

**ELECTRICITY MARKETS
AND REFORMS IN EUROPE**

**edited by
Milica Uvalic**

FrancoAngeli

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Introduction

Electricity markets in an enlarging European Union

by Carlo Andrea Bollino and Milica Uvalic

This book addresses a specific and extremely important area of economic reforms related to deregulation and liberalization of the energy sector. More specifically, it analyses various theoretical and empirical issues regarding the electricity market as the most important part of energy supply in various national and supranational environments – Italy, the European Union, and the future EU member states in the Western Balkan region.

It is well known that the future European energy policy, the "Energy 2020 strategy", envisages a very ambitious European framework for energy policy, which is deeply committed to shape a new environment where priorities are defined for the entire area and actions to be taken are clearly set and shared by all member states. This entails a strong commitment of financial resource for new investments, as well as of political will for the new institutional setup.

In this respect, the topic of this book is important for two reasons. Firstly, internal reforms underway in the EU member states, based on recent EU directives which call for the liberalization of services and of energy markets in particular, provide a conducive framework for an increasing use of renewable sources. These reforms are necessary for addressing the present challenges posed by climate change and for the effective realization of the specific energy and environmental objectives of the recent "Europe 2020".

Secondly, this topic is of utmost importance from the perspective of the future EU enlargement which has been announced towards the Western Balkans. The Western Balkan region consists of seven countries that are aspiring to become EU member states, as envisaged by the EU Stabilization and Association Process launched in mid-1999 specifically for this group of countries. Recent EU initiatives have promoted the creation of an integrated energy market in Southeast Europe, that would be closely integrated into the EU internal market. Given that Croatia has already signed the EU Accession Treaty (in December 2011) and is expected to become the 28th

EU member state in July 2013, that three countries – Macedonia, Montenegro, and Serbia (since March 2012) – are EU candidates, while the remaining countries are potential candidates for EU membership, this is a region which will increasingly be in the focus of EU policies.

The volume addresses ongoing economic reforms related to the energy sector that have been implemented at variable speed in various European countries during the last two decades and provides useful and operational guidelines for policy makers who are in charge of adopting future reforms of the energy sector in the Western Balkan states. Critical market issues, consumer attitude developments, successes and failures of many policy reforms adopted in various European countries can provide a very useful toolbox for the Western Balkans, as thoroughly discussed in the concluding chapter of the book.

More specifically, many EU member states have adopted electricity sector reforms, where the general trend of public policy has been to support liberalisation in sectors that were once dominated by regulated national monopolies. The essays included in this book, more or less explicitly, deal with the effects of these reforms on the electricity market, as well as the role played by renewable sources for electricity generation. The papers are the result of a two-year research project funded by the Italian Ministry for University and Scientific Research (a PRIN project), entitled “Real structure and empirical models of the Italian electricity market: an analysis for the design market transfer to the South Eastern European countries”. The main objective of the project was to explore how the experience gained in the EU, and particularly of a country like Italy that for years has had functioning electricity markets, could help in choosing the most adequate type of energy reforms in countries in the South East European region – primarily the seven Western Balkan states (Albania, Bosnia and Herzegovina, Croatia, Kosovo, Macedonia, Montenegro, Serbia, and Kosovo).

The first two chapters concentrate on the functioning of the Italian electricity market. Chapter 1, “Market strategies and market structures in the Italian wholesale electricity market” by Carlo Andrea Bollino and Paolo Polinori, focuses on the characteristics of the Italian electricity market which, despite a substantial degree of liberalization, still faces a number of difficulties to reach a fully competitive environment.

In order to determine the degree of competition in the Italian market (IPEX), the authors use data for the April-December 2004 period to estimate a regression that relates the difference between the hourly

equilibrium price and individual hourly bids offered by competitors, and a large set of structural and behavioral variables. A residual demand curve is also constructed in order to measure unilateral market power of the Italian generation companies. The rich empirical evidence provides important insights regarding the functioning of the wholesale electricity markets in Italy. By pointing to some of the crucial problems which persist on the Italian electricity markets, the research also indicates possible ways that could help enhance competition and design appropriate market surveillance.

