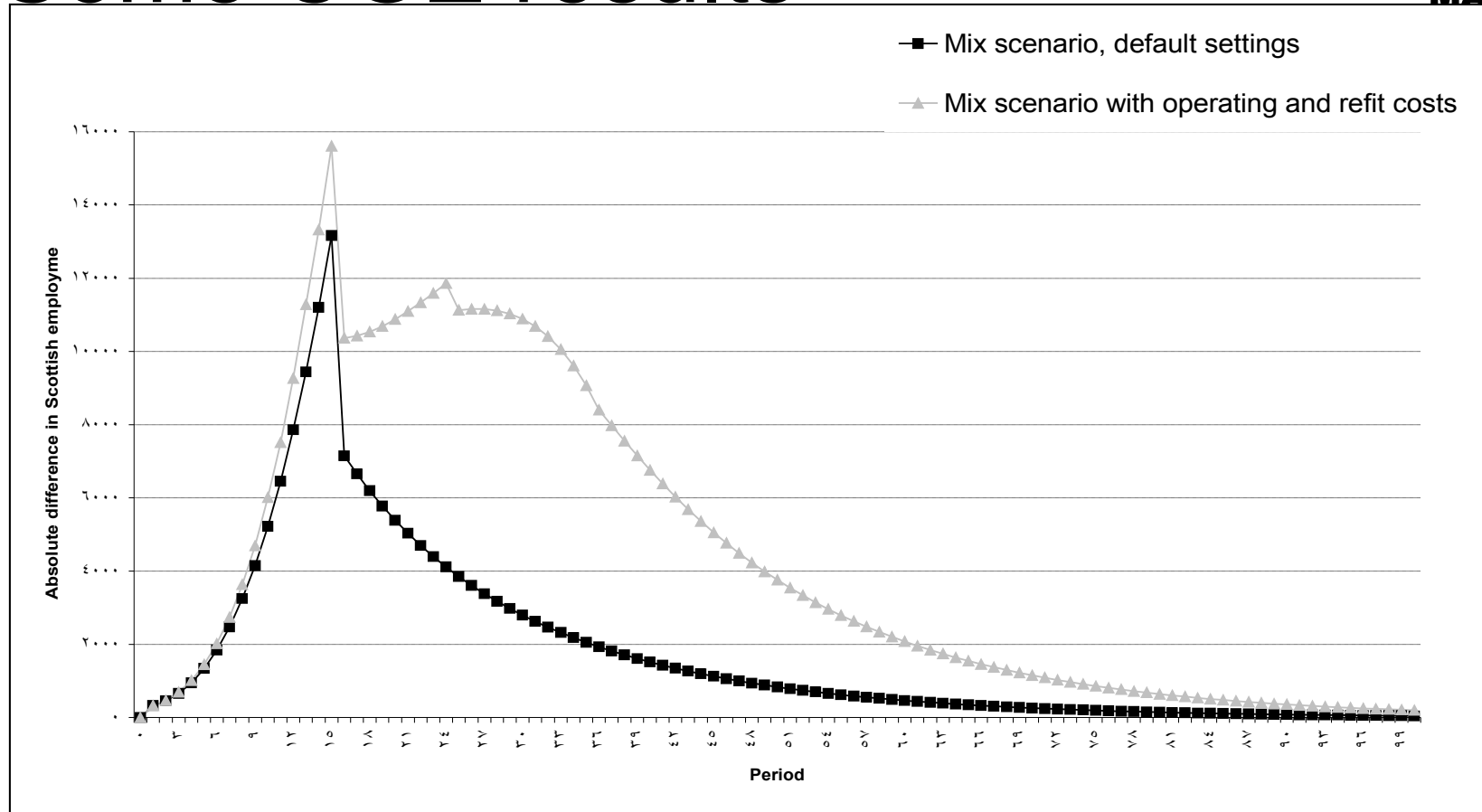


- New extension of IO database for Scotland
- Economic benefits from the operation of different electricity generation technologies

Progress with modelling (2)

- CGE: used projections for marine industry in Scotland to 2020 – possible futures, beyond “scenarios”, to quantifiable outcomes and sensitivity of impacts for general marine technology
 - Link to data on costs from WP7

