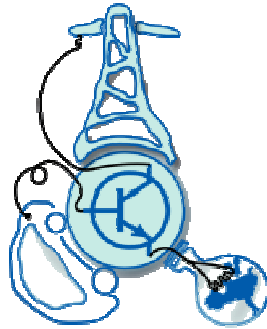# Strategy Competencies Analysis in Renewable Energies and Combined Heat and Power

By

Emilio Bayón Cerezo

Submitted to the Department of Electrical Engineering, Electronics,
Computers and Systems
in partial fulfilment of the requirements for the degree of
The Master Course in Electrical Energy Conversion and Power Systems
at the
UNIVERSIDAD DE OVIEDO
July 2015

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Abstract

The Master Thesis will be focus on analyse the significant participation of huge green power Installations in electrical Spanish market. As a consequence of the new remuneration model, incomes will be split on market price plus payment for the capacity, it emerges in the market the variable cost of offer agents. Received public information of all agents who compete in the market is received without agent's name, sometimes in aggregate few time after the market, but 90 days after information will be complete and global. Thesis will try to identify both in short term and after 90 days offer strategy of the agents or representative of the wind power plants or generate a helpful tool in order to understand the behaviour of the different agents on competence

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Thesis Supervisor: Pablo Arboleya, Associate Professor
Thesis Supervisor: Rodrigo Fdez. Prado

Acknowledgments

Thanks to my family for their unconditional support.

To my friends of this master specially Sandra and Adrián.

To Rodrigo and Pablo for the time spent on the project

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Chapter 1

Introduction

Nowadays, the several changes in the directives related with renewable energy generation in Spain and also over the remuneration, last valid directive date from June 2014 (BOE 413/2014) [1] in which support schemes were removed.

However this kind of energy it is still allowed to trade their energy in the liberalized Spanish electrical market. This system enables competition between different agents and a greater economic efficiency

In the case of a real-life wind power producer (WPP) agent, the typical strategy is to bid the production in daily ahead market at marginal cost, a conservative and less profitable strategy that not take advantage of the intra daily and imbalance markets in order to restructure the bid in the daily Ahead.

In this project the analysis of the bidding strategies and the competitors was done and each offer unit strategy was analyzed one by one over the period of time between December 2014 and March 2015.

121 days in which they have obtained different strategies and patterns for the sale of energy.

Spanish Electrical System

The basic limitation that electrical market have is Electrical energy cannot be stored in large quantities, and therefore, the amount of energy required must be generated in a precise manner at the exact moment it is demanded, maintaining a constant balance between generation and consumption.
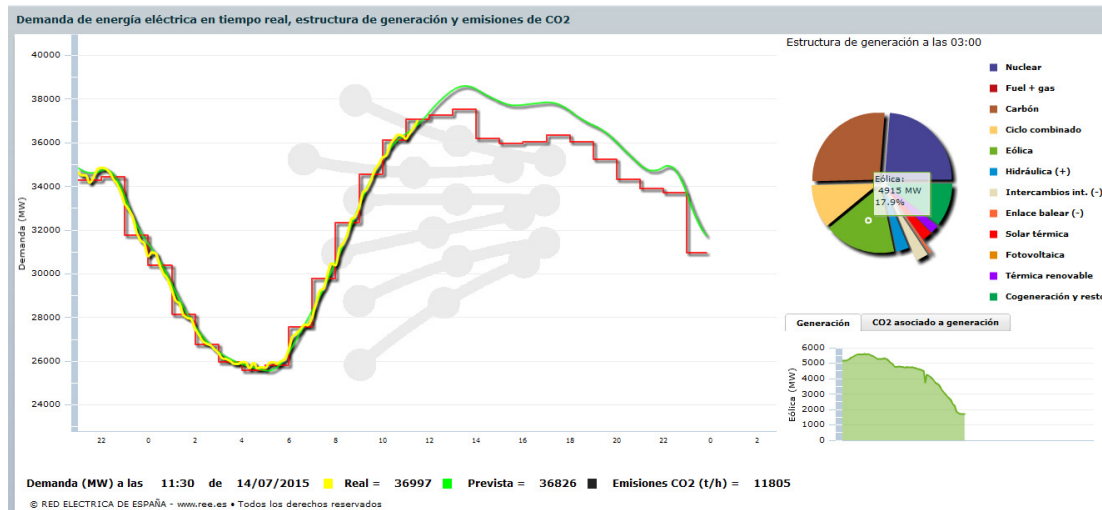
Figure 1: Real time Demand and Generation Graphs [2]

Spanish directives make a distinction over the activities of the electrical system, regulated and non-regulated activities.

