

Can current electricity markets cope with high shares of renewables? A comparison of approaches in Germany, the UK and the State of New York

Michael G. Pollitt and Karim L. Anaya

This paper explores the way different jurisdictions are dealing with the expansion of renewables in the electricity system and electricity market reform. It provides an empirical and theoretical background regarding the meaning of high shares of renewables and how to cope with them, considering the energy trilemma. Three experiences of electricity market redesign are evaluated: Germany, the UK and the State of New York. The three experiences are similar in the desire to decarbonise the electricity sector and promote renewable electricity. A game changing set of policies is necessary to do this.

Germany is seen as a unique experience due to the rapid expansion of distributed generation (DG) which might imply the need of more active DSOs. Germany's Energy Transition (Energiewende) is behind the significant deployment of renewables and the phase out of nuclear power. The expansion is mainly driven by wind and solar PV generation. However, the expansion of renewables has implied higher household electricity prices. Other issues that arise from the renewables are related to the implementation of a new charge on own consumption of solar, reverse power flows, frequency variation, re-dispatch and lack of stabilising inertia from large power stations. However, regulation is changing – with a cost - due to the need to improve frequency and voltage control, upgrade communications to DG to allow active and reactive management and increase in grid investment. There must be some learning here in how to avoid much of this cost.

In the UK, the Electricity Market Reform (EMR) promotes the near complete decarbonisation of the electricity sector by 2030. It is expected a reduction of CO₂ emissions by 90% of its 2010 level by 2030. The EMR is composed of four key elements:

Contract for differences (CfDs) for low carbon generation, a contract offered to low carbon generators that allows them to top up the income per MWh from the average market price to a target strike price stated in the contract.

A carbon price support (CPS) based on the existing climate change levy (CCL). This began in April 2013 with a target CO₂ price of £30/tonne but now is capped at £18 /tCO₂ (now binding).

A capacity market (CM) ensures security of supply by promoting investment in intermittent and inflexible low carbon generation sources. Includes all non-subsidised generation and consists of a 4-year ahead and 1-year ahead auction.

The *emissions performance standard (EPS)* with a maximum CO₂ emission for new electricity generation set at 450g/kWh.

We observe that CfD auctions look good but administered contracts look bad. The CPS has hit predictable problems of unsustainability. The CM auction has been politicised as predicted and been unnecessarily costly. EPS may be preventing investment in coal.

The Reforming Energy Vision (REV) was launched by the New York State regulator in 22 August 2014. Through this, the 6 state utilities are to become 'distribution system platform providers' (DSPs). The DSP is seen as an integrator of multiple technologies and services (e.g. distributed generation, distributed energy resources - DER), that meet customers' and society's needs. This initiative seeks to promote (1) the identification of projects which will use DER to reduce costs; (2) the use of DSM projects to serve need of distribution system; (3) the development of DERs such as via ESCOs, among others.

In conclusion, the three case studies offer different visions of the use of electricity markets. Germany illustrates a just do it approach (i.e. just add renewables and make necessary re-arrangements to the market ex post), based on societal preferences for renewables and against nuclear. The UK is focussed on decarbonisation, rather than renewables per se. New York promotes smaller scale new technologies within the distribution grid (DERs).

They illustrate different jurisdictional trade-offs between security of supply, the environment and affordability. This has been possible in Germany, but with a considerable cost to domestic consumers. Germany's mistakes are important to learn from as it has been one of the first movers in adding wind/solar capacity in large quantities. The UK's EMR and the State of New York's REV are interesting cases which exhibit new market arrangements that support high quantities of renewables.

We suggest that we will see a new round of electricity market experiments aimed at coping with large shares of renewables, but that seems unlikely in the short run to lead to convergence in approaches across the world.