Chapter 2 by Carlo Andrea Bollino, Davide Ciferri and Paolo Polinori considers the issue of contagion in electricity markets in Italy (“Contagion in electricity markets: empirical evidence from Italian markets”).

An econometric framework is constructed in order to determine contagion between spot prices for the seven regional electricity markets of the Italian IPEX. A simultaneous analysis of contagion and interdependence is undertaken in order to show how contagion effects in Italian electricity markets can be separately identified from simple interdependence. The paper suggests that under certain conditions, the contagion effects between electricity prices could be over-estimated and that asymmetry effects could occur when there is high prices volatility in the other markets. This result could be interpreted as confirming different collusive behaviors among operators. The result is consistent with expectations that a sudden equilibrium change will occur when a collusive behavior breaks down, resulting in a new competitive framework.

The next two chapters focus more specifically on issues related to renewable energy. Chapter 3 by Simona Bigerna and Paolo Polinori, “Households’ willingness to pay for renewable energy sources in Italy: a bidding game approach” identifies and empirically estimates an appreciable consumer’s Willingness to Pay to use green electricity. The research evaluates the attitudes of Italian households towards renewable energy sources, in order to determine whether consumers are willing to pay for the use of green energy in electricity production.

Using a national survey based on 1596 phone interviews in Italy in 2007, the study considers three issues: how the different elicitation affect respondents choices; the relationship between a “single point value” and “a valuation distribution”; and finally the gaps between different formats, such as a bidding game and the dichotomous referendum (single bounded) contingent valuation method. A significant path dependence in respondents answers was found in the various elicitation formats. The research confirms

that Italian consumers demonstrate a substantial willingness to partially undertake the costs of the EU goals on Renewable Energy Sources.

Chapter 4 by Silvia Micheli, “Learning curve and wind power”, explores yet another question linked to renewable sources, namely the reasons why countries chose subsidies to green electricity instead of implementing the more common Pigouvian tax on polluting emissions. The author focuses on the learning by doing effects from the production of wind power on the cost of future production, as the main justification for the observed policies. Two models are presented, that differ in the way learning is introduced. Under reasonable parameter values, price paid to a firm for energy produced from wind power is heterogeneous, and varies among firms that produce energy from wind power according to the productivity index of the firm itself. The suggested strategies of the research differ from the main price-driven schemes adopted by many EU member states. By comparing these results with European Union recommendations, the paper shows that current EU policy may not be optimal.

This conclusion leads us to the broader perspective regarding the efficiency of the electricity sector in European Union countries provided by Fabrizio Pompei in Chapter 5 “Regulation and technical efficiency in power electricity sector: evidence from some European Union countries”. The paper addresses the impact of liberalization on technical efficiency of the electricity sector, focusing on the relationship between the stringency of regulation (OECD indicators) and total factor productivity (TFP) growth in the electricity sectors of 19 EU countries during 1994-2007. The causal effect of the stringency of regulation on the sector’s performance is investigated by decomposing the productivity Malmquist Index on three components: technological change, pure efficiency change and scale efficiency change. The empirical findings offer several interesting results. Estimation results suggest that only the stringency in entry regulation significantly reduces technological change, whereas vertical integration exhibits a negative and significant impact only on the catching up process. Another interesting result suggests that high levels of public ownership of electricity companies guarantee improvements in reaching the optimal scale of production.

The volume concludes with chapter 6 by Milica Uvalic on “The regional energy market in the Western Balkans”. The situation regarding energy supply in the seven Balkan countries – Albania, Bosnia and Herzegovina, Croatia, Kosovo, Macedonia, Montenegro and Serbia – is considered in

detail, including main energy sources, degree of trade dependence, causes of inefficiencies in electricity markets and potential for expanding renewable sources for electricity generation. Policies implemented by the Balkan countries aimed at liberalizing the energy sector are also briefly reviewed. Recalling recent EU initiatives to create a new regional energy market in Southeast Europe, the paper suggests that, given the high degree of complementarities and interdependence between the countries in the Balkan region, creating a more efficient and more integrated regional market could indeed prove beneficial. Drawing on the Italian experience and results reported in the other chapters of the book, some policy implications are made that could be useful for future reforms of the energy sector in the Western Balkan states.