The activities for the supply of electricity are: generation, transmission, distribution, energy recharge services, marketing community and international exchanges as well as economic and technical management of the electrical system. The main ones are:

- Generation

    The production of electricity.

- Transportation:

    It concerns the transmission of electric energy by the transport network, used for the purpose of providing it to different subjects and conducting international exchanges.

The network of electricity transmission is constituted by the primary transport network (facilities greater than or equal to 380 kV) and secondary transport network (up to 220 kV).

- Distribution:

    It concerns the transmission of electrical energy from transport networks, or possibly from other distribution networks from the generation or connected to the own distribution network, to the point of consumption or other distribution networks in appropriate conditions quality with the ultimate aim of providing it to consumers.

Generation is one of the areas that are exposed to competition and the main area of the project.

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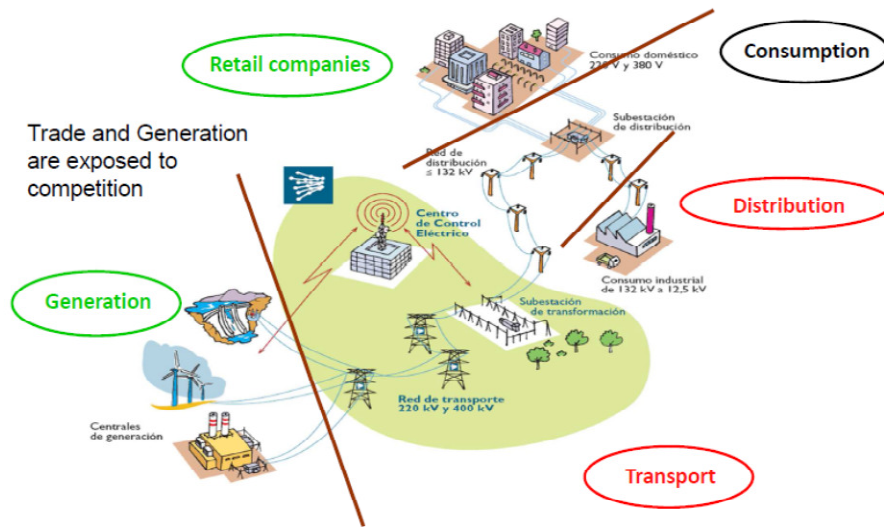
Figure 2: Spanish Electrical System [3]

System Operator

The role of Red Eléctrica as system operator consists of maintaining this balance and, for this purpose, it produces the electricity demand forecasts, oversees the operation of the generation facilities and manages the transmission facilities in real-time, constantly ensuring that scheduled generation in power stations matches consumer demand. Should a difference arise between the two, it sends the appropriate instructions to the power stations to increase or reduce their output.

Red Eléctrica also manages what are known as adjustment services, the purpose of which is to facilitate the adjustment of the generation schedules resulting from the day-ahead and intra-day electricity markets to the quality, reliability and security requirements of the electricity system. Adjustment services or adjustment markets are understood as the resolution of technical restrictions of the system, the allocation of ancillary services and the management of deviations.

Red Eléctrica drafts the annual power demand evolution forecasts, together with the relevant coverage, for the medium and long term. These forecasts are essential in order to draw up the transmission grid development plans for the upcoming years, approved by the Ministry of Industry, Tourism and Trade.

Electricity is a vital utility in the everyday life of households, and essential for business operations. At OMIE, we manage the wholesale electricity market, where market agents trade the amounts they need (MWh) at publicly stated and transparent prices [2].

Market Operator

OMIE manages the entirety of the markets (daily and intraday) for the whole of the Iberian Peninsula, and its operating model is the same as the one applied by many other European markets.

Taking part in the market involves an electronic platform that is easy to access via the internet, which permits the simultaneous participation of a large number of agents and the management of a high number of bids for the purchase and sale of electricity over a short period of time. OMIE also carries out the invoicing and settlement of the energy traded on these markets, as well as overseeing the corresponding financial settlements.

