European Regulation Forum
on Electricity Reforms

Cambridge SESSA Conference
"Refining Market Design"
Scientific Consensus

SESSA, a programme financed by the European Commission, is a European forum on electricity reforms involving researchers and energy stakeholders (http://www.sessa.eu.com/). The first SESSA Conference, *Refining Market Design*, was held in Cambridge, England, on 14-15 July 2004. It was organised by David Newbery, Department of Applied Economics. The objective was to examine the performance of electricity market designs. This brief summary represents the consensus view of the academic SESSA participants, and not necessarily those of the stakeholders who attended the conference.

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The goals of market design **include, as a pre-condition of continued popular and therefore political support, confidence in security of high quality supply at sustainably competitive prices.**
Sustainability **here refers both to the ability of the sector to finance and deliver efficient and reliable electricity supply and in the environmental sense of reducing greenhouse gas emissions.**
Efficiency **requires that energy, capacity and ancillary services are at least cost but at prices that allow adequate investment to be financed by the private sector. This in turn requires that the markets provide price signals for entry of new generating capacity that is efficient in location, timing, scale and fuel choice, and for dispatch that minimises social costs including environmental costs. Market integration in turn means that European costs are minimised, trade takes place guided by comparative advantage, importing competition into more concentrated markets.**

Competition requires equal treatment, non-discriminatory access, unbundling and low concentration

Competition requires that entrants can deliver power to consumers on the same terms as incumbents, and that requires non-discriminatory access to transmission and distribution, unbundled cost-based tariffs for their use, and no informational advantages to the incumbent. Vertically integrated transmission and generation companies can exploit informational advantages, discriminate in the provision of access, balancing and other ancillary services, and cross-subsidise competitive activities by inflating monopoly costs. British, US and German experiences demonstrate that vertical integration is a major impediment to efficient market access and also to inter-TSO trade.
Full ownership unbundling is the prize to strive for, and pressure from regulators and competition authorities should make this the least undesirable option for incumbents. If ownership unbundling cannot be negotiated, then the second-best alternative is an independent system operator (ISO), although it is harder to incentivise ISOs than TSOs with assets to bear the profit risk associated with any incentive regime. This seems to be more likely than the final option of regulatory and judicial pressure on vertically integrated TSOs to implement access and balancing arrangements that minimise consumer costs. If the ISO option is adopted, benchmarks, is a demonstrated method of improving efficiency and incentive regulation for transmission and distribution, ideally based on reducing consumer costs, and, if well-designed, without prejudicing investment and security.

Effective competition requires that individual generating companies are rarely pivotal (that is, essential for balancing supply and demand), which can be achieved by a combination of adequate spare capacity, sufficiently numerous generators or import capacity, and a competitive contract market, supported by free entry and non-discriminatory access to transmission and balancing services. Current market structures are often too concentrated to deliver competitive outcomes without close regulation, state ownership, or imposed contracts or equivalent schemes (such as the Spanish CTCs). Outside Nordel, interconnection is typically inadequate to address country-level concentration, and absent these conditions for competition, the choice of market design is unlikely to adequately mitigate market power, although some designs may facilitate collusion more than others.

The question of market design has a number of dimensions. Clearly it should be tailored to the circumstances of each country (ownership structures, fuel sources, and institutional/legal endowments and capabilities), but it should also facilitate a move towards a single EU-wide electricity market. The EU has been able to make remarkable progress in creating the preconditions for a liberalised and integrated electricity market through a sequence of Directives and Regulations, but these can only reflect current political consensus. Whereas in the US FERC as the federal energy regulator can encourage and cajole states to adopt a standard market design (SMD), Europe lacks such a regulator and relies on consensus and comitology for progress beyond the rather sparse details of the Directives. Progress on both sides of the Atlantic has been slow – states' rights have similar salience to national subsidiarity. Creating markets which undermine impediments to market integration, perhaps starting with the regional integration of power exchanges (PXs), leading on to agreements among Transmission System Operators (TSOs) to integrate balancing markets to increase liquidity, might be more effective than political consensus-building. Liquidity and integrated balancing markets are both impeded by vertical integration and poor information sharing between TSOs.

Among wholesale market designs, marginal single-priced pools have advantages in providing a reference price facilitating contracts and hence entry, and allowing scarcity-responsive capacity payments (as in the former English Pool), but their transparency and repeated auction structure facilitate collusion if there are fewer than four or five comparable generation companies. Problems of gaming and collusion fall as the number of participants increases and the length of time for which bids must hold increases (so that bidding separately for each hour as in Spain or APX is likely to be inferior to bids that must hold for 24 hours, as in the former English Pool)[1] Power exchanges typically only trade 5-15% of consumption in the prompt market, while forward bilateral contracts are either illiquid (if profiled) or inflexible (if restricted to base and peak power). In such cases liquid balancing markets are critical to competitive entry and supply. They may also be essential for security of supply in concentrated markets where the dominant incumbent is inhibited from investing (and further foreclosing the market) and entrants are deterred by the risks of illiquid, volatile and unpredictable balancing markets or mechanisms.

Balancing markets are therefore of central importance to promoting the European dream of market integration that delivers sustainable competition, and offer the prospect of breaking the log-jam of political consensus-building required to deliver mandatory Directives. While that process seems to have worked quite well for telecommunications with the Communications Directives emphasising regulation to address Significant Market Power, telecoms liberalisation is both older and more amenable to ex post regulation than electricity. Optimists believe that the process of introducing new Directives and Regulations has accelerated and will solve these problems; realists are sceptical.

