

## ELECTRIC SYSTEM IN SPAIN: GENERATION CAPACITY, ELECTRICITY PRODUCTION AND MARKET SHARES

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**Abstract-** Spanish market was typically constituted by regions, where a monopolizer company had all electric roles: generation, transportation and distribution. As a result of the merger and acquisition transactions carried out in the nineties, the electric energy production market in Spain started to function with four large electricity groups. In the rest of the retail market, concentration remains high: the market shares of the three biggest companies add up to 75% in energy and 90% in customers.

**Keywords:** Wholesale Market, Retail Market, Power Generation, Generation Capacity.

### I. INTRODUCTION

In its early years, in Spain the electricity industry was a fragmented and dispersed sector. Later, increased economies in generation and the conception of power supply as a public service brought to consider the electricity sector as a natural monopoly, whether public or private property. However, from the 1980's, several economic, technical and political elements highlighted the inefficiencies of the monopoly model and prompted the beginning of a reform process, with the ultimate aim of introducing competition in the sector.

The introduction of competition involves the restructuring of the electricity sector, which must pass from the monopoly model to another model of structure of free market.

Liberalization of such an industry involves the creation of a combination of competitive energy and retail markets, and regulated transmission and distribution activities. Successful liberalization requires well-organized energy, associated ancillary services and transmission capacity markets to achieve competition with physical balancing and appropriate regulation of monopoly power [1].

Liberalization requires a suitable market structure within which effective competition can be fostered. Generally, this involves restructuring the sector by unbundling vertically integrated activities and reducing their horizontal concentration. The aim of vertical unbundling is to separate potentially competitive

generation and retail supply from the natural monopoly activities of transmission and distribution networks.

That happened in Spain in 1997. But after that, 2009 was an important year for the electricity and gas sectors in Spain and, in particular, for retail markets. On 1 July 2009 end-user regulated electricity prices disappeared. After more than 6 years in which Spanish consumers could choose between being supplied by distribution companies (through end-user regulated prices) or by retailers under free market conditions, distributor companies cannot retail electricity and gas to their clients anymore and a list of last resort suppliers is available for a 4 year term [2].

Therefore, since July 2009, just small consumers, below or equal to 10 kW for electricity and below or equal to 4 bar and below or equal to 50000 kWh/year for gas, are allowed to stay under the last-resort-tariff scheme. In this new context, special provisions on vulnerable consumers ("social bonus") have been established and a new body, the Office for Switching Supplier has been created to oversee switching procedures (for both gas & electricity)

Related to wholesale markets, electricity and gas demands both decreased significantly in 2009 as a result of the downturn of the Spanish economy and, consequently, wholesale energy prices decreased too [3].

### II. DESCRIPTION OF THE WHOLESALE MARKET

The following graph and table show the shares by technology of installed generation capacity in the Spanish mainland system in 2009; the total values reached 93215 MW.

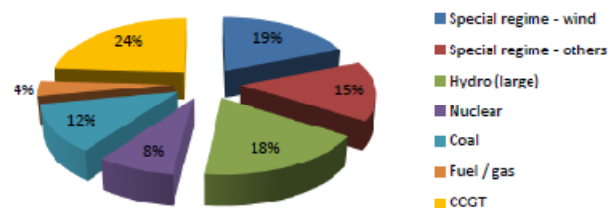


Figure 1. Installed generation capacity in the Spanish mainland system at the end of 2009 (Source: REE)

Table 1. Installed generation capacity structure in the Spanish mainland electricity system (Source: REE)

Technology\Generation capacity (MW)	2008	2009
CCGT (Combined Cycle)	21.667	22.243
Fuel+Gas (conventional)	4.418	3.927
Coal	11.359	11.359
Nuclear	7.716	7.716
Hydraulic	16.658	16.657
Wind power	15.576	18.119
Other Special Regime	12.552	13.194
Total	89.944	93.215

On 31st December 2009, the generation capacity shares of the different companies in the "ordinary regime" (conventional generation) of Spanish mainland electricity system were as shown on the following table:

Table 2. Companies' market shares of available generation capacity in the ordinary regime (year 2009, Source: CNE)

	Available generation capacity	HHI
Iberdrola	32.50%	2254
Endesa	26.60%	
Gas Natural Fenosa	20.30%	
Edp-HidroCantabrico	5.40%	
E.ON	6.50%	
Others	8.80%	

In these figures and tables, international interconnections are got around, because they are centered into the internal Spanish system. But, obviously, there are interconnections with the neighbors: France, Portugal and Morocco. For example, as far as the new line of the French-Spanish interconnection is concerned, the engineering project has been defined but the works on site have suffered delays. It is expected that in 2014, there will be around 2000 MW from FR to ES and 1000 MW from ES to FR [4].

