The first renewable forward market mechanisms in the Iberian Electricity Market

Álvaro Capitán Herráiz*
Technical University of Madrid (UPM), Madrid, Spain, alvarocapitan@hotmail.com

Carlos Rodríguez Monroy**
Technical University of Madrid (UPM), Madrid, Spain, crmonroy@etsii.upm.es

*The corresponding author, is a PhD candidate researching at UPM, Madrid 28006, Spain.
**Professor at UPM, Madrid 28006, Spain.

ABSTRACT

A description of the first renewable forward market mechanisms in the Iberian Electricity Market is provided. A contract for difference mechanism is available in Spain since March 2011between the last resort suppliers and the special regime (renewables and cogeneration) settling the price differences between the equilibrium price of the forward regulated auctions for the last resort supply and the spot price of the corresponding delivery period. Regulated auctions of baseload futures of the Portuguese zone in which the Portuguese last resort supplier sells the special regime production exist since December 2011. The experience gained from renewables auctions in Latin America could be used in the Iberian Electricity market, complementing these first market mechanisms. Introduction of renewable auctions at least for the most mature technologies (i.e. wind) in Spain and Portugal providing a fair price for the renewable generation will be of utmost importance in the short term to diminish the tariff deficit caused by the massive deployment of the feed-in-tariff scheme. Liquidity in the forward markets will also increase as a result of the entry of renewable generation companies intending to maximize their profits due to gradual suppression of feed in tariff schemes.

Keywords: energy regulation; power futures; regulated auctions; over the counter; renewable generation

1. INTRODUCTION

Capitán Herráiz and Rodríguez Monroy (2009) provide a description of the evolution of the Iberian power futures market managed by OMIP, located in Lisbon (Portugal), during its first two years of existence. That research focuses on the assessment of the ex-post forward risk premia (i.e. the difference between the futures prices and the underlying average spot prices for the corresponding delivery period). OMIP forward risk premia are remarkable, specially at the beginning of this market, limiting its price efficiency. The current research enlarges the data set (from the start of that market on July 3, 2006, to January 31, 2011) providing a robust picture of the trading evolution in this power futures market. Additionally, data cleared and settled in the energy derivatives clearing house located in Madrid, MEFF Power, operating since March 21, 2011, are also considered. The 2 clearing houses are complementing each other. The most cleared instruments in OMIClear are baseload futures of the Spanish zone with month, quarter and year maturity. On the other hand, the most cleared instruments in MEFF Power are baseload swaps of the Spanish zone with day and week maturity. The Iberian electricity market is composed of 2 zones, the Spanish and Portuguese zones, since 1 July 2007, having the same price with lack of congestion but different price when congestion occurs and the market splitting algorithm is applied. In order to understand the dynamics of the Iberian forward electricity market, a brief description of the trading activity in OMIP, in the auctions for catering the last resort supplies –the so-called ―CESUR" auctions, in Spanish

—Contratos de Energía para el Suministro de Último Recurso"– and the dominant OTC –—Over The Counter"– market is provided. The OTC market corresponds to forward financial transactions established bilaterally by two agents or through a broker.

Due to the relevance of the renewable generation in the Iberian electricity market, a review of pioneering renewable market mechanisms in Latin America is provided. This research also describes the recently introduced forward market mechanisms based on the special regime generation in the Iberian electricity market. The special regime is mainly composed of cogeneration, photovoltaics, concentrating solar power, wind, small hydro, biomass and solid waste. The first experience in Europe of similar mechanisms for the special regime is found in Italy, in which the public company GSE (Gestore dei servizi energetici Spa) aggregates all the special regime production (the so-called –CIP6" covering the nonconventional incentivised generation) and sell it in the market in the form of CIP6 rights as stated in Decrees of the Ministry for Economic Development. The sold amount corresponds to conservative forecasts. In year 2010, 17% of such rights are bought by the single wholesale buyer ("Acquirente Unico") for the last resort market. The remaining 83% is offered in the liberalised market. Each quarter, a regulated price is fixed for the sold energy. The buyer establishes a contract for differences with GSE and commits himself to buy at least in the spot market a quantity equal to his CIP6 rights. If the market price is higher (lower) than the regulated forward price, the buyer receives from (must pay to) GSE an amount equal to the price difference multiplied by the allocated quantity (AEEG, 2011).

