Mis-Designing the UK Electricity Market?

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Abstract: *In January the Trade and Industry Secretary, Stephen Byers, introduced the Utilities Bill into the House of Commons. The bill will enable the energy regulator Ofgem to completely revamp the way wholesale electricity is traded in England and Wales. But do we have any reason to believe that the new electricity trading arrangements will be an improvement upon the existing ones? The answer is no.*

Introduction

For the past two years Britain's energy regulator, Ofgem, has been engaged in the task of reviewing the way electricity is traded between generators and electricity supply companies in England and Wales. This 'review of the electricity trading arrangements' (RETA, for short) was initiated in October 1997 by John Battle, then Minister for Science, Energy and Technology. The process is now nearing its conclusion, and a redesigned electricity market for England and Wales has been proposed, tested, and will soon be ready for implementation.

Both the regulator and the Trade and Industry Secretary promise a ten per cent reduction in wholesale electricity prices with the introduction of the new electricity trading arrangements. But do we have any reason to believe that these new arrangements will in any sense be an improvement upon the existing ones?

The answer is no. Economists who pay attention to such matters are near unanimous that the new trading arrangements are badly misconceived and poorly designed. The expectation, if anything, is that the new market design is likely to make things worse rather than better. This is despite the fact that the problems with the existing wholesale electricity market have long been well-known and well-understood. How has this remarkable state of affairs come about?

The Old and the New

Since 1990 all electricity in Britain has been traded through the electricity 'pool'. The pool is a day-ahead auction in which generators announce how much electricity they are willing to supply at each possible price for the following day. Then demand is estimated and market prices result from equating demand and supply. Generators whose bids are below the market-clearing price, i.e. 'in merit', are called on to supply power.

Although a radical and innovative market design when introduced in 1990, the pool has been beset by a host of problems. A complex set of bidding rules and payments to participants has made its operation complex and opaque. The dominant generators have exercised their market power in ways that were as predictable as they were long in being recognised by the regulator. The capacity payment mechanism has been manipulated. There is little or no provision for effective demand side bidding. Transmission pricing signals are inadequate or non-existent. And so on.[1]

The new electricity trading arrangements seek to resolve these problems by replacing the pool with a series of forward markets and a short term 'balancing' market. Market participants will now be

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1 See K. Binmore and D. Harbord, "Reforming the electricity pool of England and Wales: approaches from game theory and mechanism design," (1997) ELSE Workshop on Reform of the Electricity Pool, University College London, for a discussion.

expected to contract bilaterally for the exchange of energy in advance. They will then tell the System Operator what they plan to produce and consume. Traders will be paid their balancing market bids to change their plans if this is necessary to match overall supply and demand on the day. Deviations from forward contracts not 'rebalanced' in the market will be priced afterwards using the average of balancing mechanism bids.

Mis-diagnosing the Problem

Was such a radical overhaul of the market necessary? Everybody accepts that prices in the pool have been too high, and too easily manipulated. But the RETA programme got off to an unfortunate start by immediately mis-diagnosing the problem which it had been set up to resolve. The electricity regulator decided that the form of the electricity pool auction - a uniform-price auction - was at least partly to blame for the excessively high pool prices experienced since privatisation.[2] He hoped that this could be rectified by adopting a 'discriminatory-price,' or 'pay your bid', auction instead. For the uninitiated we will briefly explain what these terms mean.

In a uniform-price auction, every bidder who buys or sells a unit pays or receives the same market-clearing price for it. Since this price is determined by the bid on the marginal accepted unit, it is sometimes referred to as the 'marginal' price. In electricity markets - a world of near impenetrable jargon - it goes under the name of 'system marginal price', or SMP.

In a discriminatory-price auction, on the other hand, bidders pay or receive whatever they have bid on each unit bought or sold. That is, if a generator offers to supply the first 50MW of energy at £5/MWh and an additional 10MW at £10/MWH, then if these bids are successful, the generator will receive precisely those prices for those quantities. Similarly if a buyer (an electricity 'supplier' in industry parlance), submits bids to purchase 100MW at £15/MWh and an additional 50 MW at £8/MWh, these are the prices which the supplier will pay on those quantities.

Both uniform-price and discriminatory-price auctions are commonly used in financial and other markets, and there is now a voluminous economic literature devoted to their study. Recent research has been particularly focused upon comparing the outcomes of each type of auction format under different sets of circumstances.[3]

Without bothering to consult this literature, Ofgem decided that a discriminatory-price auction would obviously be more competitive than a uniform-price auction. Their reasoning seems to have been that when market prices are set by the marginal accepted unit, i.e. the marginal generator, this provides greater incentives for non-competitive bidding than does a 'pay your bid' auction. Ofgem's first proposal was therefore to scrap the existing electricity pool with its SMP-determined prices, and use a discriminatory-price auction format in their new market designs.

Economists could be forgiven for being bemused by such arguments. Not least because two Nobel Laureates in economics - Milton Friedman and Merton Miller - famously made precisely the opposite claim in advising on the design of auctions for US Treasury bills in the early 1990s. Friedman and Miller argued that a uniform-price auction would obviously be more competitive than a discriminatory-price auction.

It was soon realised however that Friedman and Miller were drawing incorrect parallels between auctions for a single good (such as a painting at Sotheby's), for which a more satisfactory theory exists, and multiunit auctions such as those for Treasury bills, and electricity. In multiunit settings

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2 Ofgem "The new electricity trading arrangements, Volume 1," (1999) July.