Agreement among TSOs (encouraged, supported and perhaps pressured by their local regulators) to exchange appropriate information and delegate balancing dispatch offers the prospect of creating liquidity first in the balancing or real-time market. Integrating balancing markets will reduce the required balancing volume, as some volatility cancels out, and will increase the number of competitors providing services in each market, thereby reducing balancing costs and encouraging trust in the balancing market. It may be that integrating balancing markets need to await the development of a well-functioning European day-ahead energy market, although progress is presumably more likely at a regional level first, again possibly following the improvement of day-ahead market integration. Again, vertically integrated TSOs might be reluctant to integrate balancing markets that allow more entry into their own wholesale markets and reduce generator or supply profits.

Electricity markets are likely to be more conducive to tacit coordination than most other markets of comparable concentration, while non-storability and

1 APX adopted the Spanish software that allows separate bids for each hour (and both power exchanges publish the aggregate supply and demand schedules for each hour). Bids are firm but in Spain they can be adjusted with new bids in the six intra-daily markets at four-hourly intervals.

a low elasticity of demand amplifies market power, requiring a more informed approach to competitive analysis by regulators and competition authorities. Creating competitive gas markets, with gas-on-gas competition through liquid spot and balancing markets (as in Britain) offers the prospect of equilibrating the effective cost of the major electricity fuel across Europe, and hence reducing cross-border generation cost differences, reducing the need to trade and hence freeing up more interconnection for importing competition into otherwise concentrated markets (as in Nordel).

Pricing and Allocation of Transmission : nodal, local and zonal

Efficient trade requires efficient pricing and allocation of transmission, best achieved by nodal pricing on the PJM standard market design. The next best solution is market coupling. Local power exchanges would send their aggregate bid-offer curves to an international clearing stage, which would allocate transmission capacity between countries in a procedure similar to the synchronised auctions currently proposed by the European system operators. Local power exchanges would then schedule the corresponding international flows and clear the local markets. This approach allows for netting and may work reasonably well if transmission within countries is adequate. Zones can be subdivided further if internal congestion levels increase. Again, access to full information is key to improving allocation and increasing available capacity, but requires trust that is best underlined by ownership unbundling or a regional ISO structure. Once that has been achieved, it might be sensible to revisit the appropriateness of the current technical transmission standards to see whether they are suitable for a decentralised and liberalised market.

There are two major problems with this approach.
The first is the likely reluctance of local PXs to create and join an international clearing house, which would largely undermine their own function (and similar progress for European stock exchanges has been woefully slow).
The second problem is the existence of zones with adequate uncongested internal transmission. If the zones have to be subdivided much, then one may run into problems of lack of liquidity within the zones and absence of local power exchanges to do the job.

Generation and Transmission Adequacy

There are also concerns about the problem of generation and transmission adequacy. Generation margins are getting tight in several European systems and there is widespread doubt that this issue could be left to energy-only markets, although this is still an open issue. Any move away from energy-only markets requires a choice between the alternative mechanisms that could be used, such as the LOLP scheme (which has some attractions but also critics), capacity payments, capacity obligations, etc. The CEER has issued a recent document on transmission investment, where the need to guarantee an adequate return on new investment (best achieved by running public auctions to build new lines, proposed by TSOs and authorised if needed by regulators) and full recovery via transmission tariffs was emphasized. The experience in the U.S. is that unless actively encouraged, adequate inter-TSO transmission investment is most unlikely, while building any transmission in the teeth of local environmental objections is difficult, as the failure to complete the France-Spain interconnector demonstrates.
A disagreeable implication of this is that market integration is likely to stall at the regional level, so that each region will remain largely isolated from the other regions. This might not matter too much if countries evolve similar fuel prices and make similar technology choices, as that will equilibrate electricity prices, arguably at lower financial and political cost than massive investments in interconnectors.

Finally, sustainability in the context of electricity markets has a further connotation in that the full environmental costs should be taken into account in investment and consumption decisions, so that the industry can evolve towards a low carbon future that does not prejudice the life chances of subsequent generations. This is recognised by the EU acceptance of the Kyoto targets and an EU commitment to market solutions to reflect the cost of greenhouse gas emissions. As the output of wind energy (the dominant source of renewable generation) can only be accurately predicted a few hours before dispatch, it is important that market design does not create artificial barriers for such flexibility. This operational flexibility is of particular importance for transmission and it constitutes a new challenge in transmission network operation and design. An adequate design of balancing markets is crucial here. Market design and market structure should be used to minimise the exercise of market power in short-term (and ancillary service) markets which increase the costs of intermittent generation. Efficient use of international transmission capacity will allow international balancing and should further reduce intermittency costs.

The aim of the European Emissions Trading Scheme (ETS) is to equalise the price of carbon across the EU. If it is combined with a form of allocation that does not distort investment and operating decisions, the ETS should lead to the same cost increase for marginal electricity generation by each fuel in each country, and hence would not distort dispatch, trade or investment.

The main concerns are to do with distortions arising from the system of allocating emission allowances. If emission allowances are contingent on continuing plant operation, they will discourage replacing inefficient high emissions plant by more efficient low emission plant. If future allowances are allocated on the basis of generation (kWh) in some countries (rather than capacity, kW) they could distort the marginal cost of operation in different countries and hence trade. If allowances are allocated by type of plant they could also prevent the desired change in the merit order towards lower carbon-intensive plant. Nevertheless, the ETS represents a considerable advance on more political and quota-based alternatives.