Reforming UK Electricity Markets

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How Should OFGEM Approach the Issues of Security and Sustainability?

The recent OFGEM consultation on gas and electricity markets has been seen as radical and controversial because, in a context of security and sustainability objectives, it questions the effectiveness of the current market structures for the UK energy sector. In this it reaches a very similar set of conclusions to the October 2009 Committee on Climate Change Progress Report to Parliament on Meeting Carbon Budgets. This article concentrates on electricity and argues that, at least for the power sector, OFGEM's concern is well founded and should imply a radical reappraisal of market arrangements. This is especially important given the central role of the power sector in achieving targets for reduced CO_2 emissions.

If anything the OFGEM arguments for more radical reforms are understated. This paper seeks to:

- examine more critically the sources of the benefits, in lower costs and prices, that have accrued under the post 1990 market regimes;
- consider whether current trading and system operation structures would be technically consistent with the generation technologies likely to form part of the new low carbon energy economy;
- discuss the main market problems posed for securing the investment necessary to meet key objectives of adequate capacity and low carbon sustainability;
- argue that a central purchasing agency for the power sector could deliver the main policy objectives for the sector while retaining the most important features of competitive market structures.

Post 1990 Experience. Assessing the Gains from Regulation, Competition and Other Factors

It is the attribution of the efficiency gains and substantial cost and price reductions following the major market reforms and privatisations in 1990 that largely drives argument over the advantages of current market arrangements, and especially over particular features such as the forms of electricity trading or supply competition. OFGEM implicitly attributes a substantial part of past gains to the current structure of trading arrangements rather than to the body of 1990 reforms as a whole; this conditions its assessment of the risks associated with more radical changes to current trading and market structures.

However, a very high proportion of historical efficiency gains and falls in consumer prices post 1990 derived directly from factors which cannot legitimately be ascribed either to particular features of the market structure or even to the existence of a competitive market per se. In particular, and taking the whole period since 1990, the most important factors promoting lower costs and prices included:

- Elimination of high cost UK coal, which disappeared as initial vesting contracts were phased out in the 1990s. This reflected abandonment of the policies of successive UK governments in forcing the electricity industry, the CEGB, to support the UK coal industry. Privatisation and competition may have provided a convenient cover for this policy change, but this gain would have occurred under any form of regulated or competitive industry.
- The simultaneous advent of relatively new technology in the form of combined cycle gas turbines (CCGT); since this was and is an international technology, the innovation and its development cannot be ascribed wholly or in part to UK market liberalisation.
- The combination of this factor – CCGTs – with a period of low energy commodity prices, and cheap and plentiful gas.
- Very substantial increases in efficiency, and cost reduction, in natural monopoly elements of the sector, especially distribution costs; these however were driven by a combination of regulatory and private sector incentives, not by market arrangements for generation and supply.
- With CEGB assets sold off at below book value, and significant capacity surpluses through much of this period, both the need and ability to earn a full return on the capital value of historic investment were largely removed.

These factors should condition any assessment of the effectiveness of competition per se as the prime driver of efficiency and cost reduction.

There is substantial evidence, especially post 1990, of significant improvements in generation efficiency, most notably in power station operation and availability, driven partly by competitive market pressures and partly by disciplines arising from private ownership of the facilities. This was reinforced by reductions in concentration within the industry in the late 1990s, driven by post-1990 competition policy concerns.

However it is very hard to argue convincingly that these gains resulted from *particular* characteristics of the competitive market structure and rules since 1990 or 2000, and certainly not from the particular feature of supply competition per se, the component of the competitive framework most directly affected by more radical reforms such as a supplier obligation or a central buyer. Indeed Richard Green argued in 2003 that retail competition can raise wholesale prices, corresponding to reduced efficiency and ultimately higher consumer prices, in comparison with a market based on long-term contracts and a regulated supply business.

One further factor deserves mention – the 2001 NETA changes. Inter alia this removed the element of capacity payment, with an inevitable short-term downward effect on prices. However failure to provide an alternative means to reward capacity contradicts the fundamental economics of the power sector, especially the link between market driven prices and investment. It is now widely held to be a

significant part of the security of supply issue.

We should not therefore assume that established advantages and benefits, accruing from a structure built around competition and private investment, would necessarily be compromised even in quite major modifications to the current structure.

Technical Requirements for Trading and System Operations in a Low Carbon Non-fossil Future

One of the great technical achievements of the radical market design for the 1990 privatisation was that it successfully replicated the operational optimisation embodied in the CEGB merit order structure into a market bidding arrangement. Without this feature the market would have been substantially and visibly less efficient at its inception, undermining claims for the virtues of competition in promoting efficiency. It was a pre-condition imposed on the market design.

