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## **What's Happening to the European Electricity Market?\***

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**Abstract:**

*This paper deals with market power and information issues in the ongoing process of the European Electricity Market. We present a regulatory game played among the key group of utilities, the customers and the regulatory authority. The development of the game allows us to state for a clear commitment to entry freedom reducing the informational strategic advantage of incumbents. As the assumption of such a commitment involves another game, we develop it and we conclude that the liberalisation of entry is also a key factor for credibility and effectiveness of flexible regulation and tariffs reduction as well.*

**Key Words:** *Electricity Market, Competition, Regulation Games*

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## **1. Introduction**

Since the first Electricity Liberalisation Directive (96/92/EC) a complex process towards the restructuring and deregulation of the electricity market was accomplished. Actually, market opening is slightly over 90%. EC Directives represented a successful, centralized approach to market liberalisation.

Notwithstanding, switching levels being still low in households and heavy losses suffered by new entrants – then leaving the market – seem to point to a situation of legal opening rather than a real opening. Except for UK and North Pool countries, this may apply to a significant share of the European electricity (and natural gas) market(s) (EC, 2011).

Serious deficiencies in the competitive structure of current market can be easily identified. They are related to: insufficient unbundling, highly concentrated market structures, insufficient network connections and significant differences between network costs and wholesale prices.

Natural gas market distortions remain crucial, as gas is a major fuel for electricity generation. Its non-competitive market structure and still poor regulation of transmission and storage affect both markets.

The problem of concentration seems chronic. Furthermore, both the European Commission and national regulators are facing increasing difficulties to control mergers on each market and between companies with activities in both markets, which is particularly problematic for a fair competition. The state direct or indirect aid to “National Champions” is still another problem as it can help concentration. The electricity sector is moving into a period of major investments, thus state resources can have important foreclosure effects on competition (Lowe, 2006). Furthermore, under a serious economic and budget crisis, some national governments as utilities shareholders, can have a strong influence on future market structure through the sale criteria (and final decision) of their corporate shares.

Like other network industries (telecom, railways, aviation, postal services) electricity (and gas) have unique characteristics: significant economies of scale or scope (extending to natural monopolies); far-reaching externalities in production or consumption; and large vertical and horizontal integration. These features explain why the introduction of competitive mechanisms and the creation of open markets had equal impacts on both innovations and disruptions (Joskow and Schmalensee, 1983; Baumol and Sidak, 1994). Furthermore, beyond being capital intensive, the European electricity industry presents two other characteristics: price elasticity of demand below 1 and severe storage constraints.

In what concerns the game and the strategic variables the electricity generation market is very much like a Cournot market with capacity constraints (Kreps and Scheinkman, 1983) where the quantities correspond to the decision variable. Even when the price is assumed as a strategic variable, the results of the strategies are similar to the Cournot game due to capacity constraint.

Due to the nature of the electricity generation, the exercise of market power occurs almost naturally.

In this paper we present a regulatory game played among the key group of electricity companies, the customers and the regulatory authority, discussing the strategic features under the process of taking liberalization measures to lower electricity prices or tariffs to end-users. The development of the game allows us to state for a clear commitment to entry freedom reducing the informational strategic advantage of incumbents. As the assumption of such a commitment involves another game, we develop it and we find that the sector opening to potential competitors and the liberalisation of entry are also a key factor for credibility and effectiveness of flexible regulation and tariffs reduction as well.

The rest of the paper is organized as follows. In Section 2 we propose a critical perspective of the outcome of 14 years of EU top-down liberalization strategy of the electricity sector. Section 3 proposes a regulation game played among a key group of electricity companies, the regulator and the customers. Our main goal is to analyse credible entry as a key factor for a successful liberalisation process. Section 4 presents our main conclusions and final remarks, concerning a flexible regulatory framework and the need to the Agency for the Cooperation of Energy Regulators (ACER) empowerment. Both of them appear as indispensable conditions to guarantee: credible freedom of market entrance, as a tool to make a correct scrutiny of mergers & acquisitions, and also of possible effects of cross-country ownership of vertically integrated companies.