The functions to the market operator can be classified in five different points, only remarkable parts in each point will be explained

1. Functions relating to the operation of the markets.

Receipt of the sale bids issued for each programming period by the different parties participating in the daily electrical energy market and also the acquiring bids

Receipt of the necessary information from the entities participating in the electrical energy markets.

Implementing the matching process of the bids for sale and purchase starting from the cheapest offer until demand is matched in each programming period.

Determination of the different energy prices resulting from the matching processes in the daily electrical energy market for each programming period and notification to all agents involved.

Settlement and communication of the payments and collections to be carried out in accordance with the energy prices resulting from the matching processes and other costs that may be laid down according to regulations.

Communication to the system operator of the bids for the sale and purchase of electrical energy, made by the different parties participating in the electrical energy markets under their responsibility, for each one of the programming periods.

Communication to the system operator of all agent additions, deletions and modifications and, where appropriate, bid units, with sufficient forewarning for the correct updating of the information systems.

Definition, development and operation of the necessary computer systems to guarantee the transparency of the transactions carried out in the daily and intraday production market.

2. Functions relating to Market Activity Rules and the Contract of Adherence.

3. Functions relating to information to be provided to market participants.

Regarding the results of the matching, providing participants with the information concerning their production and purchase units.

Providing market participants with the marginal price of electricity in the daily market and in the intraday market sessions, as well as the final prices of electricity.

Guarantee the confidentiality of any confidential information made available by market participants, in accordance with applicable regulations.

4. Functions relating to information given to third parties.

Publish the aggregate supply and demand curves of the daily and intraday markets.

Publish monthly the bids submitted by the participants in each of the daily and intraday markets, three months after the end of the month to which they refer.

Publish information on market developments with the frequency required in each case.

5. Functions relating to the principles of independence, transparency and objectivity [4].

Day Ahead Market and IntraDaily Market

The daily market is the main electricity trading market on the Iberian Peninsula, and it operates 365 days a year. As in the rest of the EU, it is a marginal pricing market in which the price and trading volume in each hour are set according to the point of equilibrium between supply and demand. On a daily basis, bids for the purchase and sale of electricity are received for the next day up until 12 noon, which is the deadline for the submission of bids. These bids are then processed jointly with those submitted to APX, Nord Pool and EPEX Spot, using a European algorithm called EUPHEMIA, following which OMIE publicly announces the energy that will be produced and purchased in each one of the hours the following day. On average, the daily market in 2013 traded 71% of the energy consumed in the Iberian market.
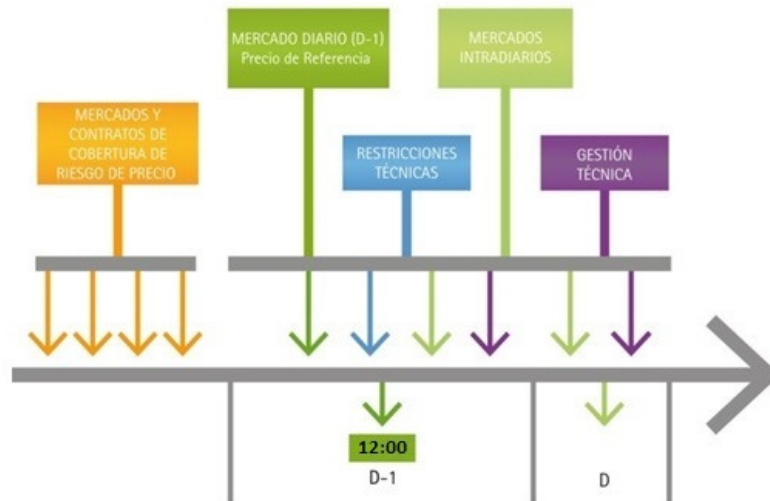
Figure 3: Daily market operation