As shown on the above table, the number of companies with more than 5% of the Spanish electricity system's installed power is 5, being Endesa, Iberdrola, Gas Natural Fenosa, E.ON and HidroCantabrico.

Structure of the Generation Market – Energy: In 2009, total demand of power generation (including mainland and extra-peninsular demand) declined 4.4% and decreased to 266874 GWh, which was covered as Figure 2.

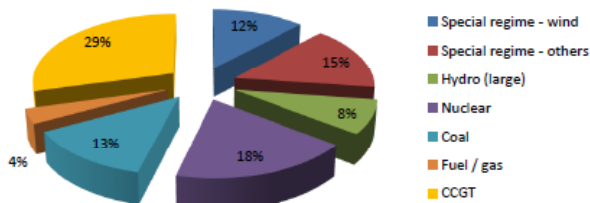


Figure 2. Electricity production in the Spanish system per technology during 2009 (Source: REE)

During the year 2009, 13th January was the day on which the highest ever peninsular hourly demand was recorded, with a value of 44440 MW. The maximum daily energy value occurred the same day and amounted to 886 GWh.

Table 3. Balance of Spanish electric system, GWh (year 2009, Source: REE)

Balance of Spanish electric energy system	energy 2008 (GWh)	energy 2009 (GWh)
Hydroelectric	21175	23236
Nuclear	58756	52765
Coal	49726	37812
Fuel+Gas (conventional)	10858	10156
Gas (combined cycle)	96005	83895
Special Regime	67343	79226
International Exchanges	-11221	-8398
Consumption in generation	-9280	-8116
Consumption in pumping	-3494	-3703
Total demand	279868	266874

As a result of the merger and acquisition transactions carried out in the nineties, the electric energy production market in Spain started to function with four large electricity groups: Endesa, Iberdrola, Union Fenosa and HidroCantabrico. In 2007 ENEL and Acciona took over Endesa, defeating another competing bid from E.ON; E.ON has taken full control over formerly ENEL-owned Viesgo. Additionally, Gas Natural has taken over Union Fenosa during 2009.

As for 2009, there were five groups of a significant size competing in the market: Endesa, Iberdrola, Union Fenosa-Gas Natural, HidroCantabrico (EDP) and Viesgo (E.ON), whose market shares in energy are shown in Table 4.

There are 4 companies with market shares in excess of 5%. The HHI would be in an interval between 1403 and 1788 depending on what minimum threshold is considered for computing a company separately (some companies have very little shares). The share in the big five companies includes ordinary and special regime. The rest of ordinary regime generation makes up 6.2% and the rest of special regime generation, 19.6% (which, in fact, is splitted in many companies).

Table 4. Market Shares in electricity generation (year 2009, Source: CNE)

	Energy Share	HHI
Iberdrola	24.60%	(1403-1788)
Endesa	22.50%	
Gas Natural Fenosa	16.20%	
Edp-HidroCantabrico	5.40%	
E.ON	4.70%	
Others (Ordinary Regime)	6.20%	
Others (Special Regime)	19.60%	
Imports	0.70%	

III. DESCRIPTION OF THE RETAIL MARKET

Since 1 July 2009, all electricity consumers are formally in the liberalized market. However, in the liberalized market, there is a last resort tariff available only for consumers with contracted load capacity below or equal to 10 kW. In addition to the access tariff (which is a regulated cost), the price for energy in the last resort tariff is computed by the Government according to CESUR auctions (Supply of Last Resort Energy Contract Auctions) [5].

In Spain, as in many other countries, there is also a penalty for big consumers for the reactive power. Only for small consumers, usually assigned to the called "last resort tariff", there is the chance to not take into account this part of the energy. Reactive power flows can give rise to substantial voltage changes across the transmission system, which means that the balance between the sources of generation and points of demand must be controlled locally within zones distribution systems. According to Strategies for development and diffusion of Energy Efficient Distribution Transformers (SEEDT), the losses caused by harmonics and reactive power in European Union (EU) distribution transformers are estimated at about 5000 GWh/year [6].

It must be mentioned that from an overall amount of 27589557 electricity consumers in mainland Spain, most of them (23941730) are supplied by last resort suppliers. In terms of energy, in the second half of 2009, 36% of all energy retailed in Spain was supplied by last resort suppliers. Therefore, it is worth to analyze separately the market in two categories: last resort supply and rest of the market.