## **2. From Economic Theory to Empirical Evidence**

Since the 19(90)'s the EU energy policy has introduced deep and extensive changes on electricity and natural gas markets that have completely modify the old energy paradigm. Three Electricity Directives have been set: 1996, 2003 and 2009. As Pollitt (2009) refers, these Directives also had a significant impact on the energy policy of two European non-EU countries: Norway and Switzerland. The rationale behind the Directives was clear: wholesale and retail activities could be made competitive, thus the prices would be set by markets as the core assumption was that sectors which are run on competitive rules are more efficient than those run as monopolies. The final result should be lower prices to the final consumers. Transmission and distribution were natural monopolies and prices would be set by an independent Regulator.

The liberalization process has been a dynamic task, involving complex problems: the enlargement of national to regional markets, the reduction of entry barriers to new competitors on generation and retail, the reforming of transmission and distribution regulation emphasizing investment incentives and considering scattered, intermittent renewable generation. Independent regulation also proved to be critical for the achievement of the reforms. Notwithstanding the broader scope of

the EU Directives, the unbundling issue stands as the core of the controversy about the best strategy to break down persistent barriers to cross-border trade, investment and competition (Buchan, 2007).

There is a consensus over the key lessons learned from the liberalization of the European electricity market learned:

- Vertical Integration remains a serious problem.
- Collusion or gaming are relatively frequent due both to market structure and market design.
- Entry barriers still exist, sometimes closely linked to effective “protectionism” from national governments.
- Regulation is not always effective.

Although the high number of companies in the market, six of them dominate the energy markets: Electricité de France (EdF), German E.ON, Italian Enel, Swedish Vattenfall, German RWE and Gaz de France Suez ( GdF). These companies have generation assets in several European countries and most of them have also some assets outside European borders.

Empirical evidence also emphasized the economic characteristics of the electricity business:

- Absolute cost advantage of established companies (techniques, know how, research)
- Consumer loyalty
- Capital requirements and funding constraints.
- Economies of scale
- Irreversible commitment

Typical reasons for market power and market power strategies also proved to happen in the real world. Capacity withholding and strategic bidding are effectively typical market power strategies in the European electricity market. On the other hand, market power is the outcome of seven well known features of the electricity sector: transmission constraints and market fragmentation, high degree of concentration, inelastic demand, peak demand conditions and instantaneous balancing, strong national incumbents, joint capital control of generation and transmission capacities, gaps in market arrangements.

Moreover, the organization of spot markets seems to matter! The controversy between the Uniform Pricing Auction (UPA) model and the Pay-As-Bid (PAB) model has not finished. In the UPA model, the generator that sells the marginal amount defines the system marginal price, while in the PAB the electricity sold by different generators is paid at the price of their bids. Neither auction model is inherently immune to the exercise of market power. Consequently, market



monitoring remains an important element of any market design regardless of the choice of auction model. Under a Pay-As-Bid auctions model there is an incentive for all suppliers to bid the *expected market-clearing price*, rather than submitting bids reflecting each facility's *individual marginal costs*. Then, the variation in bid prices within any given period is substantially reduced by a Pay-As-Bid auction (Tierney et al, 2008). However, such wholesale market design would potentially reduce the effectiveness of such monitoring and mitigation efforts by creating barriers to the identification of potential manipulation and complicating alternatives for subsequent price mitigation.

### **3. Credible Entry in Regulation Games**

Let us consider the regulation game which is played among the key group of electricity enterprises, the public and the regulatory authorities (or government agencies). We are going to discuss the strategic features underlying the process of lowering electricity prices or tariffs to end users. In an efficiency framework this process implies a parallel adjustment and cost reduction in the supply chain of electricity in order to make compatible price reduction and profitability, investment and the quality and guarantee of services provided by electricity companies. Otherwise, the reaction from the public would force the government to change the policy guidelines and to stop reform and liberalization in electricity sectors.

The success of a liberalisation program and the policy aimed to reduce prices or tariffs to end users of electricity depends upon the maintenance of the quality of services and the guarantee of supplies. The key sector of marginal or low profitability companies must adjust their costs and production levels to successfully face prices or tariffs reductions keeping enough quantity and quality in electricity supply services. This key or strategic group is made up by the segment of high costs and less efficient companies. This electricity enterprises segment will be denominated as the electricity strategic group (E).

