

Ph.D. course
Electricity Economics

Department of Economics and Resource Management (IØR)
Norwegian University of Life Sciences (UMB), Ås

Lecturer: Richard Green, Professor, Dep. of Economics, University of Birmingham
Dates: 30 August - 3 September 2010
Place: Ås, Norway
Credits: 5 ECTS
Course code: ECN 480
Application deadline: 22th of August 2010

Objectives

This course will show how economic analysis has been, and is being, applied to the electricity industry. Key themes will include the relationship between costs and market prices, methods of regulating monopolies, and the desirable level of investment. Ways of internalising environmental effects, such as carbon emissions, will be considered at length during the course. The course is intended for PhD students, early-career researchers and advanced Masters students, and there will be some opportunities for participants to present their work during the course.

Course schedule

Monday 30 August

Morning Introduction to the electricity industry – technology and economics
Afternoon Overview of liberalisation
System planning exercise

Tuesday 31 August

Morning Electricity transmission
Afternoon Wholesale markets for electricity

Wednesday 1 September

Morning Economic regulation in theory and practice
Afternoon The fuel industries
Electricity retailing

Thursday 2 September

Morning Market power models and studies
Afternoon Price control exercise

Friday 3 September

Morning Energy policy, carbon trading, support for renewable generation

Depart after lunch

Abstract and participation

Students who wish to present their work should send a 2-page abstract to Inger-Lise Labugt by **August 9th** – they will be notified whether they will be asked to give a presentation (which is likely to be for between 15 and 30 minutes, depending on demand, by August 18th).

Email: inger-lise.labugt@umb.no and cc. ole.gjolberg@umb.no

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The lecturer

Richard Green is currently the Director of the Institute for Energy Research and Policy and Professor of Energy Economics in the Department of Economics at the University of Birmingham. He has worked at the University of Cambridge (where he took his degrees) and the University of Hull, and held visiting positions at the Office of Electricity Regulation, University of California Energy Institute, and the Massachusetts Institute of Technology. Professor Green is further a member of the Supergen Flexnet Consortium, and an Associate of the Electricity Policy Research Group. He is also a Fellow of the Energy Institute.

Readings

These form a “long bibliography” for further research, rather than expected reading for course participants. Students who wish to do some background reading (entirely optional) before the course begins are advised to concentrate on the starred items (*).

Introduction to the electricity industry and its economics

Green, R.J. (2000) “Competition in Generation: The Economic Foundations” *Proceedings of the IEEE* Vol. 88, No 2, pp 128-139

*Stoft, S.E. (2002) *Power System Economics: Designing Markets for Electricity* Chichester, Wiley

Gilbert, R.J. and E.P. Kahn (eds) (1996) *International Comparisons of Electricity Regulation*, Cambridge, Cambridge University Press; particularly chapters on England and Wales (Newbery and Green), Scandinavia (Hjalmarsson) and the US (Gilbert and Kahn).

Generation

Gross, R., P. Heptonstall, D. Anderson, T.C. Green, M. Leach and J. Skea (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*, London, Imperial College

*Green, R.J. (2005) “Electricity and Markets” *Oxford Review of Economic Policy*, vol. 21, no.1, pp. 67-87

Green, R.J. and N. Vasilakos (2010) “Market Behaviour with Large Amounts of Intermittent Generation” *Energy Policy*, vol. 38, no. 7, pp. 3211-3220

Müsgens, F., and K. Neuhoff (2006) *Modelling Dynamic Constraints in Electricity Markets and the Costs of Uncertain Wind Output*, Electricity Policy Research Group working paper CWPE 06010 and EPRG 0514, University of Cambridge

Liberalisation

Al-Sunaidy, A. and R.J. Green (2006) “Electricity deregulation in OECD countries” *Energy – The International Journal*, vol. 26, nos. 6-7, pp. 769-87