Some CGE results

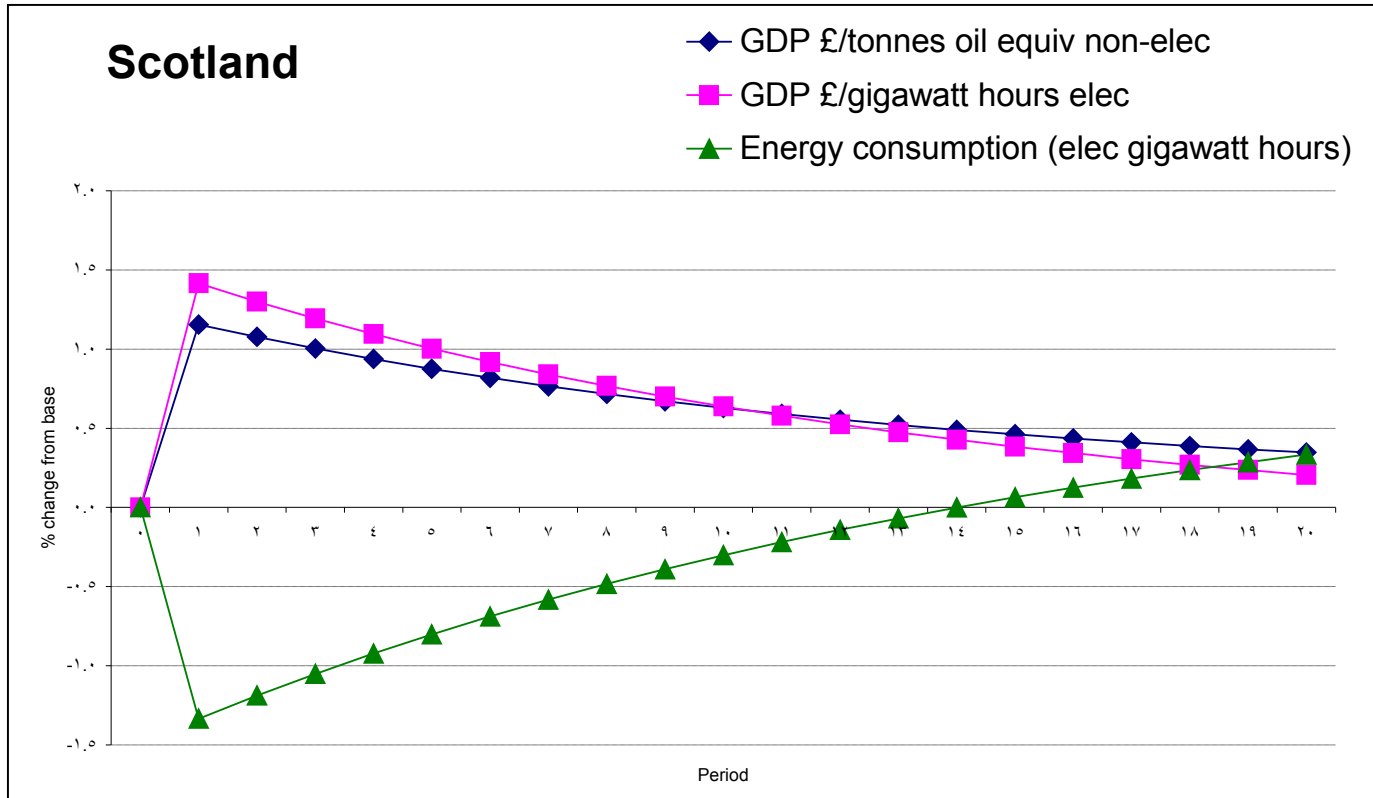


- Micro costs from WP7
- Macro simulations of impacts – GDP, employment, wages – using CGE model