It also demonstrates the link between the technology of power generation and market structure. Pre-1990, system operation was based on deployment of flexible fossil fuel plant that could respond to meet continuously changing demand for a non-storable commodity. Central control scheduled and dispatched the lowest marginal cost plant in ascending order of merit. Post-1990 this worked through a bidding process which, conceptually at least, encouraged players to bid at marginal cost, and corresponded exactly to the merit order ranking employed within the command and control system of the CEGB. Notwithstanding the NETA modifications to trading arrangements, this close connection remains.

However a future low carbon world is likely to have very different plant operating characteristics, dominated by relatively inflexible plant (nuclear), plant with intermittent and/or stochastic characteristics (renewables), and in the medium term much greater opportunities for positive/negative storage through different types of more flexible demand (e.g. to serve the transport sector). Faced with very different technical and economic characteristics, where a high proportion of plant may have zero marginal cost but technology specific limitations on flexible response to load changes, electricity markets and system operations will need to be defined very differently. Efficient system operation for example may depend on more complex forms of optimisation defined over weeks or months rather than hours or days.

Some issues associated with current arrangements have already been highlighted in the 2009 Pöyry report on wind variability, paradoxically the problems for viability of fossil-fired generation dependent on price spikes and infrequent operation, resulting from intermittent wind power. We should expect new problems as both the number of new non-fossil technologies and their contribution increase.

Optimising the operation of generation based largely on a variety of non-fossil or non-thermal technologies is inevitably a much more complex task than simply stacking the short-run marginal costs of generating plant in a one stage, one price, auction process. If it is amenable to an auction process at all, it would probably be to a multi-stage auction with complex structures and no very clearly defined output of a single 'price' for each period.

We cannot assume therefore that a market built around the notions of daily or half-hourly optimisation and pricing will remain 'fit for purpose', or that the current structure is capable of incremental evolution to a new and more complex system of market 'auctions', let alone any bilateral trading equivalents, that will still deliver short-term operational efficiency.

This emphasises the central importance of having market arrangements that are compatible with the predominant technologies of the day. If we are seeing an evolution towards a set of technologies with very different operating characteristics, both on the supply and demand side, then we shall need very different market structures. We cannot assume a natural incremental evolution from the rules that exist today, or even that a similar market structure will be possible or optimal.

Problems in Securing Low Carbon Investment and Adequate Capacity under Current Market Structures

OFGEM correctly focuses on the primary issue for market arrangements as being how to ensure high and unprecedented levels of investment, to meet both security and low carbon targets, all against a background of an aging plant stock. Several difficulties exist and are apparent in current market structures.

Perverse treatment of financial risks. OFGEM correctly observes that 'investments with stable operating and fuel costs (such as nuclear and wind) could be viewed by … suppliers as more risky than investments whose costs vary with volatile global fuel costs.' Fossil fuel plant will continue to be at the margin for some time and hence to set price. So fossil plant gets a degree of protection (varying by type of fuel and efficiency) equivalent to partial pass through of fossil fuel price volatility. This intrinsically discriminates against non-fossil plant; a pass through of fuel costs for incumbent forms of generation creates a barrier to entry of new technologies.

Asymmetry in treatment of capacity risk. Another unsatisfactory feature of current arrangements is the fundamental asymmetry between the risks of under- and over-provision, and in particular the conflict this creates between market and social objectives for the power sector.

From a societal perspective, the net costs of over-provision may be relatively small. There is a significant resource cost in over-investment, but it is partially offset by earlier retirement of less efficient plant. Under-provision on the other hand is commonly seen as near catastrophic. Inelastic demand is not choked off by prices, and the outcome is load disconnection and potentially widespread loss of output across all sectors of the economy. It is a 'market failure' that cannot be ignored by governments.

However, from an individual investor perspective, and in the absence of long-term contracts, it is over-provision that presents worse outcomes, through a collapse of prices. Restoring equilibrium by closing capacity invites regulatory intervention on competition grounds. Under-provision, by contrast, implies higher prices and better returns.

This asymmetry was balanced in the 1990 arrangements

through market mechanisms established specifically to provide continuity in security of supply – a penal incentive requirement on public suppliers to buy in the market up to a price intended to reflect the value placed by consumers on secure supply – the Value of Lost Load (VOLL). This feature was discontinued under NETA, abandoning a fundamental link between setting a security standard and explicit assumptions about the costs of system failure.