The article is structured as follows: (i) Section 2 describes the trading activity in the Iberian electricity forward market; (ii) Section 3 lists the main renewable auctions in Latin America; (iii) Section 4 describes the existing forward market mechanisms related to the special regime in Spain and Portugal; (iv) Section 5 summarises all the insights of the research, suggests further lines of research and concludes.

2. THE TRADING DEVELOPMENT IN THE IBERIAN ELECTRICITY FORWARD MARKET

The evolution of OMIP traded volumes has to be seen in conjunction with the dominant non-organised OTC market and with the CESUR auctions. The OTC market reflects, in Spain, financial trading either done bilaterally or with the intermediation of brokers, being a portion of them cleared and settled through clearing houses. The equilibrium price of the CESUR auctions is one of the inputs in the the price formula for the last resort rate (Alba Ríos and Moreda Díaz, 2010; Villaplana and Cartea, 2011).

Figure 1 shows the evolution of the cleared and settled volumes (in TWh) in OMIClear (OMIP clearing house) and in MEFF Power through bars, and the matched volumes in CESUR auctions through triangles. There are two market modes in OMIP: the continuous market and auctions. Whereas the former is the main mode, the latter has performed a key role in the development of the liquidity in OMIP, as the Spanish distribution companies and the Portuguese last resort supplier were obliged to purchase energy in such auctions until July 2009 and July 2010 respectively. Furthermore OMIClear permits the clearing and settlement of OTC volumes by OMIP trading members, either bilaterally or through one of the four registered brokers. In the period June 2007–January 2012, 17 CESUR auctions have been celebrated where the Spanish distribution companies acquired the energy for their regulated supplies. Since the 9th auction, such a role was taken over by the last resort suppliers (OMIP-OMIClear, 2012; CESUR, 2012).

OMIP traded volumes in the first two years were led by the compulsory auctions. Since that moment until the end of 2009 the continuous volumes reached a similar size to the auction ones. Afterwards, the continuous market volumes kept growing. During 2010, the scarce auction volumes were generated by compulsory auctions of peak futures for the Portuguese last resort supplier with underlying price the spot price of the Spanish zone. On December 16th, 2011, the first auction for OMIP baseload futures with underlying price the spot price of the Portuguese zone was celebrated. Both peak futures of the Spanish zone and baseload futures of the Portuguese zone have still limited liquidity. The month with record of continuous volumes was March 2011 (4.86 TWh). The OTC cleared volumes also reached a record in that month (5.68 TWh) and maintained a growing trend, influenced by the OTC trading development.

Since March 21, 2011, OTC power trades with Spanish underlying spot prices can also be cleared and settled by another clearing house: MEFF Power. Although its number of enrolled members is growing fast (25 at the end of January 2012, of which 13 are also active in OMIP, which has 38 members at that date) the registered volumes in that period are still small (4.3 TWh) compared to OTC registered volumes in OMIClear in that time (26.5 TWh) (BME, 2012; OMIP-OMIClear, 2012).

The first 17 CESUR auctions account for a traded volume of 191.3 TWh, 19% less than the accumulated volumes cleared by OMIClear in the period July 2006 – January 2012 (CESUR, 2012). The OTC market has experienced a steady growing trend, summing up in that period approximately 888.0 TWh (Intermoney, 2012). Therefore the OTC volumes are 3.8 times bigger than the volumes cleared by OMIClear and 4.6 times bigger than the matched volumes in CESUR auctions. Only a minor part of the whole OTC volumes is cleared and settled by the existing clearing houses (10.3 % by OMIClear and 0.5% by MEFF Power) (OMIP-OMIClear (2012); BME (2012)).