Actually, regulatory authorities (A) always face a serious information problem. Anti-competitive behaviour is extremely difficult to prove. In fact, there are plenty of reasons to restrain generation capacity which increase prices: power failure, risk of equipment damage, the end of the company emission quotas.

However, the correct identification of such behaviour is also difficult because it demands the evaluation of the company price-cost margin. This implies the calculation of the marginal cost of production. International experience on this matter reinforces the idea that we are dealing with critical, often unavailable information. Why? Because, to get a reliable calculation, it is absolutely necessary to have, *inter alia*, a detailed level of knowledge and information:

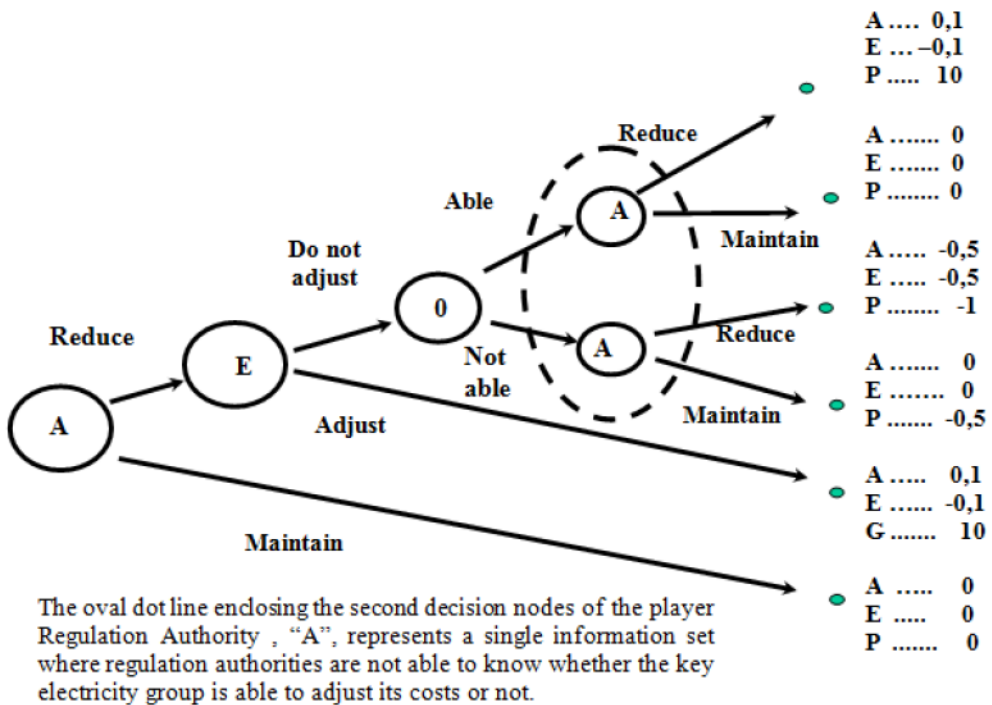
- To distinguish all the different kinds of power plants.
- To evaluate all variable costs over the fuel cost

- To consider the opportunity cost of not producing on a certain moment, in order to produce later (option to postpone power generation). This can involve the postponing of water basin use or the saving emission rights.

The Regulatory Authority (A) can never be 100% sure about all these key issues. They are also unable to foresee which feasible adjustments the electricity companies are going to do. Both Governments and Regulatory Authorities cannot rely on information coming from electricity companies for there is a conflict of interests and the later can benefit from their informational advantage.

The different decision nodes and branches of the game tree modelling this conflict of interests are represented in Figure 1.

Figure 1. Tariffs and adjustment in the electricity sector.



The game starts with the decision by regulatory authorities to take measures to reduce electricity prices or tariffs to end users. The effectiveness of the measure depends upon avoiding undesirable effects in the amount and quality of the services

delivered to the public (P). This requires the effective adjustment of the electricity company strategic group (E).

The trouble is that group E has no incentive to provide the authorities and/or the public with reliable information about its real possibilities to undertake restructuring and cost reductions activities. Its real interest lies in inducing both the authorities and the public to believe that its costs are high. Then, there is no significant way to adjust costs and production. Therefore, prices and tariffs must be maintained at high levels to ensure enough investments, to keep the quality of the services and to avoid supply shortages.