3 Recent research and evidence is summarised in K. Binmore and J. Swierzbinski, "Uniform or discriminatory?" (1997) ELSE Advisory Paper on Treasury Auctions commissioned by the Bank of England, University College London.

the comparison between these two auction forms is much more complex. In fact, neither theory nor empirical evidence tell us that discriminatory-price auctions perform better than uniform-price auctions in markets such as those for Treasury bills[4] or electricity.[5] So there is no evidence at all that a discriminatory-price auction will produce more vigorous price competition or result in lower electricity prices.

Mis-designing the Market

There may be nothing inherently wrong with the proposal to replace the existing electricity pool with a series of forward markets and a 'balancing' mechanism. Similar, though not identical, market arrangements have been adopted in Norway and California. There is a great deal wrong with what is being proposed in practice however.

The most serious flaw is that the discriminatory-price auction format has led to balancing market prices that are 'manipulable'. This means that traders will not simply be able to exercise whatever market power they may have by withholding capacity and raising prices in the market. They will also be able to manipulate the price setting mechanism itself, and make large sums of money in the process.

That this possibility exists was clear to any trained eye at the outset, but it was proven rather dramatically when the market design was recently put to an experimental test.[6] One clever trader (and a co-author of this article) constructed two different ways of manipulating the balancing market price. Both involved writing specious contracts in the forward market and then submitting specious quantities and prices to the balancing market. As a consequence the trader made tens of millions of (fictional) pounds from the embarrassed experimenters in a matter of a few days.

The first task of a market designer is to ensure that opportunities for manipulating prices are eliminated, or at least reduced to an absolute minimum. Early experiments or market simulations should be primarily aimed at identifying any such opportunities for market manipulation which may have survived critical scrutiny. It is a hopeless exercise to test for stable or 'steady state' market behaviour while opportunities for outright manipulation exist, although this is what the experimenters employed by the regulator thought they were doing.[7] Where one trader has gone, many will soon follow. Far from converging to a 'steady state', market behaviour will eventually be dominated by the 'manipulators'.

New pricing rules have been suggested to address this particular form of manipulation, adding additional layers of complexity to the market, but other opportunities for playing the system remain. This fact has been belatedly recognised by the regulator, who has now proposed that generators sign a "good conduct" agreement before the new trading arrangements are introduced. But the generators have so far refused to sign on the dotted line, and the matter may ultimately be sent to the Competition Commission for adjudication. We could not ask for a clearer demonstration of the futility of introducing a flawed market design than the heavy-handed regulation now required to make it work.

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4 See K. Binmore and J. Swierzbinski op. cit. and L. Ausubel and P. Cramton , "Demand reduction and inefficiency in multi-unit auctions," (1998) University of Maryland.

5 N. Fabra, N-H von der Fehr and D. Harbord, "Design of electricity auctions: uniform, discriminatory and Vickrey," (2000) forthcoming, University of Oslo, analyse duopoly and oligopoly in this context. G. Federico and D. Rahman "Bidding in an electricity pay-as-bid auction," (2000) mimeo, Nuffield College, Oxford, consider the cases of perfect competition and monopoly.

6 See the report by London Economics commissioned by Ofgem, "Role Playing Simulations of the New Electricity Trading Arrangements," (1999) October.

7 The experimenters were so disconcerted to discover that a relatively inexperienced trader was able to run circles around the market design that they decided not to include the results of those trials in their simulation statistics!

There are other serious problems with the balancing market being created by our inexperienced market designers. The discriminatory-price auction format has led to an arbitrary and increasingly complex pricing mechanism which bears little or no relationship to underlying economic realities. And the mistakes of the past are being replicated in the new market arrangements. To provide one example, a notorious feature of the England and Wales electricity pool is that it pays generators not to produce when transmission constraints force them 'out of merit'. The proposed balancing market similarly contains provisions to compensate generators when transmission constraints prevent them from fulfilling their contractual obligations.[8] Another example is provided by the rules which allow traders to revise or revoke their quantity bids into the balancing market, despite the well-known opportunities for market manipulation that this affords participants.

Conclusions

The existing electricity pool suffers from well-known defects. A complex set of bidding rules and payments to participants has made its operation complex and opaque. The dominant generators have exercised their market power in ways that were perfectly predictable from standard economic analysis.[9] The market's 'bells and whistles' have been manipulated, making the problems even worse.

All of these issues should have been addressed, and rectified, by the trading arrangements review. None required the complete abandonment of the existing market arrangements, and certainly not their replacement by untried and untested market forms which even the inexperienced quickly recognise as being manipulable. Indeed, independent comparative analyses which have been undertaken to date to test the performance of the two market types find that the current 'uniform-price' auction performs at least as well or better than 'pay your bid' bilateral trading.[10]

The *sine qua non* of this market reform process, as the Secretary of State has pointed out, is that it should result in lower electricity prices. If there are lower prices, it won't be the result of the policy choices made to date. The market design being implemented with great haste this autumn contains flaws that make it unlikely it will survive for long in its current form. As traders quickly become expert in manipulating the market it is likely that the market will derail itself and require even stronger regulation than is currently envisaged, or perhaps redesign.

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8 Under the new market rules generators which are predictably 'constrained off' will be able to achieve this by bidding very low, or even negative, prices into the balancing market.

9 For an analysis see N-H von der Fehr and D. Harbord, "Spot market competition in the UK electricity industry," *The Economic Journal*, (1993) 103: 531-546. For a survey of the literature see N-H von der Fehr and D. Harbord, "Competition in electricity spot markets: economic theory and international experience," (1998) Dept of Economics Memorandum 1998/5, University of Oslo.

10 For example, the London Business School study, J. Bower and D. Bunn, "A model-based comparison of pool and bilateral market mechanisms for electricity trading," (1999) forthcoming in the *Energy Journal* .