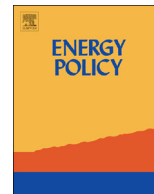




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Missing money and missing markets: Reliability, capacity auctions and interconnectors [☆]

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HIGHLIGHTS

- Energy-only markets can work if they avoid missing money and missing market problems.
- Policy makers over-estimate the cost of so-called “loss of load events”.
- Policy makers tend to over-procure capacity, exacerbating the missing money problem.
- Rectifying missing market problems simplifies trade between different capacity markets.
- Addressing missing market problems makes under-procurement cheaper than over-procurement.

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ABSTRACT

In the energy trilemma of reliability, sustainability and affordability, politicians treat reliability as over-riding. The EU assumes the energy-only Target Electricity Model will deliver reliability but the UK argues that a capacity remuneration mechanism is needed. This paper argues that capacity auctions tend to over-procure capacity, exacerbating the missing money problem they were designed to address. The bias is further exacerbated by failing to address some of the missing market problems also neglected in the debate. It examines the case for, criticisms of, and outcome of the first GB capacity auction and problems of trading between different capacity markets.

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1. Introduction

Britain was the first country to introduce a capacity auction to deliver capacity adequacy after the EU Third Package² (to deliver the Target Electricity Model, TEM) was announced and it coincided with the date by which the TEM was to come into effect. The TEM is designed as an energy-only market that leaves the delivery of capacity adequacy to profit-motivated investment decisions by liberalized and unbundled generation companies. The UK's *Energy Act 2013* that set out the Electricity Market Reform (EMR) rejected relying on an energy-only market and legislated for auctions to

deliver capacity adequacy.

This paper examines the design and justification of that capacity auction, its relation to the wider issue of reliability, and criticizes the under-studied issue of how the amount of capacity to procure was determined. It argues that typical capacity auction designs have a bias towards excess procurement, in contrast to fears that the energy-only market would lead to under-procurement. While capacity remuneration mechanisms, of which auctions are potentially the best, are intended to address the missing money problem, by ignoring the missing market problem they perversely exacerbate the missing money problem. Capacity auction design also raises important questions for cross-border trading and the role of interconnectors, which this paper addresses. It argues that it is less important to harmonize capacity remuneration mechanisms than to ensure that trade between countries is governed by clear market signals or clear out-of-market agreements between System Operators (when markets reach price caps or otherwise fail), without the fear of political or regulatory overrides in stress situations. This may require reforms to the *Security of Supply Directive* (2005/89/EC). Given confidence in these stress allocation mechanisms, countries have an incentive to address

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² See e.g. <http://www2.nationalgrid.com/UK/Industry-information/Europe/Third-energy-package/>

market failures and ensure efficient trade.

Capacity adequacy is the ability “to supply the aggregate electrical demand and energy requirements of the end-use customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements” (NERC, 2015). The *reliability* of an electricity system also requires *security*: “The ability to withstand sudden disturbances, such as electric short circuits or unanticipated losses of system components ...” (ENTSO-E, 2015).³ Security is a public good supplied by the System Operator (SO) through his acquisition of a range of ancillary and balancing services, while adequacy could, in principle, be delivered by competitive energy-only markets, as the TEM envisages (Oren, 2000).

The core of the TEM is an energy-only market with a single auction platform, EUPHEMIA (Pan-European Hybrid Electricity Market Integration Algorithm) which simultaneously clears bids and offers and the use of all interconnectors across the EU, fragmenting the market into different price zones only after interconnectors are fully used. Its working hypothesis, that energy-only markets will deliver capacity adequacy, was based on the experience of Nord Pool, which served as the model for the TEM.

Nord Pool has operated a successful energy-only trading system for many years, as have the major power exchanges such as EEX and APX, without any apparent problems of capacity adequacy, but not all EU countries have (or once) followed this model. Many markets have made or continue to make capacity payments, and DG COMP has been very critical of this practice, arguing that they often have more to do with compensating generators for stranded assets than delivering reliability at least cost. The GB capacity market is,⁴ as of mid-2015, the only capacity market to be explicitly designed and operating since the announcement of the Third Energy Package.