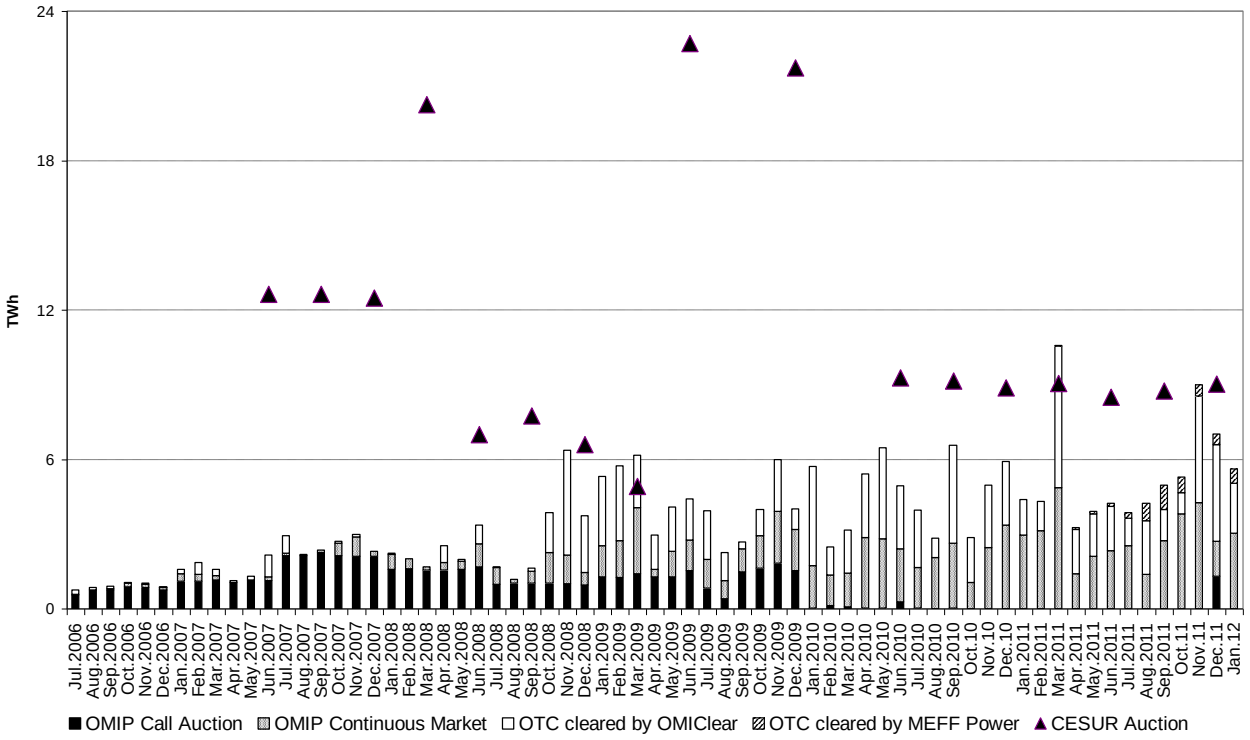

Figure 1: Evolution of traded and cleared volumes in OMIP-OMIClear, cleared volumes in MEFF Power, and matched volumes in CESUR auctions (TWh). (Source: OMIP-OMIClear (2012); CESUR (2012); BME (2012))

3. RENEWABLE AUCTIONS IN LATIN AMERICA

Maurer and Barroso (2011) describe the existing auctions for competitive procurement of electricity from renewable generation in Latin America as well as in other parts of the world. Auctions can contribute to the development of renewable sources in a more cost-competitive and sustainable way. Auctions foster competition pushing prices down, reducing tariffs for end-users. Auctions can either consider all forms of renewables as eligible to participate in the same auction process or restrict to particular types of technologies and/or sites. Two countries are reviewed:

- Peru: The implementation of technology-specific auctions has been tried twice. The first time was in 2008, for hydropower, without great success and with limited bidders. In February 2010, a similar mechanism was applied again in an auction to contract renewables under a specific law (Legislative Decree 1002) covering diverse technologies. About 150 MW of wind power were competitively contracted at prices around US$80/MWh. For the case of small hydro and solar, contracting of 160 MW and 90 MW respectively was possible with contract durations of 20 years and delivery for three years ahead. The average price for biomass was 63.35 US$/MWh, for wind 80.35 US$/MWh, for solar 221.10 US $/MWh, and for small hydro 59.90 US $/MWh.
- Brazil: A feed-in-tariff scheme was in force since year 2002. The first renewable auction took place in 2009 for wind technology. Since then, the feed-in-tariff was no longer used, but instead comparable sources should compete to achieve the ad hoc quotas for non-conventional renewables, periodically set by the government. Separate auctions were held distinguishing the renewable technology. So far, auctions for biomass and wind energy have been carried out. The main advantage of conducting auctions differentiated by technology is the possibility of explicitly introducing energy policy concerns, such as the renewable penetration in the energy mix, the socio-economic development, the development of some forms of generation technology, and an easy comparison of bids. Its main disadvantages include the criteria from which the quotas for different technologies should be selected, and the fragmentation of the procurement process, with risk of reduced competition and increased costs for end-users. The so-called "reserve energy auctions", meeting the demand of energy distribution companies according to amounts fixed by the government and not responding to demand forecasts, increase the reserve margin, and/or foster the development of particular sources of energy, such as renewables. They are fully specified by the government, including the definition of the technology (or project) and the portion of the demand to be contracted. There is no requirement for a Firm Energy Certificate (i.e. a commitment to produce a certain amount of energy, otherwise a penalty is applied) in a reserve energy auction model, and the product delivered is basically a 15-year energy contract (20 years for wind). The total cost of the energy contracted is paid by all consumers (both regulated and free) through a fixed charge. All energy produced by the plants is sold at the spot market on a merchant basis, and the revenue is used to offset the fixed payment by consumers. The first technology-specific reserve auction for the regulated market was carried out in 2007 and only renewable energy could participate. The participation was limited and discriminatory: prospective developers preferred to sell the energy to large end-users as they were eligible for discounts on the use of the transmission and distribution system and could therefore pay higher prices (discriminatory). On the other hand, the fact that generators do not need a Firm Energy Certificate mitigates several risks, making those auctions very attractive for generators, which are basically selling their production for a fixed price. There is a natural production synergy between hydroelectric and bioelectricity generation: the energy produced by biomass power plants during the dry season is more "valuable" because wholesale market spot prices are higher during that season than the annual average. The same counter-seasonal production behavior is observed for wind plants, whose production pattern is complementary to hydro storage levels in some parts. This counter-cyclical characteristic represents a significant competitive advantage to renewable sources: the benefits of portfolio diversity partially offset the higher unit costs of those technologies. Regarding site and technology-specific auctions, project specific auctions to supply the regulated market have been carried out to develop large hydro plants in the Amazon region. Three hydro plants –Santo Antonio (3,150 MW), Jirau (3,300 MW), and Belo Monte (11,233 MW)– were auctioned in specific procurement processes in 2007, 2008, and 2010, respectively. Special financial conditions were created (granting of 30-year energy contracts, incentives for the formation of multiple consortia, tax incentives, et cetera). These auctions present a trade-off when there are few bidders: the government has to strive either to attract one more bidder with the expectation of pushing prices down, or to reduce the reserve price (the maximum price (i.e. a price cap) permitted by the auction administrator). The reduction in the reserve price could happen when only one bidder participates in the tender. In the case of Santo Antonio, the government's efforts to find an alternative bidder appart from a well-positioned consortium was succesful compared to control the price via reserve prices: the winning bidder price was R$ 78.9/MWh, significantly lower than the R$130/MWh original estimate by

the consortium that had carried out the initial pre-feasibility studies. The reserve price set by the government, and corresponding to the best available cost estimate for the site in question, including a prudent return on capital, was R$122/MWh.

Appart from the renewable auctions celebrated in Peru and Brazil, description of similar experiences in other Latin American countries –Argentina and Uruguay– can be found in Battle and Barroso (2011). A comprehsensive description of the renewable auctions in Brazil can also be found in Müller-Monteiro and Moutinho dos Santos (2010).

4. THE FIRST FORWARD MARKET MECHANISMS RELATED TO THE SPECIAL REGIME PRODUCTION IN THE IBERIAN ELECTRICITY MARKET

4.1 THE CONTRACT FOR DIFFERENCES DERIVED FROM CESUR AUCTIONS IN SPAIN

As indicated in CNE (2011a), the Royal Decree 302/2011, of 4 March 2011 regulates the sale of products to be settled through price differences by the special regime facilities with a regulated tariff scheme and the purchase by the last resort suppliers. Therefore this mechanism aims to establish a compulsory purchase mechanism for the last resort suppliers and compulsory sale mechanism for those special regimes facilities of products with price differences settlement between CESUR prices and the spot prices.