The lack of information about the real situation of the strategic electricity group (E) is modelled through the action of a new player, (O), hazard, whose probability distribution captures the authorities' uncertainty about the actual adjustment possibilities the strategic group E really has.

The payment structure of the game reflects the fact that (consumers and the economy as a whole) benefit a lot from the adjustment and reduction of electricity prices and tariffs. However, once the authorities start the liberalisation process, the effectiveness of flexible regulation and price reductions depends upon a successful restructuring of the electricity strategic group. Electricity companies hold an important strategic informational advantage and they are in a good position to exploit it as they are a highly organized and effective pressure group interested in keeping a comfortable monopolistic position.

The analysis of the game through retrospective induction lead us to a sub-game perfect Nash equilibrium, that is, an equilibrium based only upon credible threats. The key matter is to be found in the final sub game where regulatory authorities must decide whether to confirm the tariffs reduction or to go back maintaining the initial tariff level. They do not know what real adjustment possibilities the E group has and the risk to generate shortages and supplies troubles lead the regulatory authorities to stop tariff reductions returning to initial situation. Maintenance is the authority's best replay for a wide range of probabilities.

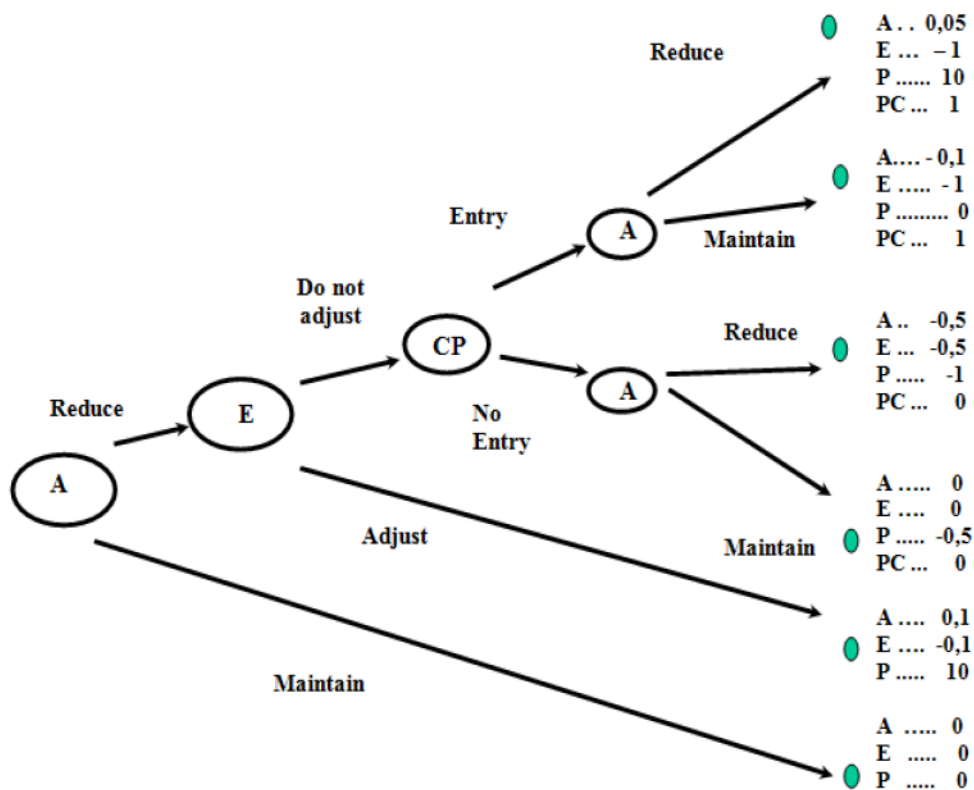
Other players and the electricity companies can analyse the game and they are able to anticipate the authorities' best reply. Therefore, they are not interested in undertake a cost and price reduction policy, even if they have enough margin to get it, because they know that doing so they would reveal information to the regulatory authorities who will confirm the tariff reduction process. As a consequence the most likely result is that electricity companies refuse to undertake the restructuring and adjustment policies and the government will be driven to stop the tariff reduction process.