The authors thank the Italian Ministry of Education, University and Research for supporting this project (PRIN 2007 -Progetto di Ricerca di Interesse Nazionale- Contract 20074PFL7C_003) under the title: “Real structure and empirical models of the Italian electricity market: an analysis for the design market transfer to the South Eastern European countries” – “Struttura reale e modelli empirici del mercato elettrico italiano: un analisi per il trasferimento del market design nei paesi del Sud Est Europeo”.

Market strategies and market structures in the Italian wholesale electricity market

by Carlo Andrea Bollino and Paolo Polinori

1. Introduction¹

At the end of the 80's and at the beginning of the 90's, a new intellectual and political wave started to design a new market reform in main industrialized countries. After the pioneering revolution which occurred at the beginning of the 90's in UK (1990), Norway (1991) and USA (1992), nowadays there has been progressive fading of monopoly and administered prices in many countries. In March 2002 the European Commission launched the initiative for the development of the South East European Regional Electricity Market (SEEREM) (Ex Yugoslavia, Albania, Romania, Bulgaria, Greece, Turkey) setting a medium-long term regional plan that addresses the following topics: institutional and structural reforms; development of market rules and regulatory aspects; strategic planning for infrastructure investment based on a regional approach (future demand vs generation capacity). Italy has applied for membership in 2003 and the Italian Authority for Energy and Gas leads the Athens Process. Following the European Directive on energy sector liberalization, 96/92/CE, the Italian legislation envisaged (Law 79/99) the breakdown of the vertically integrated monopolist, the Italian State Company ENEL, with complete unbundling of an Independent System Operator (initially the GRTN) and creation of 3 GENCO to be sold to the private market. The Law 79/99 also envisaged a pool market, to be administered by a Market Operator, GME and a Single Buyer (AU) enabled to aggregate non eligible customer demand. Similar to other countries (Newbery 2005), Italian Power Exchange (IPEX) has been organized as a sequence of a day ahead market, an adjustment market and a dispatching resource market, Ancillary

¹ *ACKNOWLEDGEMENTS: A preliminary version of this paper was presented at the: 25th Annual North American Conference of the USAEE/IAEE, Denver, Colorado (USA) September 18-21, 2005; 29th IAEE International Conference, Potsdam, Germany, 7-10 June 2006; 9th IAEE European Energy Conference, Florence, Italy, 10-12 June, 2007; we are indebted to all participants. The authors are also thankful to Marie Anne Plagnet and to all participants at the IDEI conference "The Economics of Energy Markets", Toulouse, June 20-21, 2008 for their helpful suggestions and remarks. The usual disclaimer applies.*

services market. Because IPEX is surely a very interesting case for analysis and research, given that it has started only recently and that its operations show relevant complex features. The analysis results could be useful for the SEE countries for the implementation of reforms of their electricity markets.

2. The liberalization of electricity market

2.1. The European context

Liberalization processes and technical features of electricity markets have been vastly studied and analyzed in the literature². Typically the reform process follows the steps shown in figure 1. Anyway, there still exist technical features in electricity markets, which give rise to practical difficulties to reach a fully competitive environment. Electricity cannot be stored and security of supply requires the existence of a centralized operator whose task is to coordinate in real time the production of individual plants³. Electricity liberalization is an issue of interest in a wide range of EU countries. The main reasons are the security of high quality of power supply at sustainable competitive prices (Newbery, 2005, p. 3). The power supply must be technical, scale and allocation efficient and must be provided at lowest cost, but at a prices that allows adequate investment to be financed by the private sector, too. But sustainability here also refers to the ability of the sector to deliver electricity supply reducing greenhouse emission and reaching the minimum social cost.