In the context of low carbon investment, this asymmetry is even more pronounced. Over-investment implies over-achievement of sector carbon targets, and hence more carbon-efficient operation of the sector. Within a rationally administered framework of national targets this would in principle allow more carbon allowances to be 'spent' in sectors such as aviation where consumers implicitly attach a much higher value to their use of fossil fuel and resulting emissions. Given that current carbon emissions are typically valued or priced at well below most estimates of their social cost, according to the Stern Review and other sources, this would be a large offsetting social gain, albeit one whose incidence may be very diffuse.

Background of uncertainty. OFGEM suggests one problem is a heightened perception of risk and hence high costs of capital. However nominal interest rates are at an all time low, and according to most of the canons of modern finance theory, investment in well regulated utility industries, with risks that are not heavily market correlated, should be low risk and low beta. Anything else implies lack of confidence in the regulatory framework. The real difficulty therefore is in attracting high levels of investment against a backdrop of *contractual* or *regulatory* uncertainty.

The most obvious historical parallel for a high investment transformation of the power sector in a modern economy is the highly successful decarbonisation of the French power sector in the 1980s and 1990s, the scale of which was certainly comparable to the challenge facing the UK today, and which was accomplished primarily through the state sector (EdF).

A more convincing statement of the problem, therefore, is to consider how the necessary and very high levels of investment can be achieved through private investment and an appropriate balance of regulation and competition in electricity markets.

Carbon prices. Markets, essentially through the EU Emissions Trading Scheme (ETS) have so far failed to deliver carbon prices that are sufficiently high and stable to support necessary investments in low carbon generation technology. This may reflect unwillingness by governments to countenance adequately tight emission limits, and this has led OFGEM, among others, to consider carbon price fixes as one possible solution.

*Coordination***.** Finally, in parallel with the system operation issues posed by new technologies, there are analogous questions of coordination, not considered by OFGEM, in the choice of investment: to determine what combinations and proportions of technologies in the generation capacity mix are technically feasible in meeting future load patterns. Coordination issues also include incorporation of decentralised options, along with their associated infrastructure requirements, choice of sites for wind power, to maximise diversity, and for CCS, to minimise new infrastructure costs for pumping and storage of captured CO_2. This suggests a possible need for an overall investment framework, in the form of additional powers and responsibilities for the National Grid, or for a new power-purchasing agency with responsibility for ensuring adequate capacity and meeting sectoral emission targets.

Finding the Right Path to Effective Reform

The main problems identified in achieving essential investment relate therefore to carbon prices, contractual or revenue certainty for investors, potential inadequacies in system operation and trading linkages as the sector moves away from conventional fossil technologies, the coordination and timing of investments in capacity and infrastructure, and adequate incentives to ensure security of supply.

OFGEM (and the Committee on Climate Change) propose alternative approaches to reform, on a spectrum from incremental changes to existing trading arrangements, including very significant measures such as a carbon floor price, to more radical institutional changes, such as additional supplier obligations or a central agency. The essential strategic choice is between reliance on a series of possible 'fixes' to correct deficiencies in existing market structures, or introduction of formal obligations to provide adequate security and meet emissions targets.

The analysis above suggests that the first approach has several deficiencies: the general problem of trying to second guess markets, the potential proliferation of complex additional rules, schemes and instruments, and failure to address the implications for market structure of fundamental technology-driven change in the sector, all of which will add to investor uncertainty and carry significantly higher risks of not delivering on the objectives.

The more radical options, for a supplier obligation or central agency, are similar, in that the first might naturally evolve into the second with suppliers creating a jointly owned agency to meet obligations, and in that both tend to imply limitations on supply competition. Such an agency offers the most certain prospect not only of securing an adequate quantum of low carbon investment, as well as supply security, but also of securing a balance of different types of capacity and load management options compatible with secure and efficient system operation, and of coordinating that with the necessary infrastructure investments.

The agency would in effect become the major purchaser and wholesaler for the sector, inviting tenders for new capacity, and coordinating its programme with associated infrastructure investment by the National Grid. With properly designed and implemented tenders and contracts, this would retain both competitive pressures in building new plant and incentives for efficiency in operation. Its obligations would encourage a diverse balance of capacity types technically compatible with maintaining supplies, and higher reserve margins to ensure adequate security.

Competition in retail supply could continue but would have to focus on competition in the true supply functions of providing a billing service, rather than exploiting consumer inertia or lack of information as to the true wholesale price of electricity as a commodity.

As a purchaser and wholesaler the agency would also provide a natural channel for support to innovative solutions in the sector, including economically viable decentralised generation capacity. It would also be able to contract for existing capacity, and this would help to encourage a natural transition from existing commercial arrangements.

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