Energy, climate, land-use and money - four challenges in one go!

Brian Ó Gallachóir, Paul Deane and Alessandro Chiodi

UCC Environmental Research Institute and School of Engineering, University College Cork, Ireland

Our energy usage globally over the past century has been the primary driver of climate change. We require radical changes in energy use, energy efficiency and in fuel switching, in order to mitigate against the worst impacts of climate change, and in particular if we wish to limit global temperature increases to at most 2°C above pre-industrial levels. This paper focuses on these changes in the energy system due to climate mitigation pathways focussing on Ireland as a case study. It explores impacts across a range of areas, notably technology, economics and land-use.

The paper presents the results of a range of climate mitigation scenarios using the linear programming model Irish TIMES. TIMES is an economic model generator for local, national or multi-regional energy systems, which provides a technology-rich basis for estimating energy dynamics over a long-term, multi-period time horizon. The Irish TIMES model forms part of a family of least cost energy systems models developed under through collaborative research activity under the auspices of a Multilateral Technology Initiative of the International Energy Agency, namely the Energy Technology Systems Analysis Programme (IEA-ETSAP).

The results show that achieving deep cuts in CO_2 emissions in Ireland in the period to 2050 will have significant economic cost implications, arising from investments required to transform the current energy system delivering the required levels of electricity, transport energy and heating and cooling. These costs are compared to the costs of a scenario in which Ireland's future energy system delivers future energy needs in the absence of a CO_2 reduction target.

The results also illustrate the changes in land-use associated with the various mitigation scenarios. In particular the additional land allocated to bioenergy, comprising additional forestry, willow and miscanthus crops, grasslands utilised to generate biogas is quantified. These quantified impacts can inform discussions associated with the competition for land-use to produce fuel rather than food.

The purpose of this paper is to increase the knowledge base underpinning energy, climate and agricultural policy discussions as Ireland deliberates over climate change legislation and develops economy wide and sector specific low carbon roadmaps. It draws on analysis from a range of disciplines, notably engineering, economics and agriculture.