How is it possible to face this problem? It seems clear that only a credible liberalisation and competition in a flexible regulation framework can accomplish such a challenge. If the reform and the liberalisation are associated with a clear commitment and a policy framework favourable to freedom of entry in the electricity sector, the threat and the possibility of entry of new enterprises changes the nature of the game and reduces the strategic influence and power of the

incumbent electricity companies. Potential entry of new competitors – namely, international groups – gives credibility to the liberalisation process and highly contributes to its success.

Let us see how the game structure changes with a believable commitment for entry freedom reducing the informational strategic advantage of incumbent electricity companies. The new game tree is now showed in the next Figure, where a new player appears to model the potential competitor, (PC), who has a real possibility to enter the national electricity market if the incumbent strategic electricity group is not able to carry out a convenient restructuring and cost-price reduction to meet the requirements of liberalisation and tariff reduction process launched by the government.

Figure 2. Tariffs and electricity sector adjustment with freedom of entry.



In this new game it can be realized that the entry of potential competitors is highly improbable when the strategic electric group (E) is decided to undertake a cost-price restructuring to meet the liberalisation requirements and the tariff reduction process launched by the government. We are not going to consider the



details of this situation but it can be easily assumed that in most cases the reply from the incumbent electricity companies and the regulatory authorities can manage this situation very well.

However, if the strategic electric group is unable to carry out the adjustment and restructuring, there are wide possibilities to entries of potential competitors. The play of the potential competitor (PC) is watched and known by the regulatory authorities providing a proof on the comparative efficiency of the domestic electricity strategic group. If the potential competitor does not enter the market it can be supposed there is not enough profitability appeal and the best reply from regulation authorities is to stop the tariff reduction process.

On the contrary, if the potential competitor plays in order to enter the market, it becomes evident both of an important margin to improve the comparative efficiency of the sector and a step further in the tariff reduction process. The best reply from authorities is to go ahead with the tariff lowering process. The public and the economy as a whole benefit from improved efficiency and reduced tariffs, but the most inefficient enterprises in the incumbent strategic group must suffer the costs and losses of being retired from the market.

How likely is this kind of game? What does it really mean? The incumbent strategic electricity group (E) is perfectly able to anticipate these situations by means of analysing the sub games in the last stages, its best reply is to undertake enough restructuring efforts to improve its comparative efficiency and successfully meet the cost-price reduction requirements of the process. The analysis of the sub game perfect equilibria shows that a strong commitment with the sector opening to potential competition and the liberalisation of the entry policy is a key factor for the credibility and effectiveness of a flexible regulation and tariff reduction process as well.

Provided the freedom of entry to efficient foreign investors, the real point is that cutting production or lowering quality standards from national producers as a reaction to price or tariff reduction measures by government or regulatory authorities is not anymore the best reply if they are able to adjust either costs or margins. Government or regulatory authorities can observe applications from efficient foreign investors whenever incumbents claim tariff reduction is putting on risk future supplies and/or service standards. If regulatory authorities are committed to a credible free entry policy, they will be able to achieve optimal results in any case.

There are three main equilibrium possibilities:

1. Incumbents react to tariff reductions announcements claiming it will be impossible to meet enough investments and there are no applications from foreign investors, tariffs and price caps should not be further reduced.
2. Incumbents are able to cope with tariff reduction process and meet demand quantities and standards, they are able to

reach efficiency levels comparable to new applicants, tariff reduction process must be fostered and there will be no entries of foreign competitors.

3. Some national incumbents are not able to reach good enough efficiency levels, there are applications from more efficient foreign investors, price reductions must go ahead and the entry of new producers will allow considerable improvements in the sector.

In most cases, credible commitment towards a clear free entry policy is the key factor for a successful liberalisation and flexible regulation in the electricity sector. Is there no credible free entry policy, the regulatory game equilibrium dramatically changes, and also cost and margins adjustments are the best reply of incumbents any more. Moreover, it will be really hard to obtain efficiency gains through any kind of regulatory reform. This is why a credible commitment to free entry is ever a highly advisable policy in flexible regulatory reforms of electricity sectors to increase the welfare of consumers and to improve the efficiency of the sector and of the economy as a whole.