² About the analysis of market operations and of competitive behavior the literature focuses to model and critically assess generators market power, as well as the eventual abuse of such market power. Among many, it is worthwhile to mention that there are several comparative studies (Brunekreeft 2002, Llamas e Stéphane 2000, Wolak 2001, Jamasb 2002, Jamasb et al, 2004, Jamasb Pollitt 2005), there are analyses for USA (Joskow 2004, 2005), and specific studies of the California market (Sweeney 2002, Wolak 2003). In addition, focus on Europe includes: UK (Newbery e Pollitt 1997, Newbery 2005), Scotland (Littlechild 1996), Wales (Domah, Pollitt 2001), North Pool (von der Fehr et al. 2005) and in particular Norway (Magnus, Midttun 2000). Moreover, there have been studies of German electricity market (Arentsen et al. 2001, Brunekreeft, Tweleemann 2005, van Damme 2005), of Spanish electricity market (Crampes e Fabra 2005) and French electricity market (Glachant e Finon 2005). As far as Europe is concerned the main conclusion is that the reform process is incomplete and gives signals of uncertainty to markets. It follows that uncertainty fosters opportunistic behaviour, increases the cost of capital, depresses investment. A further result is discouraging new entrants in the short run and delaying innovation in the long run.

³ This operator is in charge of unit dispatching, in order to satisfy demand, according to merit order. In this way less costly units are called first, more costly units are called only at peak.

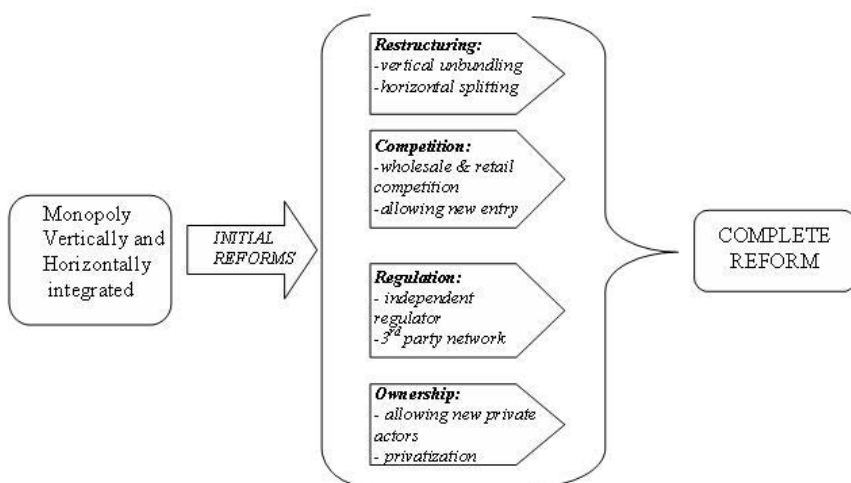


Figure 1: Main steps in electricity reform

In theory, this can be accomplished with a competitive system where each potential new entrant can produce energy at the same conditions of incumbents, where there is equal access to transmission and distribution grids and where there does not exist relevant information asymmetry.

The German and UK experiences show how surviving integration between generation and distribution may hinder efficiency attainment (Newbery 2005; Brunekreeft and Twelwmann 2005), while the North Pool experience highlights the importance of equal access to transmission grids (von der Fehr et al., 2005). Another crucial feature of the international literature is the analysis of the residual market power of the former national monopolist, typical in Europe, for instance, in Spain (Crampes and Fabra, 2005), in France (Glachant and Finon, 2005) and in Italy (Bollino and Polinori, 2006).

As the EU is clearly accelerating toward further market integration (European Commission 2004, 2005), it is wise to analyze in depth the liberalization status in Italy, also to check coherence of Italian market design (known as “IPEX, Italian Power Exchange”, started in April 2004) with the European one. It is obvious indeed that full coherence between IPEX and the European design is a necessary condition for the international competitiveness of the whole Italian industrial sector.

