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**SUPERGEN Wind Hub**

**Deliverables:**

**D2.3.1** Report on estimates of the aggregate and sectoral system-wide impacts on output and employment.

&

**D2.3.2** Model-based estimates of the impact on carbon emissions

Delivered by:	University of Strathclyde
Author(s):	Grant Allan, Kevin Connolly, Peter McGregor, and Andrew Ross
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### **D2.3.1 Report on estimates of the aggregate and sectoral system-wide impacts on output and employment.**

An up-to-date UK input-output (IO) table was constructed that incorporates an offshore wind sector with connection scenarios represented [17]. This was then used to simulate the employment and value-added impacts of the sector using a simple IO model, with exogenous demands informed by the latest BEIS information [4,5]. The IO database was further augmented to a social accounting matrix (SAM), which fully accommodates the income flows associated with wind farm ownership [18]. SAM modelling can illustrate the significance of alternative ownership patterns [e.g. 15].

We assess the economic and environmental impacts of UK offshore wind development [4]; focus on the impact of changing local content [5]; consider characteristics of energy employment in a system-wide context [1,10]; consider concepts of green jobs [2]; develop an electricity satellite account [3]; assess employment in low-carbon and renewable energy activities [6]; and identify the regional economic impacts of offshore wind energy developments [7].

However, the main purpose of the SAM is to provide a database [18] that allows us to focus on updating and extending a computable general equilibrium (CGE) model for the UK, which incorporates a fully-specified supply side, as well as all the income flows associated with offshore developments. This allows us, for example, to accommodate the potential “crowding out” of other activity by wind farm development. Importantly, however, it also allows exploration of the likely impact of innovation, for example, through the incorporation of (endogenous) learning effects. The impacts of alternative policy packages can also be explored, including a focus on the distinction between announced and unanticipated changes in policy. We present simulations of alternative scenarios using our offshore-wind-augmented CGE models in [7,8].

We analyse how Brexit may affect the UKERC and BEIS roadmaps for deployment, UK content, and exports: as offshore wind is deployed in UK waters, we consider how Brexit affects the UK content in the supply chain, and UK exports from the offshore wind supply chain [12,13,4]. Furthermore, we illustrate the importance of revenues accruing to owners and the Crown Estate, indicating the importance of their dispersion and use [e.g. 16], and we develop an illustrative cost-benefit analysis of offshore wind development in the UK [14].

### **D2.3.2 Model-based estimates of the impact on carbon emissions**

The outputs summarise the impact of the various modelled scenarios above for changes in carbon emissions. This is most straightforward for production-oriented measures of emissions such as those emphasised in Kyoto, since these are automatically tracked in both energy-economy-environment IO and CGE systems [8].

We identify employment in low-carbon and renewable energy activities [6]; incorporate CO<sub>2</sub> emissions into macroeconomic models through primary energy use [9]; consider energy and climate change challenges and policies [11]; and identify economic and environmental impacts of UK offshore wind developments [4,5,8].

#### **Journal publications (and submissions)**

1. Allan, G. J., & Ross, A. G. (2019). The characteristics of energy employment in a system-wide context. *Energy Economics*, 81, 238-258.
2. Allan, G., & Caio A. (2019 in preparation for submission). Taking concepts of green jobs to the data: the UK case. Forthcoming.
3. Allan, G. J., Connolly, K., & McIntyre, S. (2019a R&R at Economic Systems Research). Developing an electricity satellite account (EISA): an application to Scotland, UK. Forthcoming.
4. Allan, G. J., Connolly, K., Comerford, D., Ross, A.G., McGregor, P.G. (2019b in preparation for submission). Economic and environmental impacts of UK offshore wind development to 2029: the importance of local content. Forthcoming.
5. Allan, G., Connolly, K., Ross, A. G., McGregor, P.G. (2019c in preparation for submission). Economic activity supported by offshore wind: a hypothetical extraction study. Forthcoming.
6. Allan, G., McGregor, P., & Swales, K. (2016). Greening regional development: employment in low-carbon and renewable energy activities. *Regional Studies*, 51(8), 1270–1280.
7. Connolly, K. (2019 in preparation for submission). The regional economic impacts of offshore wind energy developments in Scotland. Forthcoming.
8. Lecca, P., McGregor, P. G., Swales, K. J., & Tamba, M. (2017). The Importance of Learning for Achieving the UK's Targets for Offshore Wind. *Ecological Economics*, 135, 259–268.

#### **Reports, book chapters, working papers, and other relevant work**

9. Allan, G., Connolly, K., Ross, AG, McGregor, PG. (2018). Incorporating CO<sub>2</sub> emissions into macroeconomic models through primary energy use. *Discussion Papers in Economics*, 18(18).

10. Allan, G. J., & Ross, A. G. (2018). The characteristics of energy employment in a system-wide context. *Discussion Papers in Economics*, 18(11).
11. Allan, G., McGregor, P. G., & Swales, J. K. (2017). Energy and climate change: challenges and policies. In: *The Scottish Economy: A Living Book*. ISBN: 9781138960916.
12. Allan, G., & Comerford, D. (2017). How might Brexit impact the UK energy industry? In: *Scotland, the UK and Brexit*. Luath Press Limited, Edinburgh. ISBN 9781912147182.
13. Comerford, D., Cui, C. X., Lecca, P., McGregor, P.G., Swales, J.K., & Tamba M. (2017). How will Brexit affect the offshore wind industry in the UK? In: *Applied Environmental Economics Conference 2017*, The Royal Society.
14. Cui, C. X., Lecca, P., McGregor, P.G., Swales, J.K., & Tamba M. (2016). An Illustrative Cost-Benefit Analysis of Offshore Wind Development in the UK. Report for SUPERGEN Wind Hub.
15. Fraser of Allander Institute (2017a). Economic impact of the proposed Neart Na Gaoithe offshore wind farm. *University of Strathclyde, Department of Economics*.
16. Fraser of Allander Institute (2017b). The potential macroeconomic impacts of floating offshore wind: a methodological guide, Crown Estates. *University of Strathclyde, Department of Economics*.

## Data sets

17. Allan, G., Connolly, K., & Ross, A. G. (2019d) UK Social Accounting Matrix disaggregated by electricity production sectors. *Forthcoming*. <https://doi.org/10.15129/eb99ccc0-04f0-4a40-a3f9-309de1dc80d9>
18. Allan, G., Connolly, K., & Ross, A. G. (2019e) UK Input-Output table disaggregated by electricity production sectors. *Forthcoming*. <https://doi.org/10.15129/03734143-205d-4152-97af-104196cfe50d>