

THE ECONOMICS OF INTEGRATING WIND ENERGY

Instructor: Professor Richard Green, Imperial College Business School

Cologne, July 29 - August 2, 2013

Many countries (in Europe and elsewhere) are adding a significant amount of wind generation to their electricity systems. This course assesses some of the impacts of this, combining empirical studies of past impacts with modelling work on possible future effects. The course is anchored in the discipline of economics, but recognises that it is important to take full account of the technical features of wind power and of electricity systems more generally.

All participants will need to be familiar with the basic economics of electricity markets. One possible primer is:

Green, R.J. (2005) "Electricity and Markets" *Oxford Review of Economic Policy*, vol. 21, no.1, pp. 67-87
<http://dx.doi.org/10.1093/oxrep/gri004>

Topics to be covered (provisional):

Modelling the output of wind farms

Green, R.J. and N. Vasilakos (2010) "Market Behaviour with Large Amounts of Intermittent Generation" *Energy Policy*, vol. 38, no. 7, pp. 3211-3220
<http://dx.doi.org/10.1016/j.enpol.2009.07.038>

The short-run impact of wind power on electricity prices

Twomey, P., Neuhoff, K., 2009. Wind power and market power in competitive markets. *Energy Policy*,
<http://dx.doi.org/10.1016/j.enpol.2009.07.031>

F. Sensfuß, M. Ragwitz, M. Genoese (2008) "The merit-order effect: a detailed analysis of the price effect of renewable electricity generation on spot market prices in Germany" *Energy Policy*, 36 (8), pp. 3076-3084, <http://dx.doi.org/10.1016/j.enpol.2008.03.035>

G. Sáenz de Miera, P. del Río González, Ignacio Vizcaíno (2008) "Analysing the impact of renewable electricity support schemes on power prices: the case of wind electricity in Spain" *Energy Policy*, 36 (9), pp. 3345-3359, <http://dx.doi.org/10.1016/j.enpol.2008.04.022>

Absorbing intermittent supplies of wind power

Gross, R., Heptonstall, P., Anderson, D., Green, T, Leach, M., Skea, J., 2006. The Costs and Impacts of Intermittency: An assessment of the evidence on the costs and impacts of intermittent generation on the British electricity network. UK Energy Research Centre, London

<http://www.ukerc.ac.uk/Downloads/PDF/06/0604Intermittency/0604IntermittencyReport.pdf>

Green, R.J. and N. Vasilakos (2012) "Storing Wind for a Rainy Day: What kind of electricity does Denmark export?" *The Energy Journal*, vol. 33, no. 3, pp. 1-22 <http://dx.doi.org/10.5547/01956574.33.3.1>



Building a portfolio

Rombauts, Y., E. Delarue and W. D'haeseleer (2011) "Optimal portfolio-theory-based allocation of wind power: Taking into account cross-border transmission-capacity constraints" *Renewable Energy* Vol. 36, Iss. 9, pp. 2374-2387 <http://dx.doi.org/10.1016/j.renene.2011.02.010>

Roques, F., C. Hiroux, and M. Saguan (2010) "Optimal wind power deployment in Europe – A portfolio approach," *Energy Policy*, vol. 38, no. 7, pp. 3245-325, <http://dx.doi.org/10.1016/j.enpol.2009.07.048>

Green, R. and I. Staffell (2012) *How Large Should a Portfolio of Wind Farms Be?* Presented at the IAEE European Conference, Venice, <http://www.iaeeu2012.it/pdf/Greenppt.pdf>

The impact of wind power on emissions

D.T. Kaffine, B.J. McBee, and J. Lieskovsky (2013) "Emissions Savings from Wind Power Generation in Texas", *Energy Journal*, Vol 34, no. 1, pp. 155-175 <http://dx.doi.org/10.5547/01956574.34.1.7>

Robert Gross, Richard Green, Iain Staffell, Phil Heptonstall (2012) [ICEPT addendum to the Energy and Climate Change Select Committee on the economics of wind – addressing the claims of the Global Warming Policy Foundation](#)

Investment decisions

Green, R.J. and N. Vasilakos (2011) *The Long-Run Impact of Wind Power on Electricity Prices and Generating Capacity*, discussion paper, University of Birmingham,

<http://www.bhamlive2.bham.ac.uk/Documents/college-social-sciences/business/economics/2010-papers/economics-papers-2011/economics-papers-2011/11-09.pdf>

Staffell, I and R.J. Green (2012) *Is there merit in the Merit Order Stack?* Presented at the 2012 BIEE Conference