The special regime facilities considered in the Royal Decree 302/2011 are those choosing option 1.a) in the article 24 (Mechanisms for the retribution of the electricity produced through the special regime) of Royal Decree 661/2007 (MITyC, 2007). This Royal Decree regulates the special regime generation in the Spanish electricity market. The article 24 considers two modes of feed-in-tariffs, i.e. tariffs for the remuneration of the energy generated by a special regime facility. If the generation facility chooses option 1.a) then it receives a regulated tariff (fixed amount) per kWh generated; with option 1.b) the recognised price is the spot price plus a fixed premium.

Of the 59.211 installations registered in September 2011 as special regime facilities at the Spanish Energy Commission (CNE) –the National Regulatory Authority manages the settlement of the feed-in-tariff scheme– 57,928 followed the regulated tariff mode and 1,283 the premium mode. The recognised amounts for the sold energy that month reckoned 430 million € for the regulated tariff and 115 million € for the premium facilities (CNE, 2011b).

Leyton (2010) provides a review of the feed-in-tariff implementation schemes around the world in order to open a dialogue for the implementation of similar initiatives in the Chilean electricity market. Such a reflection exercise is motivated by the Law 20.257, published on April 1, 2008, obliging the power producers with an installed capacity bigger than 200 MW, to supply 10% of energy from renewable non-conventional or hydro power with capacity less than 40 MW, own or contracted, since January 1, 2010 (BCN, 2010).

Back to the Spanish case, the maximum compulsory volume to consider in the contract for differences is obtained through the difference between the sum of the quantities requested by the last resort suppliers during the period in force of the last resort rate (a natural quarter) and the quantities matched in the corresponding CESUR auction (the auction celebrated some days before the beginning of such a quarter). This mechanism reduces the last resorts suppliers' risk, as it lets them purchase all the requested energy at the same cost (the equilibrium price of the CESUR auction). It is important to remark that the contract for differences are established with real production of the special regime: in case that the production would be less than the difference between the last resort suppliers' requested amounts and the matched amounts in the CESUR auction, a part of the purchases of the last resort suppliers would not be hedged neither through the CESUR auction nor through the contract for differences mechanism.

In other words, the contract for differences mechanism permits to transfer to the end consumer the price differences between the equilibrium prices of the CESUR auctions and the spot prices for the energy requested by the last resort suppliers and not purchased in the CESUR auctions. Since the entry in force of the last resort supplies (July 2009), the ex-post forward risk premia between the CESUR equilibrium prices and the underlying spot prices is usually positive (Villaplana and Cartea, 2011). By means of the contract for difference mechanism the end consumers can benefit from such a difference to mitigate the tariff deficit caused, among others, by the massive deployment of the special regime subject to attractive remuneration prices through the existing feed-in-tariffs. The solution is quite smart, as the affected special regime facilities will receive in any case the whole regulated tariff, and the end-users, in the cases when CESUR prices are higher than the underlying spot prices, although forced to face an increase in the last resort rate, will contain the tariff deficit due to the rents generated by the contract for differences mechanism. When the forward risk premium is negative (i.e. CESUR equilibrim price less than the spot price), the last resort suppliers will receive such a price difference (as a natural hedging at the CESUR equilibrium price) but in this case the end-users could as well benefit from smaller last resort rates due to lower CESUR prices. The spot market operator acts as a clearing house facilitating the settlement of the contract for differences mechanism.

However, as the counterpart supporting the price differences for the special regime with regulated tariff is in fact the collective group of end-users, the design of the contract for differences mechanism could be improved (maximization of profits) considering:

- on the purchase side, not the requested demand by the last resort suppliers but the real demand (i.e. physically measured) when exceeding the requested demand (prior to each CESUR auction).
- on the sale side, not only the real production of the special regime with regulated tariff but the whole generated amount (by any technology, not necessaily renewable) to cover the difference between the total demand of the last resort suppliers and their purchases in the CESUR auction. In case of insufficient generation by the special regime, the rents generated by the other technologies selling that remaining part in the spot market could be settled equally and help to diminish the tariff deficit when the forward risk premium is positive. Note that the objective of this mechanism is to find this alternative way to finance the regulated tariff of the special regime, and any generation unit acting as a counterpart of the last resort suppliers is representing artificially the Spanish power system and thus the collective group of end-users, being the generated rent not received by any producer but entirely destined in an anonimous way to the financing of the special regime retributed with specific regulated tariffs for each technology.