- Glachant, J.-M. and F. Leveque (2009) *Electricity Reform in Europe: Towards a Single Energy Market*, Cheltenham, Edward Elgar
- Green, R.J. (2001) "Markets for Electricity in Europe", *Oxford Review of Economic Policy*, Vol. 17 no 3, pp 329-345
- Joskow, P.L. (2003) *The Difficult Transition to Competitive Electricity Markets in the US*, CMI working paper EP28, University of Cambridge
- *Joskow, P.L. (2008) "Lessons learned from electricity market liberalization", *Energy Journal* vol. 29, Special Issue no. 2
- *Newbery, D.M. (ed.) (2006) Special Issue on European Electricity Liberalization, *Energy Journal* vol. 26, Special Issue
- Sioshansi, F. P. and W. Pfaffenberger (2006) *Electricity Market Reform: An International Perspective*, Amsterdam, Elsevier
- Vaitilingam, R (ed.) (1999) *A European Market for Electricity?* London: Centre for Economic Policy Research

Market Design

- Chao, H-P and S. Peck (1995) "A Market Mechanism for Electric Power Transmission" *Journal of Regulatory Economics*, vol. 10, no 1, July, pp 25-59
- Green, R.J. (2007) "Nodal Pricing of Electricity: How much does it cost to get it wrong?" *Journal of Regulatory Economics*, vol. 31, no.2, pp. 125-149
- Hogan, W.W. (1992) "Contract Networks for Electric Power Transmission", *Journal of Regulatory Economics*, vol. 4, no 2, September, pp 211-242

Market power

- Andersson, B., and L. Bergman (1995) "Market Structure and the Price of Electricity: An *Ex Ante* Analysis of the Deregulated Swedish Electricity Market" *The Energy Journal* vol. 16 no 2, pp 97-109
- Borenstein, S. and J. Bushnell (1999) "An Empirical Analysis of the Potential for Market Power in California's Electricity Market." *Journal of Industrial Economics*, Vol. 47, No. 3, pp 285-323
- Borenstein, S., J. Bushnell and F. Wolak (2002) "Measuring Market Inefficiencies in California's Restructured Wholesale Electricity Market" *American Economic Review* vol. 92, no. 5 (December), pp 1376-1405
- von der Fehr, N-H M., and D. Harbord (1993) 'Spot Market Competition in the UK Electricity Industry', *Economic Journal*, vol. 103 no 418 pp 531-46
- Green, R.J. (1999) "The Electricity Contract Market in England and Wales" *Journal of Industrial Economics*, Vol. XLVII, No 1, pp.107-124
- Green R.J., and D.M. Newbery (1992) "Competition in the British Electricity Spot Market" *Journal of Political Economy* 100 (5), October, pp 929-53
- Joskow, P.L. and J. Tirole (2000) "Transmission Rights and Market Power on Electric Power Networks", *RAND Journal of Economics*, vol. 31, no. 3, Autumn, pp. 450-87
- Newbery, D.M. (1995) 'Power Markets and Market Power', *The Energy Journal*, Vol. 16, No 3, pp 39-66
- Powell, A. (1993) 'Trading Forward in an Imperfect Market: The Case of Electricity in Britain', *Economic Journal*, Vol. 103, No 417, March pp 444-53
- Sweeting, A.T. (2007) "Market Power in the England and Wales Wholesale Electricity Market 1995-2000", *Economic Journal* vol. 117, no. 520, pp 654-685
- Wolfram, C.D. (1998) "Strategic bidding in a multiunit auction: an empirical analysis of bids to supply electricity in England and Wales", *Rand Journal of Economics*, vol. 29, no 4, pp 703-725

Wolfram, C.D. (1999) "Measuring Duopoly Power in the British Electricity Spot Market", *American Economic Review*, vol. 89 no 4, pp 805-826

Retail markets

Borenstein, S. and S.P. Holland (2003) *On the Efficiency of Competitive Electricity Markets With Time-Invariant Retail Prices* CSEM Working Paper 116, University of California Energy Institute

Giulietti, M., C. Waddams Price, and M. Waterson, (2005), "Consumer Choice and Competition Policy: A Study of UK Energy Markets", *Economic Journal*, Vol. 115, No. 506, pp. 949-968

Green, R.J. and T. McDaniel (1998) "Competition in Electricity Supply: Will "1998" be Worth It?" *Fiscal Studies*, Vol. 19, No 3, pp. 273-293

Joskow, P.L. and J. Tirole (2006) "Retail Electricity Competition" *Rand Journal of Economics* vol. 37, no. 4, pp. 799-815

Littlechild, S.C. (2003) "Wholesale-Spot Pass Through" *Journal of Regulatory Economics* Vol. 23 No 1, January, pp 61-91