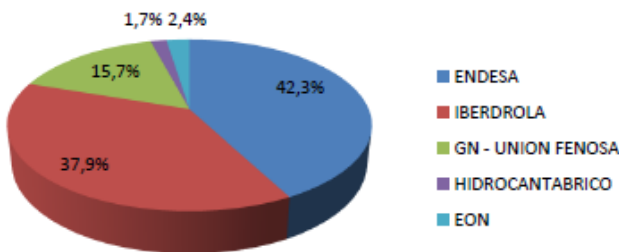


Figure 3. Market shares of last resort suppliers by number of customers (Source: CNE)

Regarding the last resort supply, 23,941,730 consumers (by the end of 2009) were supplied by last resort suppliers, with consumption (in the second half of 2009) of 43015 GWh, which is 36% of all energy retailed in Spain. Five last resort supply companies were appointed, which have the obligation to supply consumers (below or equal to 10 kW) that request it. These five companies belong to the big five electricity groups active in Spain. Endesa and Iberdrola cover around 80% of the customers.

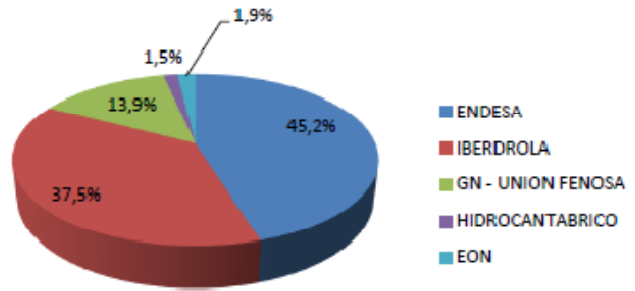
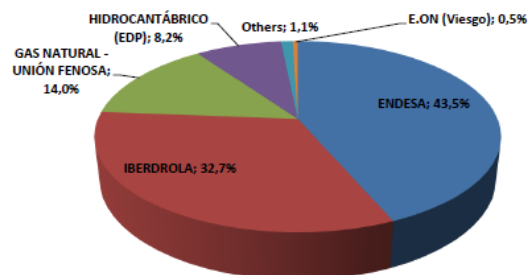


Figure 4. Market shares of last resort suppliers by energy (Source: CNE)

In the rest of the market there were (by the end of 2009) 3647827 consumers with consumption (in the second half of 2009) of 76447 GWh, which is 64% of all energy retailed in Spain. The companies with the largest liberalized market shares are those belonging to the large established energy groups, i.e. Endesa, Iberdrola and Gas Natural Fenosa, whose market shares add up to 75% in energy (90% in customers).

Table 5. Market shares of supply companies in the liberalised market by number of customers (Source: CNE)

Supplier company	Share (clients)
Endesa	43.5%
Iberdrola	32.7%
Gas Natural Fenosa	14.0%
HidroCantabrico (EDP)	8.2%
E.ON (Viesgo)	0.5%
Others	1.1%

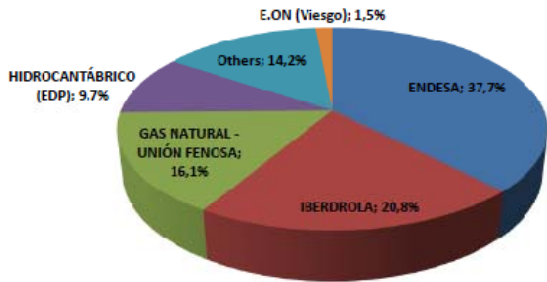


In general, the way in which all the other supplier companies have entered the market has been through organic growth, without being associated with any distribution company, with the exception of HidroCantabrico, in which the Portuguese EDP holds 96.6% of its corporate capital, and Viesgo, which was acquired by E.ON. Though Gas Natural – Union Fenosa merge was not effective until July 2009, since data provided here are a "market snapshot" by end 2009, they are showed jointly.

The company with the biggest increase was again Iberdrola: its share went up from a 20.3% in 2008 to a 32.7% in 2009, mostly at the expense of Endesa, which reduced its share from 60.27% in 2008 to 43.5% in 2009.

Table 6. Market shares of supply companies in the liberalized market by energy (Source: CNE)

Supplier company	Share (energy)
Endesa	37.7%
Iberdrola	20.8%
Gas Natural Fenosa	16.1%
HidroCantabrico (EDP)	9.7%
E.ON (Viesgo)	1.5%
Others	14.2%



With regard to switching supervision, the recently passed Royal Decree 1011/2009, dated June 19th 2009 establishes the aim, competencies and duties of the "Office for Switching Supplier" (OCSUM). This new enterprise has as sole purpose overseeing switching procedures in both power and gas markets, thus making all pertinent information and data freely available and compiling periodical reports on relevant switching indicators [7].