Energy Efficiency

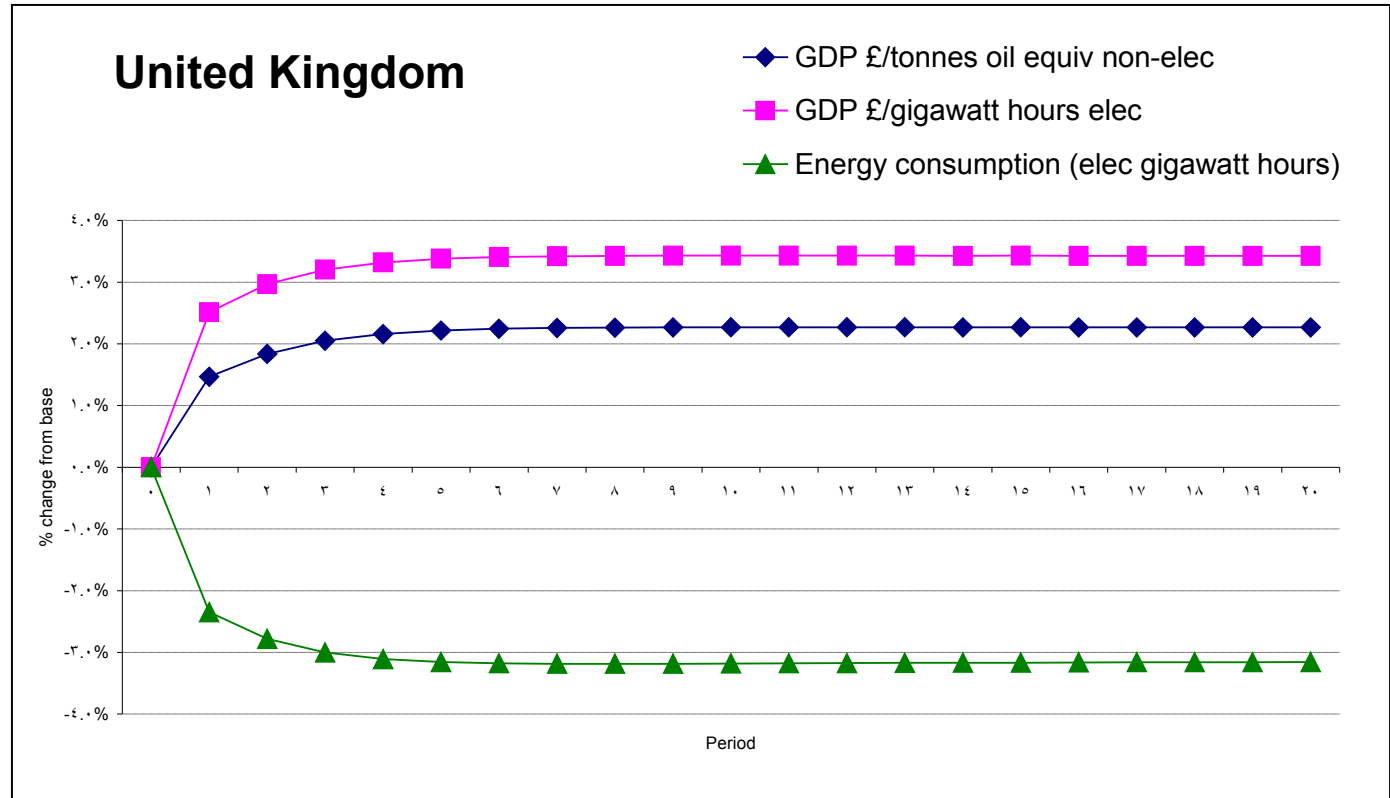
- Use of existing CGE models to explore scale of “rebound effect” for energy consumption from energy efficiency improvement
 - Part of this work funded by DEFRA
- Fed in to work of DEFRA, Stern Review, Energy Review and UKERC
- Follow-up work on use of CGE models in energy efficiency debate for UKERC TPA