As a number of countries are now considering whether, and if so how, to introduce a (or reform their) Capacity Revenue Mechanisms it is timely to examine the British experience. Eurelectric is the latest organization to recognize that not all EU countries will be happy with the reference energy-only markets of the TEM, and “recognizes that properly designed capacity markets, developed in line with the objective of the IEM, are an integral part of a future market design.” (Eurelectric, 2015, p4.) While that document discusses what might be required to deliver a reliability standard, it is somewhat skeptical on how this might be achieved, instead arguing that “whatever reliability standard is chosen, Regulators and TSOs should compute it with methodologies and tools that are publicly available.” A second objective of this paper is to assess how this might best be done, guided by the principle of addressing the missing market problem.

2. Missing money and missing markets

While ensuring short-term security of supply is normally the duty of the SO, capacity adequacy is often the subject of regulatory and political concern. EU electricity markets are now liberalized and generation is, for the most part, not regulated but subject, like other industries, to normal competition policy. If markets were not subject to policy interventions or price caps, it is plausible that capacity adequacy could be delivered by profit-motivated generation investment without explicit policy guidance. For this to be the case, investors need confidence that the revenue they earn from the energy markets (including those supplying the ancillary

services that the SO needs to ensure short-term stability) will be adequate to cover investment and operating costs.

If this revenue is not adequate, there is a “missing money” problem (Joskow, 2013), but if it is potentially adequate but not perceived to be so by generation companies or their financiers, then there is a “missing market” problem (Newbery, 1989). *Missing money* problems arise if price caps are set too low (below the Value of Lost Load, VoLL), or ancillary services, such as flexibility, ramp-rates, frequency response, black start capability, etc. and/or balancing services are inadequately remunerated, and/or energy prices are inefficiently low. Inefficiently low wholesale prices seem less likely as the normal problem is one of market power raising prices above their competitive level, and prices are not necessarily *inefficiently* low just because there is excess capacity.

Missing markets create problems if risks cannot be efficiently allocated with minimal transaction costs through futures and contract markets, or if important externalities such as CO₂ and other pollutants are not properly priced. The concept of missing markets can be usefully extended to cases in which politicians and/or regulators are not willing to offer hedges against future market interventions that could adversely affect generator profits. The various arguments for capacity markets have been extensively covered in the literature, recently in the *Symposium on ‘Capacity Markets’*, (Joskow, 2013; Cramton et al., 2013). Almost all the discussion about capacity mechanisms concentrates on the missing money problem and whether the various market and regulatory/political failures are sufficient to justify a capacity mechanism, and if so, what form it should best take.⁵

Both the missing money and missing market failures have risen in salience as renewable electricity targets have become more ambitious at the same time as the EU Emissions Trading System has failed to deliver an adequate, durable and credible carbon price, and as such is under constant threat of reform. Absent a futures market with a credible counter-party it is hard to be confident that future electricity prices will be remunerative for unsubsidized generation, and harder to convince bankers or shareholders of the credibility of investment plans based on forecast revenues. If renewables continue their planned increase in market share mandated by the EU *Renewables Directive* (2009/28/EC) they will depress average energy prices. This does not of itself give rise to an adequacy problem, although utilities may justifiably complain that their past investment decisions have been partially expropriated by unanticipated political actions. However, it increases the demand for existing balancing services such as primary reserves, fast frequency response and inertia and may also increase the need for additional ancillary services. If these services are not yet adequately defined and/or their future prices are hard to predict there is a missing market problem. If these services are underpriced by SOs whose powers of balancing supply and demand may be met by administrative or regulatory means (e.g. by requiring those connecting to the grid to make some of these services available as part of the grid code), there is a missing money problem. In either case these may precipitate a capacity adequacy problem.

2.1. Market failures in delivering reliability

Before the electricity industry was liberalized and unbundled, the SO had ownership control of generation and transmission and was responsible for both system security and adequacy. Planned investment ensured that both capabilities would be assessed,

³ Bompard et al. (2013) provides a useful taxonomy of terms used to describe security.

⁴ Northern Ireland is part of the SEM discussed below, leaving Great Britain, GB, as the rest of the UK.

⁵ See e.g. Adib et al. (2008), Batlle et al. (2007), Batlle and Rodilla (2010), Bowring (2008, 2013), Chao and Wilson (1987, 2002), Cramton and Ockenfels (2011), Cramton and Stoff (2008), Joskow (2008), Joskow and Tirole (2007); O’Neill et al. (2006); Platchkov et al. (2011); and de Vries (2007).

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