Considering the geographical scope, the relevant market can be defined as national. There are Spanish retailers active in Portugal and in other European markets (France, UK...) and there are Portuguese (EDP), British (Centrica), Italian (ENEL), German (E.ON) and French (EDF) companies participating in the Spanish retail market. The sum of the external (or foreign-controlled) supplier companies' market share lies above 45%.

In order to analyze the switching rates in terms of both: Numbers of customers and energy, two categories are considered: last resort supply and rest of the market [8].

The retail market had been quite dormant before 2009 partly because of the existence of "refuge" end-user tariffs. All consumers are in the liberalized market since July 2009, from that moment on, the retail market has been more active. Suppliers are offering new products for different types of consumers including new services. Usually joint offers (gas and electricity) incorporate additional discounts.

However, consumers supplied under the last resort regime are more conservative: only 93826 of these consumers (from 23941730, it makes just 0.4%) have switched to a last resort supplier different to the group of the distributor. In terms of energy, it makes a similar share (0.3%). One of the reasons is that the retail market is not offering attractive prices to this kind of consumer; it is more oriented to bigger consumers.

On the other hand, consumers supplied in the rest of the market (not supplied in the last resort regime) are more prone to switching. By the end of 2009, 518329 consumers (from a market comprising 3647827 consumers, it makes 14.2%) were supplied by a supplier different to the group of the distributor.

Given that, by the end of 2008, the overall number of consumers being supplied from a company different from the group of the distributor was 395531 and considering the switches occurred in the last resort regime (93826), this means that, in 2009, 216624 consumers (at least) have changed supplier. In previous years, the number of switches in a year was below 100000, so it can be inferred that the liberalization has promoted much more activity in the retail market, at least for big consumers.

In the so called "rest of the market", switching is much more important in terms of energy: in the second half of 2009, 45.3% of energy was retailed by a supplier different to the group of the distributor.

Table 7. Loyalty degree (and switching) indicators by network (in terms of energy) as of Dec. 2009 – Source: CNE

Supplier	Distribution Network Operator				
	E.ON	Endesa	H.Cantabrico	Iberdrola	U. Fenosa
Cide Hcener	0	0	0	0	0
Cons Dir Mer	1.08	0	0	0	0.01
E.ON	<b>20.75</b>	1.03	0.32	1.63	0
Endesa Cyr	0	<b>0</b>	0	0	0
Endesa E.	17.02	<b>72.96</b>	3.47	11.49	25.17
Enr.Gran.Con	0	6.27	0.51	8.55	6.94
Hcantab Ener	8.62	4	<b>48.56</b>	9.78	4.85
Hispaelec E.	0	0.18	0	0.35	0.25
Iberd. Gener	0	0.06	42.88	0	0
Iberdrola SA	6.03	2.95	0.73	<b>42.84</b>	4.69
Naturgas Com	0	0.01	<b>0</b>	<b>2.87</b>	0
Otros	38.16	4.95	1.13	8.08	7.48
GN UF	8.34	7.6	2.4	14.41	<b>50.61</b>



#### IV. CONCLUSIONS

In 2009, total demand of power generation (including mainland and extra-peninsular demand) decreased to 266874 GWh, which is 4.4% less than demand in 2008. This was due to the downturn of the Spanish economy, however, electricity production from renewable energy sources rose. These are some of the reasons that explain a significant reduction in wholesale prices. Weighted average monthly day-ahead prices ranged from 39 to around 56 €/MWh (in 2008, the range was 56 to 73 €/MWh).

Price convergence in the Iberian wholesale market (MIBEL) has increased. During 75% of the time, day-ahead spot prices in Spain have been equal to those in Portugal.

Even though the degree of concentration in the wholesale market has risen due to the merge Gas Natural Fenosa in terms of installed capacity, this has not been the case in terms of energy produced.

The electricity market in Spain is fully liberalized since 2003: All Spanish customers (including household) have been free to choose supplier since 1st January 2003. Since 1st July 2009, the old regulated retail market for end users disappeared completely. All consumers are now in the liberalized market. However, those consumers with contracted load capacity below or equal to 10 kW can be supplied at a "last resort tariff" if they wish so. In this end user tariff, the energy price is computed taking into account CESUR auctions. Five last resort suppliers have been appointed for this purpose.

In the rest of the retail market, concentration remains high: the market shares of the three biggest companies add up to 75% in energy and 90% in customers.

This new scheme has resulted in an important increase in supplier switching, especially in the case of big consumers. In 2009, 216624 consumers (at least) have changed supplier.

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#### BIOGRAPHIES



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