Once the daily market has ended, and until 12:45 p.m. the following day, six adjustment markets are held (called intraday markets), which allow those buyers and sellers who so wish to submit bids for the purchase and sale of electricity in order to adjust their generation and consumption schedules to their best forecasts for their real-time needs. On average, the intraday markets in 2013 traded 16.67% of the total energy managed on the daily market.
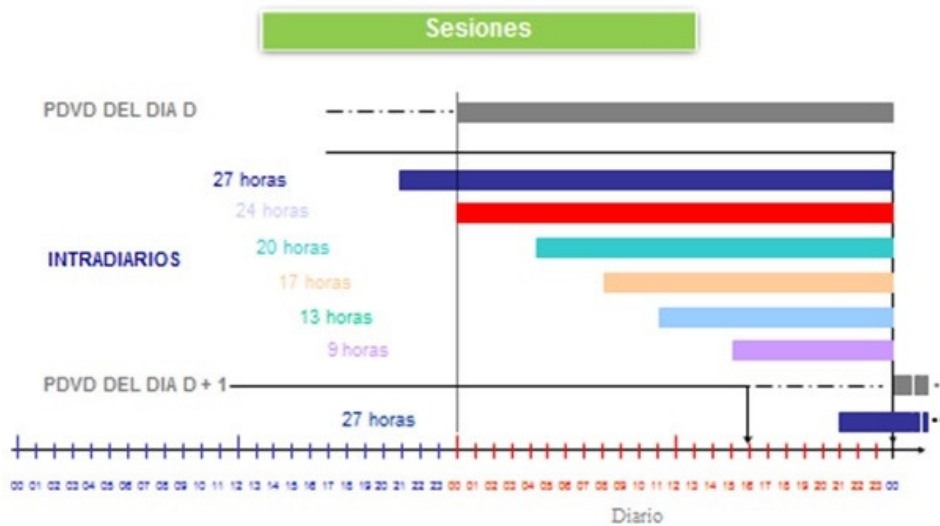
Figure 4: Intradaily sesions

Marginal Price

Sellers on the electricity power production market are obliged to comply with the Electricity Market Activity Rules by signing the corresponding contract of adherence. Bids made by these sellers are presented to the market operators and will be included in a matching procedure

All available production units that are not bound by physical bilateral contracts are obliged to present bids for the daily market.

Buyers on the electrical power market are last resort retailers, resellers, resident or no resident into Iberian Market and direct consumers. Buyers may present bids to purchase electricity on the daily market. However, in order to do so they must be registered with the Administrative Register of Distributors, Resellers and Consumers and they must abide by the Electricity Market Activity Rules. A purchasing unit is deemed to refer to a group of network connection nodes through which the buyer presents bids to purchase electricity.

Sale and purchase bids can be made considering between 1 and 25 energy blocks in each hour, with power and prices offered in each block. In the case of sales, the bid price increases with the block number; in the case of purchases, the bid price decreases with the block number.

Electricity sale bids presented by sellers to the market operator may be simple or incorporate complex conditions in terms of their content. Sellers for each hour and production unit present simple bids, indicating a price and an amount of power.

Figure 5: Marginal Price [3]

In the daily market the price in each hour will be equal to the price of the last block of the sale bid of the last production unit whose acceptance has been required in order to meet the demand that has been matched. The market operator obtains the Matching Result from this match; this represents the hourly production and demand schedule on the network established by the market operator by matching electricity sale and purchase bids and which determines the volume of electricity production required to cover electricity demand in each hour of the same day. The base daily operating schedule is obtained at 14 a.m., once the reports on the execution of all physical bilateral contracts have been obtained, together with information on production under the special regime that has not submitted bids to the market. The base operating schedule will include the following elements:

- The marginal price for each hour in the same hourly schedule.

- Electric power by block that corresponds to each production unit whose sale bid has been matched, and the electric power by blocks that corresponds to each purchase unit whose bid has been matched. The merit order that corresponds to each block of the sale bids of production units that have been totally or partially matched.

- Electric power by block that corresponds to the production unit whose sale bid has not been matched, either totally or partially, together with its merit order.

- Electric power that is programmed by available production units exempted from the obligation to present bids, such as production units subject to the special regime, as well as power executed daily under physical bilateral contracts.

Once the daily market process has concluded and the base daily operating schedule has been obtained, system operator will obtain the viable daily schedule, agreeing the withdrawal of blocks of sale or purchase bids that affect international interconnections if maximum international interconnection capacity is exceeded, and the withdrawal and/or incorporation in the base operating schedule of electricity sale bids in order to resolve the technical constraints on the Spanish and Portuguese electricity system (before 16:00 hours), without prejudice to the assignation of ancillary services

In the Intradaily market is allowed buying and selling agents to readjust their commitment (for purchasing and selling, respectively) up to four hours ahead of real time. As of that moment, there are other markets managed by the System Operator in which a balance is struck at all times between production and consumption.