Sturluson, J.T. (2003) "Consumer Search and Switching Costs in Electricity Retailing", Chapter 1 in *Topics in the Industrial Organization of Electricity Markets*, PhD Thesis, Stockholm School of Economics, Sweden

Waddams Price, C.M. (2004) *Spoilt for Choice? The Costs and Benefits of Opening UK Residential Markets* CSEM Working Paper 123, University of California Energy Institute

Regulation

Beesley, M.E. and S.C. Littlechild (1989) 'The Regulation of Privatised Monopolies in the UK', *The Rand Journal of Economics*, Vol.20, No.3, Autumn, pp. 454-72

Green, R.J. and M. Rodriguez Pardina (1999) *Resetting Price Controls for Privatised Utilities; A Manual for Regulators*, 109 pp. Washington D.C.; Economic Development Institute of the World Bank

Monopolies and Mergers Commission (1993) *British Gas plc: Volume 1 of reports under the Gas Act 1986 on the conveyance and storage of gas and the fixing of tariffs for the supply of gas by British Gas plc*. Cm 2315, London, HMSO

Monopolies and Mergers Commission (1995) *Hydro-Electric plc: A report on a reference under section 12 of the Electricity Act 1989*, London, HMSO

Pollitt, M.G. and J. Bialek (2008) "Electricity network investment and regulation for a low-carbon future" in M. Grubb, T. Jamasb and M. Pollitt (eds.) *Delivering a Low Carbon Electricity System: Technologies, Economics and Policy*, pp. 183-206, Cambridge, Cambridge University Press

Pollitt, M.G. and Jamasb, T. (2001), 'Benchmarking and Regulation of Electric Utilities: Lessons from International Experience', *Utilities Policy*, Vol.9, No.3, pp.107-130

Shleifer, A., (1985), 'A Theory of Yardstick Competition' *Rand Journal of Economics*, 16, pp.319-27

Stigler, G.J. (1971) "The theory of economic regulation" *Bell Journal of Economic and Management Science*, vol. 2 pp 3-21

Policy

Awerbuch, S. (2000) "Getting It Right: The real cost impacts of a renewables portfolio standard" *Public Utilities Fortnightly* Feb 15: 44-52

- Coase, R.H. (1960) "The problem of social cost" *Journal of Law and Economics* vol. 3, pp 1 - 44
- Department of Energy and Climate Change (2009) *The UK Renewable Energy Strategy*, Cm 7686, London, The Stationery Office
- European Commission (2007) *DG Competition Report on Energy Sector Inquiry, 10 January 2007*, SEC (2006) 1724, Brussels, Commission of the European Communities
- European Commission (2007) *Prospects for the internal gas and electricity market*, SEC (2007) 12, Brussels, Commission of the European Communities
- Green, R.J. (2009) "European Union Regulation and Competition Policy among the Energy Utilities", in Vives, X. (ed) *Competition in the EU: Fifty Years on from the Treaty of Rome*, pp. 284-313, Oxford, Oxford University Press, ISBN 978-0-19-956635-8; earlier version is Dept. of Economics working paper 08-01, University of Birmingham
- Grubb, M., and K. Neuhoff (2006) "Allocation and competitiveness in the EU emissions trading scheme: policy overview" *Climate Policy* vol. 6, no. 1, pp 5-28
- House of Lords (2008) *The Economics of Renewable Energy, Economic Affairs Select Committee Fourth Report of Session 2007-8*, HL195 of 2007-8, London, The Stationery Office
- Roques, F.A., W. J. Nuttall, D.M. Newbery, R. de Neufville and S. Connors (2006) "Nuclear Power: a Hedge against Uncertain Gas and Carbon Prices?" *The Energy Journal* vol. 27 no. 4, pp 1-23
- Sorrell, S (2007) *The Rebound Effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency*, London, UK Energy Research Centre
- Stern, N. (2007) *The Economics of Climate Change: The Stern Review* Cambridge, Cambridge University Press

Cost-benefit studies

- Damsgaard, N. and R.J. Green (2005) *Regulatory Reform in the Swedish Electricity Industry – Good or Bad?* SNS Occasional Paper No 95, ISSN 1400-2159
- Newbery, D.M. and M.G. Pollitt (1997) "The Privatisation and Restructuring of the CEGB - Was It Worth It?" *Journal of Industrial Economics* vol. 45 pp 269-303