4.2 THE AUCTIONS FOR THE SALE OF THE SPECIAL REGIME PRODUCTION IN PORTUGAL

On December 16, 2011, the first auction related to the Special Regime production was celebrated in Portugal. In these auctions, the Portuguese last resort supplier (EDP Serviço Universal, S.A.), who is in charge of managing all the purchase and sale of the Portuguese special regime energy, sells all the energy from the special regime. If the whole energy is not sold, it will automatically repurchase that remaining amount at the auction equilibrium price (ERSE, 2011b; ERSE, 2011c).

These auctions contribute to develop the electricity market, as they facilitate the access to the energy via market mechanisms to the suppliers in the liberalised market as well as to the new entrants. They are a hedging tool for the price risk of such agents. These auctions permit the market risk diverisification in the allocation of the special regime energy and mitigate the price volatility of its exclusive integration in the spot market. These auctions facilitate a level playing field for agents with or without own generation assets in Portugal. These auctions permit the stabilitiy of the last resort supplier's cash-flow. The differences in the purchase price to the special regime producers by the last resort supplier and the sale price in these auctions are recognised as a regulated cost for the last resort supply. Therefore the end-users support the global cost of the special regime production (ERSE 2011a; ERSE 2011b).

Volumes on top of the issued ones cannot be matched in these auctions. ERSE, the Portuguese National Regulatory Authority, as the auction supervisor, has to publish not later than 2 days after the auction the equilibrium price and the matched amounts, the eventual amount repurchased by the last resort supplier, the amount of qualified agents, the buyers, and the number of rounds. OMIP is the auction administrator and OMIClear is the clearing house. The auctions are electronic, with multiple rounds and ascending price clock algorithm. Different products can be auctioned simultaneously without possibility to migrate bid blocks from one product to other products. It is mandatory to be trading member in OMIP, and thus hold collateral in the futures market. ERSE communicates 10 days before the auction the quantities and the contracts (baseload and/or peak futures of the Portuguese zone with month, quarter and/or year maturity) (ERSE, 2011b; OMIP, 2011).

300 MW were sold in the first auction (the total offered amount, 1,315,000 MWh in terms of energy, equivalent to 2.6% of the Portuguese mainland demand). The pre-qualification bids reckoned 7.15 times the offered amount. Eleven companies submitted initial bids, totalling 9,403,290 MWh (ca. 19% of the Portuguese mainland demand). The average equilibrium price was 53.12 €/MWh, aligned with the settlement prices of the previous OMIP trading session, and 2.00 €/MWh (year contract) and 1.85 €/MWh (quarter contract) above the reserve prices regulatorily fixed (i.e. the price floors). For the quarter contract (baseload with time horizon the second quarter of year 2012), 200 MW (436,600 MWh) were matched by 5 of a total of 10 bidders at 53.35 €/MWh in the fifth round. For the year contract (baseload with time horizon the year 2012), 100 MW (878,400 MWh) were matched by 5 of a total of 11 bidders at 53.00 €/MWh in the sixth round (ERSE, 2011d).

Only one auction has been celebrated so far. In order to foster the liquidity of the futures products of the Portuguese zone, these auctions should be celebrated regularly, at least once a month in order not to concentrate the negotiation in few points of time (case of quarterly frequency). As a next step in the integration of the special regime through forward market mechanisms, in order to provide a competitive price, especially when some specific technology reaches the grid parity (its price is competitive in the market without need of feed-in-tariff support schemes), it can make sense to directly arrange auctions in which these producers sell the energy to the last resort supplier for the regulated market and to the suppliers for the liberalised market.