2.2. *The Italian experience*

Following Directive 96/92/EC for energy sector liberalization, Italian legislation (Law 79/99) envisaged a breakdown of the vertically integrated monopolist system, the Italian State Company ENEL, with complete unbundling of an Independent System Operator⁴ (GRTN) and the creation of three GENCO to be sold to the private market. Law 79/99 also envisaged: a compulsory pool market, to be administered by a Market Operator⁵ (GME); a Single Buyer⁶ (AU), empowered to aggregate non-eligible customer demand; a stranded cost allowance for the period 2000-2007, customized to each former monopolist power plant and inversely indexed to the future pool price. The reasons were as follows: the higher the future pool price, the less competitive the market would be, thus the lower the stranded cost suffered by the former monopoly. The maximum payable amount was fixed at 7.6 billion euro. In 2001 and 2002, the Italian Government continued the liberalization process, enacting some corrections: (i) allowing free bilateral contracts, making the pool non-compulsory; (ii) eliminating the indexation of the stranded cost to the pool market price; (iii) establishing a national price on the demand side as a weighted average of zonal prices on the supply side; (iv) establishing new simplified rules for plant construction and operation authorization.

The main results were: (i) in the period 2002-2004, 41 new authorizations were given by the Italian Ministry of Productive Activities (Industry and Energy) for a total of about 19,000 MW of new capacity; (ii) stranded costs were defined to be paid by 2003 for a total of 1.6 billion euro; (iii) in April 2004, the Italian Power Exchange (IPEX) started with a liquidity around 1/3 of total energy demand; (iv) in the period April-December 2004, the average pool price was equal to the regulated tariff, namely: to an index computed with the same method adopted by the Energy Authority before of the pool start. Like other countries (Newbery, 2005), the Italian market has been organized as a sequence of a day-ahead market, an adjustment market, and a dispatching resource market, "Ancillary services market". The first yields a system marginal price for each zone in which the market is separated, due to network congestion. In the second, generators and loads submit offers/bids to correct parts of schedules which cannot be implemented due to technical constraints. The third is a single market for procuring congestion-relieving resources and for creating adequate secondary and tertiary control reserve margins. In this market, resources are valued on a pay-as-bid basis. Other features of the market are: (i) in the period April-December 2004 only suppliers

⁴ The meaning of acronym GRTN is "*Gestore della Rete di Trasmissione Nazionale*".

⁵ GME: "*Gestore del Mercato Elettrico*".

⁶ AU: "*Acquirente Unico*".

participated in the market and demand was, inelastically, represented by the Transmission System Operator (TSO); (ii) in January 2005, active demand bids entered the market, with the TSO being able to integrate bids if total market demand was “too different” from day-ahead forecasts used for security management; (iii) in January 2005, the AU was instructed to use contracts for differences extensively and buy into the market. As a result, market liquidity rose over 60%, due to the AU dimension. (iv) the Energy Authority enacted a market surveillance mechanism aimed at discouraging producer quantity withholding strategies, essentially “threatening” a “pay-as-bid” rather than a “system marginal price” energy payment to a supplier, which withholds quantity aiming at exercising market power. This provision has recently been repealed after a Court decision. The Energy Authority also regulates market data disclosure. As a consequence of important differences which arose in 2005 we analyze the IPEX from April to December 2004. This paper is organized as follows. Section 2 describes the complexity of the IPEX, due primarily to geographic segmentation. Section 3 describes the method, data sources, and the building of our large databank and goes on to perform an explorative “and intuitive” regression analysis in order to quantify the main relation among competitiveness and some structural and behavioral characteristics of the Italian markets and Italian operators. Section 4 turns to a more consolidated framework of analysis of market power, using the Lerner index, following the procedure of Wolak (2003). Empirical results are shown in section 5 and section 6 summarizes our main findings.