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

Energy Efficiency vs Energy Use



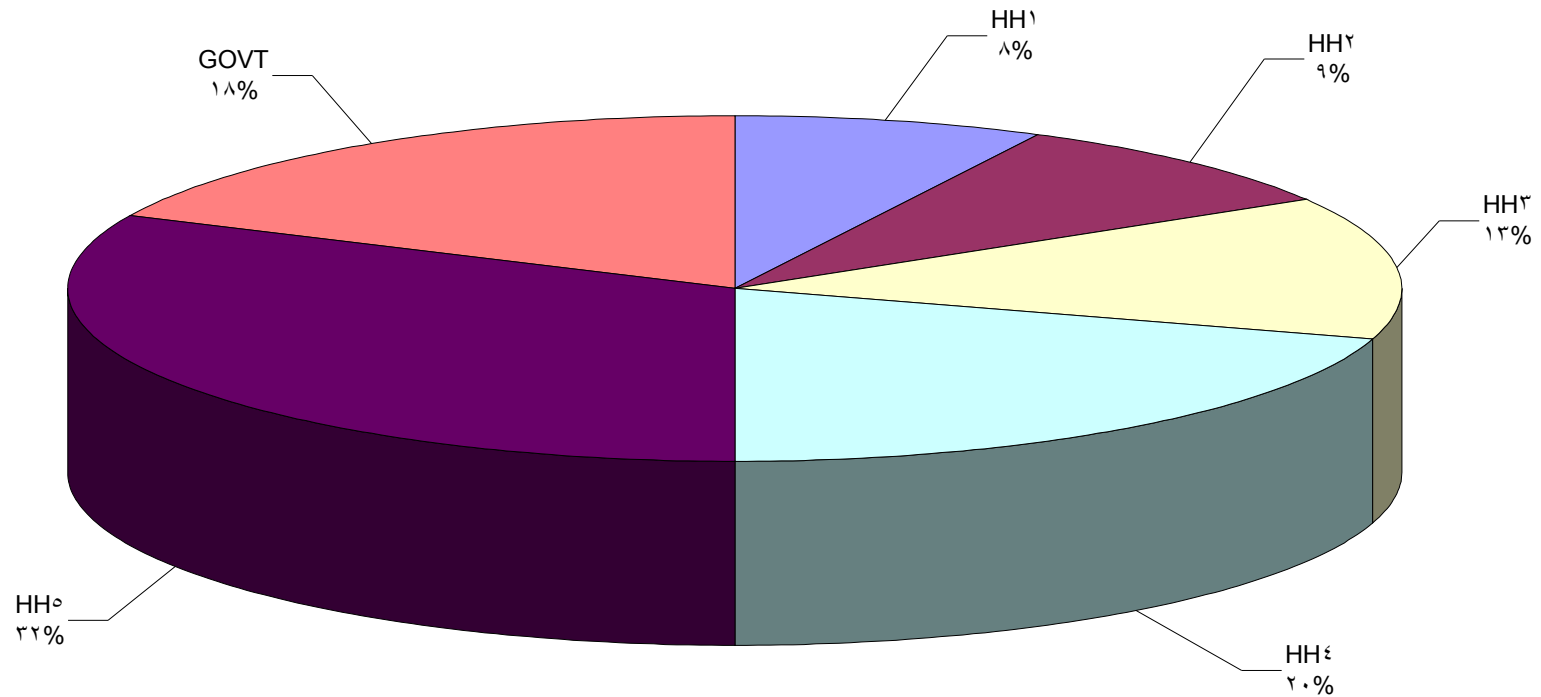
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Attribution analysis

- Work on attributing responsibility for pollution
 - NCLAS procedure to attribute pollution and energy use to final demands
 - Principle is similar and complementary to ecological footprints, but uses only territorial data and can directly address regional and national commitments
- Indicators and modelling
 - On-going work on construction of individual and composite environmental indicators
 - But need a modelling approach to be able to relate changes in indicators to disturbances (including policy changes)

Attribution index for Scotland

Figure 2 Attribution Index for Scotland (1999) to Local Final Consumption Demand in the Neo - Classical Linear Attribution System (with Trade and Capital Formation Determined Endogenously)



Interim achievements/findings

- Creation of new regional and national databases on Input-Output and SAM
- New frameworks for analysing system-wide consequences of policy and other disturbances for economy, energy and environment
- Key findings relate to:
 - Theory and simulation evidence on energy efficiency changes
 - Development of rigorous (and reproducible) alternatives to ecological footprints
 - Likely impact of switches in generating technologies in Scotland
 - Macroeconomic consequences of successful marine development

Future work

- Suite of IO/SAM databases and CGE models for single regions and UK as a whole to be completed
- Use these models for extensive simulation of policy and non-policy relevant issues
- Distinction between national policies and those of devolved authorities
 - But, regional commitments to sustainable development
 - And, though reserved, delivery will be at regional level
 - Multi-level governance issues (spillovers and coordination)