THE ECONOMIC AND ENVIRONMENTAL IMPACT OF THE UK OFFSHORE WIND ENERGY SECTOR

Peter McGregor, Department of Economics, University of Strathclyde
p.mcgregor@strath.ac.uk, Tel: +44 (0) 141 548 3848
Cathy Xin Cui, Patrizio Lecca, Kim Swales, Marie Tamba, Department of Economics
and Fraser of Allander Institute, University of Strathclyde

Overview

In 2014, the UK offshore wind installed operating capacity reached 3.6 GW, with a further 1.4 GW under development. The UK government consider offshore wind to be a major contributor to achieving the mandatory 2020 renewable energy and CO2 emission targets. Furthermore, it is considered a renewable technology that offers great potential to develop a competitive, UK-based supply chain. The latest Electricity Market Reform Delivery Plan (DECC, 2013) projects offshore wind capacity to rise to 10GW by 2020 (within a range of 8-15GW). Investments in the offshore wind sector are expected to stimulate economic activity and long term jobs. Potential domestic developments of the sizable and complex supply chain of this offshore wind industry could generate further economic benefits. Yet, the most important obstacle to the development of the sector is the overall cost of the technology. Over the period 2003-2009, the per megawatt costs of offshore wind farms have increased dramatically (Esteban et al., 2011). In terms of levelised costs, Crown Estate (2012) has estimated that recent wind farm projects show levelised costs of around £140 per MWh. Given current costs levels, reaching the renewable energy target is highly dependent on cost reductions via learning effects. In order to reach the target, the expectation for the offshore wind industry is to reduce these costs to £100/MWh by 2020 (Offshore Wind Cost Reduction Taskforce, 2012). This paper aims to address all these issues pertaining to the development of UK offshore wind energy, through economy-wide modelling analyses.

Methods

This paper examines the economic impact of developing the UK offshore wind sector to the 2030 horizon, in line with government projections and future planned developments. Two modelling frameworks are used, each addressing important issues outlined above. First, progressive annual investments in the offshore wind sector, and corresponding O&M expenditures are simulated in an Input-Output model, in order to determine their knock-on effects on UK economic activity and employment. A number of scenarios are analysed reflecting the range of projected total installed capacity and with progressive domestic sourcing for the supply-chain. Second, an energy-economy-environment CGE model is used to provide an illustrative analysis of the economic and environmental impacts of introducing costs reductions through technological change in the offshore wind sector. Technological change is represented through factor productivity improvements in the offshore wind sector, calibrated to the governments' target cost reductions for the industry.

Results

The IO simulations show that the projected developments in offshore wind can generate significant economic benefits in the UK. The stimulus to production, gross value-added and job creation more than doubles if the highest installed capacity projection is reached, compared to the lowest. Correspondingly, the expansionary impact of developing offshore wind becomes larger as the UK content of the industry's supply chain increases. In the CGE model, the cost reductions in offshore wind also stimulate the sector and the UK economy, but to a smaller extent than the IO analysis, due to the relatively small size of the sector in the base-year. Despite this expansionary impact, offshore wind is found to displace generation away from fossil-fuel technologies, generating a decrease in total CO2 emissions. A sensitivity analysis on the elasticities of substitution between energy sources in the production function also reveals that less substitution between energy sources brings larger positive economic benefits, but reduces the replacement of fossil-fuel generation and thus the potential for CO2 emission reductions.

Conclusions

The ambitious projections for the development of offshore wind in the UK could generate significant benefits in terms of economic activity and employment. However, the expected cost reductions in the industry might not be sufficient to encourage private investments to the level of installed capacity that is targeted by the UK government. The modelling analyses in this paper confirm that policy should make a priority of facilitating large investments in offshore wind capacity, as well as encouraging the development of a UK-based supply chain for the sector.

References

Crown Estate (2012) Offshore Wind Cost Reduction Pathways Study.
DECC (2013) Electricity Market Reform Delivery Plan, December 2013.
Esteban, M., Diez, J. ,López, J. & Negro, V. (2011). Why offshore wind energy? *Renewable Energy*, *36*(2), 444-450.
Offshore Wind Costs Reductions Task Force (2012) Cost Reduction Task Force Report, June 2012