5. CONCLUSIONS

The Iberian electricity forward market has experienced a continuous increase in liquidity since the start of the power futures market managed by OMIP, on July 3, 2006. Such a liquidity growth is caused, amongst others, due to the influence of the dominant Over The Counter market (the volumes from the OTC market are almost 4 times bigger than the whole cleared and settled volumes by OMIClear –OMIP clearing house–, being roughly half of those volumes related to trading in OMIP continuous market and ad-hoc auctions, and the remaining half due to registered OTC volumes for clearing and settlement in that clearing house). Another important factor for the development of the Iberian power futures trading is due to the frequent –once each quarter– celebration of auctions for catering part of the energy of the last resort supplies (the so-called CESUR auctions). The forward traded volumes can increase due to the fact that the agents can exploit the price differences between OTC, CESUR auctions and trading in OMIP and obtain arbitrage gains. Since March 21, 2011, another clearing house exists related to the Iberian Electricity forward market (MEFF Power). The OTC volumes registered in this clearing house are increasing steadily as in OMIClear. The reason behind this fact is that both OMIClear and MEFF Power are performing complementarily: whereas the bigger volumes cleared in the former correspond to baseload power futures contracts of the Spanish zone with month, quarter and year maturity, the latter is mainly employed to the clearing of baseload power swaps of the Spanish zone. Although peak products can be registered in both clearing houses, such volumes are still very small (the same liquidity problem as for the futures products of the Portuguese zone in OMIClear). The existence of forward products for both Spanish and Portugese zones is due to the fact that, since 1 July 2007, the Iberian electricity market is composed of two zones, having the same price with lack of congestion but different price when congestion occurs and the market splitting algorithm is applied

There are currently two market mechanisms related to the forward integration of the special regime (i.e. renewable generation and cogeneration) in Spain and Portugal. In the Spanish case, a contract for difference mechanism is available in Spain since March 2011between the last resort suppliers and the special regime facilities –those subjected to a regulated tariff for the retribution of their energy produced– settling the price differences between the equilibrium price of the forward regulated auctions for the last resort supply and the spot price. This mechanism helps to contain the tariff deficit by means of the rents generated when the CESUR equilibrium price is bigger than the underlying spot price. The design of this mechanism could be optimised (maximisation of profits) considering on the purchase side the real demand by the last resort suppliers when exceeding their requested demand in advance, and on the sale side the whole generated amount by any technology to cover the difference between the total demand of the last resort suppliers and their purchases in the CESUR auction. In the Portuguese case, regulated auctions of baseload futures of the Portuguese zone in which the last resort supplier sells the special regime production exist since December 2011. In order to foster the still small liquidity of the futures products of the Portuguese zone, these auctions should be celebrated regularly, at least once a month in order not to concentrate the negotiation in few points of time.

Renewable auctions as those from the pioneering experiences in Brazil and Peru could be considered as the next step in the integration of the Iberian special regime through forward market mechanisms. Therefore, iintroduction of auctions at least for the most mature renewable technologies, providing a fair price for this type of generation, would help to diminish the tariff deficit caused by the massive deployment of the feed-in-tariff scheme. The introduction of renewable auctions for specific technologies would entail the gradual suppression of the existing feed-in-tariff scheme for such a technology (i.e. the new infrastructure would be built according to new auction programs substituting the former scheme). These auctions should be designed in a way that regulatory uncertainty is minimised (successive modifications of the existing feed-in-tariff scheme have produced much uncertainty in the energy sector, damaging the investment climate). As a natural consequence, liquidity in the forward markets will also increase as such renewable generation companies would try to maximize their profits by trading actively in the forward markets, as they could no longer benefit of the full hedge provided by the previously existing feed in tariff schemes.

Further research is encouraged to simulate the economic effects and the forward price formation in the Spanish power system due to the introduction of renewable auctions substituting the existing feed-in-tariff scheme. Regarding the economic effect, evaluation of the potential reduction of the accumulated tariff deficit will be very worthy. Regarding the price formation, analysis of the forward price formation taking into account reasonable prices of those potential renewable auctions as well as the generation costs (including the CO_2 emission costs) of the thermal power plants –the gas and coal fired power plants acting as an effective back-up in the absence of windy days– would shred light about the most convenient estimation methodology for the energy costs in the last resort rates. As these rates are used as benchmark for the end-user rates in the liberalised market, social welfare would be obtained by improving the rate design including the penetration of renewable generation.

REFERENCES

AEEG (2011). Relazione annuale sullo stato dei servizi e sull'attività svolta, Struttura, prezzi e qualità nel settore elettrico, 6 August 2011, Autorità per l'energia elettrica e il gas (AEEG), Milan.

Alba Ríos, J.J., Moreda Díaz, E. (2010). Competencia en el mercado mayorista de electricidad. Anuario de la competencia 2009, pp. 215-293. Fundación ICO- UAB, Ed. Marcial Pons, Madrid.

Batlle, C., Barroso, L.A. (2011). Support schemes for renewable energy sources in South America. MIT-CEEPR Working Paper 11-001.