3. Italian market data

In 2004, in Italy, on the demand side, electricity consumption was 322 TWh. This level represented an increase of 0.4% with respect to 2003. Recent historical average annual growth was 2.4% and is forecast to continue at a comparable rate. Figures 2 and 3 describe the demand for electricity. Figure 2 illustrates the demand at different daily hours for two typical days and figure 3 shows the load duration curves (summer: from June 21 to September 21, winter: from November 21 to December 31). It is well-known that the load duration curve gives the number of hours during which demand exceeds a given level, and that this allows us to obtain a monotonic demand over time. On the supply side, Italian generation capacity is skewed toward hydrocarbons, oil and gas, which cover over two-thirds of total production (see Figure 4), despite the relative low carbon intensity of Italy. The main supply Company, ENEL, with a market share of 48-49%, remains the former monopolist which cannot produce more than 50% of total production according to anti-trust decisions. Other main

generators, which have bought capacity from the GENCO downscaling between 1999 and 2001, represent another 25% of production.

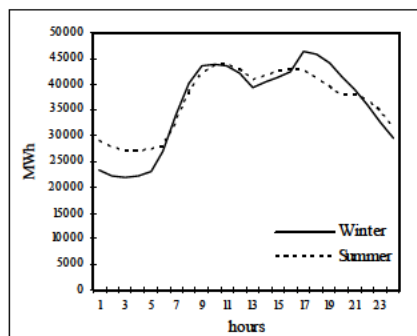


Fig. 2 - Summer - winter demand 2004

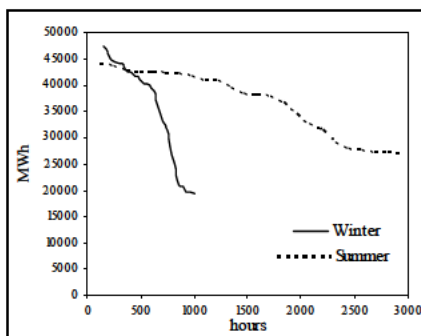


Fig. 3 - Load duration curves 2004

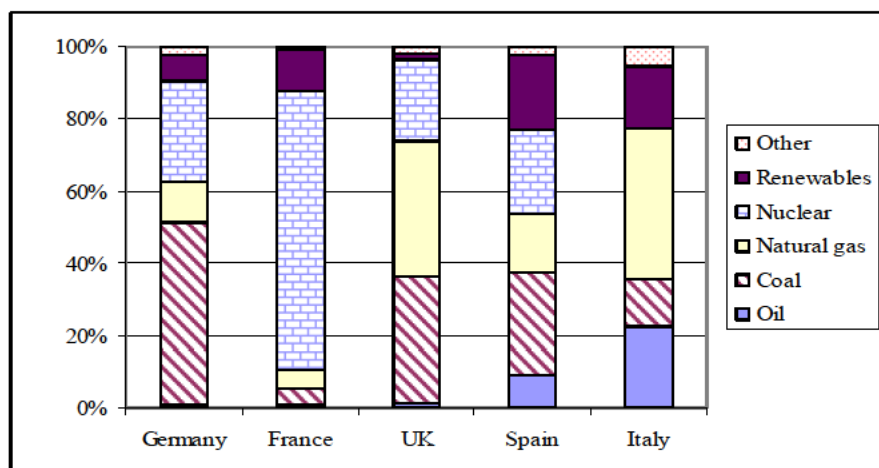


Fig. 4 - Generation capacity [Source: GME data (2004)]

Others, including ENI, the Italian oil company, make up the rest (Table 1). As a result, both consumer and, typical, industrial user prices are higher than in Europe: in particular, in 2004 the differences among the Italian and other European markets is illustrated in figure 5, but still in Summer 2005 Italian consumers paid over 14 eurocent/KWh against the 8-12 range in other major European countries. Although with higher fluctuations, market prices have more or less reproduced the previous monopolist unitary income.

As stated above, it is striking to note that in the period April-December 2004, the average market price was 56.18 euro/MWh, whereas the comparable index reproducing the previous regime was 56 euro/MWh, with a negligible 0.3% difference. At the beginning of 2005, due to the oil price