#### **4. Final Remarks**

The development of the game framework in the above paragraph allows us to state for a clear commitment to freedom of entry in the electricity market, reducing the informational strategic advantage of incumbents. We find that the sector opening to potential competitors and the liberalisation of entry are a key factor for credibility and effectiveness of flexible regulation and tariffs reduction as well. If there is no credible free entry policy the regulatory game equilibrium dramatically change, cost and margins adjustments are not the best reply of incumbents anymore and it will be really hard to obtain efficiency gains through any kind of regulatory reform. This is why a credible commitment to free entry is always a highly advisable policy in flexible regulatory reforms of electricity sectors, in order to increase the welfare of consumers and to improve the efficiency of the sector and of the economy as a whole.

However, free entry remains a very complex issue. First of all, the European Commission must change the way mergers and acquisitions are analysed. The perspective under which M&A are considered must be European, not merely national. Cross-country ownership, namely on close regional markets, must be a threat when these markets become fully integrated.

It seems clear that the increasing complexity of the European Energy Market, namely its transmission system will probably require a strengthening of the monitoring and intervention capacity of European agencies in the next years. The system deals with 42 TSOs from 34 countries and the power system serves 525

million citizens, generates 828 GW and involves 305,000 km of transmission lines managed by the TSOs.

The empowerment of the European Agency for the Cooperation of Energy Regulators (ACER) is pivotal for successful market integration and for competition. Therefore, the final compromise on ACER almost as an advisory role - to TSOs, national regulatory boards, the European Commission, the European Council and the EU Parliament - may become a strategic error.

## References

1. Abreu, D. 1986. "Extremal Equilibria of Oligopolistic Supergames." *Journal of Economic Theory* 39:191-225
2. Abreu, D., D. Pearce, and E. Stachetti. 1986. "Optimal Cartel Equilibria with Imperfect Monitoring." *Journal of Economic Theory* 39: 251-69.
3. Baumol W, Sidak J (1994) *Toward Competition in Local Telephony*. The MIT Press, Cambridge and London.
4. Buchan D (2007) *Crusading Against Vertical Integration*. Oxford Energy Comment, Oxford Institute for Energy Studies.
5. Crampes C. AMD N. Fabra, 2004, The Spanish Electricity Industry: Plus ca Change..., *The Energy Journal*, Volume 26, May 2005
6. European Commission (2011): "2009-2010 Report on progress in creating the internal gas and electricity market", *Commission Staff Working Document*, Brussels, June.
7. Evans, J. and R. Green (2003): "Why Did British Electricity Prices fall after 1998?", *CMI Electricity project WP nr 6*.
8. Fabra, N. and J. Toro,(2005) Price Wars and Collusion in the Spanish Electricity Market, *International Journal of Industrial Organization*,
9. FRiedman, J. 1971. "A Non-cooperative Equilibrium for Supergames." *Review of Economic Studies* 38:1-12.
10. Green, E., and R. Porter 1984. "Noncooperative Collusion Under Imperfect Price Information". *Econometrica* 52: 87-100.
11. Hirst E (2004) *US Transmission Capacity: Present Status and Future Prospects*. Washington, D.C., Edison Electric Institute. Available at [http://www.eei.org/industry\\_issues/energy](http://www.eei.org/industry_issues/energy).
12. Joskow P Schmalensee R (1983) *Markets for Power*. MIT Press.
13. Joskow P (2005a) Transmission Policy in the United States. *Utilities Policy* (13), 95-115.
14. Joskow P (2005b) *Patterns of Transmission Investment*. Available at <http://econ-www.mit.edu>.
15. Joskow P.(2006) Markets for Power in the United States: Na Interim Assessment. *The Energy Journal*, vol. 27, 1-36.
16. Lowe, P. (2006): "*The liberalisation of EU Energy Markets*". The Beesley Lectures, Institute of Economic Affairs. The Royal Society. London, 9th November.
17. Newbery, D. (2005): "*Refining Market Design*", SESSA Publications, Final Chapters, nr 3 ([www.sessa.eu.com](http://www.sessa.eu.com)).
18. Pollitt M (2009) Electricity Liberalisation in the European Union: A Progress Report. EPRG Working Paper 0929 and Cambridge Working Paper in Economics 0953.

19. Treaney, S. F., T. Schatzki, R. Mukerji (2008), “*Uniform Pricing versus Pay-as-Bid in wholesale electricity markets: Does it make a difference?*”, Analysis Group AMD New York Independent System Operator, March .