BCN (2010). Ley núm. 20.257, introduce modificaciones a la ley general de servicios eléctricos respecto de la generación de energía eléctrica con fuentes de energías renovables no convencionales, Ministerio de Economía; Fomento y Reconstrucción. Biblioteca del Congreso Nacional de Chile (BCN), Ley Chile: www.leychile.cl/Navegar?idNorma=270212&tipoVersion=0

BME (2012). MEFF Derivados Energía: www.meff.es/aspx/DerEnergia/Home.aspx. Bolsas y Mercados Españoles (BME), Madrid.

Capitán Herráiz, A., Rodríguez Monroy, C. (2009). "Analysis of the efficiency of the Iberian power futures market". *Energy Policy*, 37, 3566–3579.

CESUR (2012). Official websites of the Spanish Bilateral Contracting Auctions for Last Resort Supplies ("CESUR Auctions"): 1st to 5th auctions, www.subasta-cesur.eu/auction.asp; from 6th onwards, www.subastascesur.omel.es/frames/index.jsp

CNE (2011a). Spanish Energy Regulator's Annual Report to the European Commission, 22 July 2011, Comisión Nacional de Energía (CNE), Madrid.

CNE (2011b). Liquidación de las primas equivalentes, primas, incentivos y complementos a las instalaciones de producción de energía eléctrica en régimen especial, mes de producción: 09/2011, 10 de noviembre de 2011,.Comisión Nacional de Energía (CNE), Madrid.

ERSE (2011a). Regulamento n.º 496/2011, Aprovação dos novos Regulamentos: Regulamento de Relações Comerciais, Regulamento Tarifário e Regulamento do Acesso às Redes e Interligações. Entidade Reguladora dos Serviços Energéticos (ERSE), Diário da República, 2.ª série — N.º 159 — 19 de Agosto de 2011, pp. 34035-34322, Lisbon.

ERSE (2011b). Directiva n.º 5/2011, Termos e Condições de realização de Leilões de Colocação de PRE. ERSE, Diário da República, 2.ª série — N.º 226 — 24 de Novembro de 2011, pp. 46437-46444, Lisbon.

ERSE (2011c). Termos e Condições específicas do 1.º Leilão PRE. Comunicado ERSE, 15 de Dezembro de 2011, Lisboa.

ERSE (2011d). Resultados do 1.º Leilão PRE. Comunicado ERSE, 16 de Dezembro de 2011, Lisboa.

Intermoney (2012). El Mercado Eléctrico en España, enero 2012. Madrid, 15 de febrero de 2012, im energía sa, consultoría, p. 57

Leyton, S. (2010). Feed-In Tariff, Posted on 13 July 2010 in: http://centralenergia.cl/2010/07/13/feed-in-tariff/

MITyC (2007). Real Decreto 661/2007, de 25 de mayo, por el que se regula la actividad de producción de energía eléctrica en régimen especial. Ministerio de Industria, Turismo y Comercio (MITyC), Boletín Oficial del Estado (BOE), 26 de mayo de 2007, pp. 22846-22886, Madrid.

Maurer, L.T.A., Barroso, L.A. (2011). Electricity Auctions: An Overview of Efficient Practices. The International Bank for Reconstruction and Development / The World Bank, Washington DC.

Müller-Monteiro, E., Moutinho dos Santos, E. (2010). Uso Político do Setor Elétrico Brasileiro: Uma matodologia de análise baseada na Teoria de Grupos de Pressão. Rio de Janeiro, Synergia Editora, FAPESP.

OMIP (2011). Circular OMIP 1/2011, Subasta de colocación de Producción en Régimen Especial, 14 diciembre 2011, OMIP, Lisboa.

OMIP-OMIClear (2012). Daily Market Bulletins of the MIBEL Derivatives Market, July 3, 2006 – January 31, 2012.

Villaplana, P., Cartea, A. (2011). Un análisis de la evolución de los precios a plazo de energía eléctrica en España. Los nuevos mercados energéticos, pp. 193-242. Fundación de Estudios Financieros, Colección Papeles de la Fundación nº 41, Madrid.

Authorization and Disclaimer

Authors authorize LACCEI to publish the paper in the conference proceedings. Neither LACCEI nor the editors are responsible either for the content or for the implications of what is expressed in the paper.