

July 2011

 Storing Wind
 for a Rainy Day

CCP Executive Summary

Storing Wind for a Rainy Day: What kind of electricity does Denmark export?

BACKGROUND

- The last decade has seen a remarkable increase in the number of wind installations throughout the world as part of a coordinated effort to shift towards a higher share of renewable generation.
- In Europe, Denmark is amongst the leading countries in wind generation in terms of installed capacity relative to population and demand. The country has often been used as a case study to investigate the consequences and challenges of high rates of wind generation from both a technical and economic perspective.

METHODOLOGY

- The authors re-examine Denmark's patterns of electricity production and trade from 2001 to 2009 in the light of the economic theory underlying the optimal operation of a power system with a mix of hydro, thermal and wind resources.
- The cost of intermittency in Denmark's wind output is estimated.

KEY FINDINGS

- On windy days, Denmark tends to export electricity to its neighbours. On calm days, it tends to import power.
- Storing electricity in this way is theoretically optimal when a region with wind and thermal generation can trade with a region based on hydro power.
- Denmark's patterns of production and trade would not be possible without the cooperation of its neighbours and without the presence of neighbours with large systems and a lot of hydro storage.
- However, annual trends in Denmark's trade follow its output of thermal generation and are inversely related to Nordic production of hydro power and the amount of water available to Scandinavian generators, with no correlation with wind output.
- The cost of volatility in Denmark's wind output is estimated to equal between 4% and 8% of its market value.
- On the basis of their findings, the authors conclude that Denmark is able to deal with the problem of intermittency in a reasonably cost-effective way.

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THE CCP

The ESRC Centre for Competition Policy (CCP), at the University of East Anglia, undertakes competition policy research, incorporating economic, legal, management and political science perspectives, that has real-world policy relevance without compromising academic rigour.

FOR MORE INFORMATION

The full working paper (11-11) and more information about CCP and its research is available from our website: www.uea.ac.uk/ccp

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