What future(s) for liberalized electricity markets: efficient, equitable or innovative?

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Executive summary

In 1990 Britain led Europe in unbundling, liberalizing and privatizing the electricity supply industry and paved the way for the European Commission to enact a series of Directives to create liberalized and integrated energy markets across the European Union. The advantages of competition, when combined with appropriate restructuring and incentive regulation, underpin the European Union's commitment to a market approach to energy policy. However, the challenge of climate change, the need to decarbonize electricity rapidly and, as part of that goal, supporting the massive deployment of renewables through the EU's Renewables Directive (2009/28/EC), has created major challenges to the traditional utility model. The most mature renewables, wind and solar PV, are intermittent and have low reliable capacity factors but high peak outputs. Subsidies to solar PV have been concentrated on domestic take-up, while some 90% of renewables are connected to distribution, not transmission networks in the EU. Distributed Energy Resources (DER), including both locally connected generation and demand side management, are increasing their penetration, displacing the traditional transmission managed operation of the network, and posing significant operational challenges to System Operators.

This paper considers some of the implications of these developments for the future of electric utilities – including generating, retailing and network companies – as well as the implications for the regulation of networks, both transmission and distribution. Policy-makers are responsible for designing markets and interventions needed to meet various objectives, ideally informed by both good principles and evidence. They and regulators have a key role to play in balancing the often conflicting objectives of efficiency (ensuring that the prices and incentives deliver the least cost outcomes), equity (protecting less well-off consumers, ensuring that tariffs and charges are 'fair' and acceptable), and innovation, which may entail what appear inefficient and possibly inequitable tariffs to promote new developments. Net metering is an example of a tariff structure that is both inefficient and inequitable, but which proponents argue is necessary to kick-start the move to a more decentralized electricity supply industry that empowers (some) consumers and creates learning and, perhaps, valuable social acceptability. A better example is support for renewable electricity above the value of carbon displaced, which is costly, often financed in unfair and inefficient ways, but can be justified for the learning benefits created (as demonstrated in the Appendix). In both cases there are better ways of delivering these innovations.

Two aspects of this more decentralized and decarbonized system are critical to the design of markets and regulation. Decarbonized generation is often characterized by high capital costs and low variable costs. Second, rapid advances in Information and Communications Technologies

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Executive summary of the article: David M. Newbery, 2018. The Energy Journal, Vol. 39(1). http://dx.doi.org/XXXXXXXX

(ICT) and the power of Moore's Law mean that the costs of communicating with and controlling units (generation and demand) are falling to the point where Distribution Networks Operators (DNOs) can take similar control powers as Transmission System Operators (TSOs), graduating to become Distribution System Operators (DSOs). New energy service firms can similarly aggregate smaller unit offerings into Virtual Power Plants and offer their services to System Operators (DSO and TSO). This ICT revolution allows more active management of all networks, including those within buildings, and increasingly allows more granular pricing that better reflects the value or cost of power at each location and moment, ideally signaling least cost actions to those best placed to respond.

The underlying assumption supporting liberalization is that markets deliver more efficient outcomes than bureaucrats. The electricity industry is, however, characterized by missing markets, market power and externalities. Transmission and distribution networks are natural monopolies and as such, efficient pricing will fail to cover their full cost. Even with locational marginal pricing (not yet adopted in the EU), and prices on average equal to long-run marginal cost, there would still be a large shortfall to recover.

If, as is likely, policy makers choose more reliable systems than would be supported by competitive energy-only wholesale markets, efficient pricing will result in a shortfall in generation capital costs that also needs to be recovered. Most of the promising renewable technologies create external learning benefits, while R&D creates public (knowledge) goods, neither of which is recovered by competitive pricing. In all these cases, efficient prices will not cover the full system costs and the shortfall will have to be collected, balancing the objectives of efficiency and equity, concepts that are central to modern public economics. Efficiency dictates minimizing deadweight losses; equity tempers this by considering who bears these costs. While familiar to public economists, these principles seem less familiar to energy economists and policy makers.

The paper sets out the relevant theory, derives principles for designing wholesale markets, support mechanisms to address externalities such as inadequate carbon pricing and learning spill-overs, and regulated tariffs to guide efficient decentralised investment decisions. It argues that poor tariff design as well as hard-to-predict decarbonisation policies have threatened the standard utility model, and that the current electricity market designs and policies are no longer fit for purpose and need rethinking.

The final section demonstrates the quantified application of these principles to an electricity system characterised by high capital costs and low variable cost, towards which many utilities are headed. The example bears some resemblance to Peru, a country with a high renewables potential. The Appendix sets out and demonstrates a method for determining whether and how much subsidy is globally justified for supporting solar PV, showing the importance of locating such projects in favourable places, and their dependence on learning and investment growth rates, discount rates, the social cost of carbon, and the opportunity cost of the displaced fossil generation. Current support rates would appear cost effective under a favourable set of assumptions.

Keywords Electricity market design, tariffs, renewables support, utilities.

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