The intraday market is currently structured into six sessions with the following hourly distribution per session:

	SESION 1º	SESION 2ª	SESION 3ª	SESION 4ª	SESION 5ª	SESION 6ª
Apertura de Sesión	17:00	21:00	01:00	04:00	08:00	12:00
Cierre de Sesión	18:45	21:45	01:45	04:45	08:45	12:45
Casación	19:30	22:30	02:30	05:30	09:30	13:30
Recepción de desagregaciones de programa	19:50	22:50	02:50	05:50	09:50	13:50
Publicación PHF	20:45	23:45	03:45	06:45	10:45	14:45
Horizonte de Programación (Periodos horarios)	27 horas (22-24)	24 horas (1-24)	20 horas (5-24)	17 horas (8-24)	13 horas (12-24)	9 horas (16-24)

Figure 6: Intradaily structure per session

Renewable Energy in Spain

As a small appendix to this section is convenient to put in situation the order of magnitude of renewable energy in Spain nowadays.

Note that Spain is currently one of the countries of the European Union that is trying to comply with the objectives of installed wind power capacity and complies with the guidelines applied to meet the 2020 target.

European Union set three key energy targets for 2020 [5]:

- A 20% reduction in EU greenhouse gas emissions from 1990 levels
- Raising the share of EU energy consumption produced from renewable resources to 20%
- A 20% improvement in the EU's energy efficiency

As for renewable energy we can see how the installed capacity is close to 50% of the total although talking about net generation that value decreases to 40% as shown in the following figure:
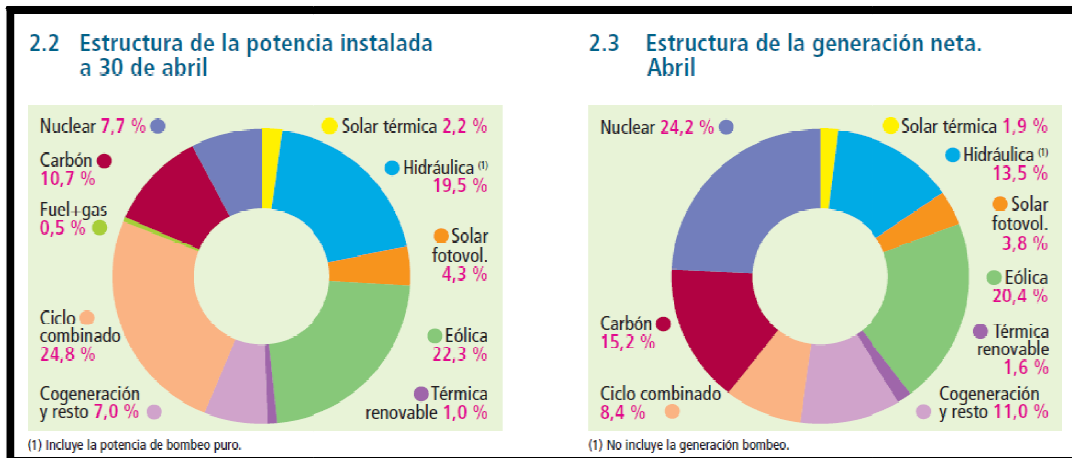
Figure 7: Capacity Installed and Net Generation [2]

2.1 Balance de energía eléctrica del sistema peninsular[1]

	Potencia[2] MW	Abril 2015 GWh	% 15/14	Acumulado anual GWh	% 15/14	Año móvil[3] GWh	% 15/14
Hidráulica	17.791	2.350	-48,7	11.202	-40,6	28.209	-24,9
Nuclear	7.866	4.906	-7,1	20.730	1,3	57.647	-0,2
Carbón	10.972	3.144	137,3	14.256	151,7	52.656	40,5
Fuel + gas	520	0	-	0	-	0	-
Ciclo combinado[4]	25.348	1.688	31,5	7.517	35,4	24.025	3,4
Consumos generación[5]		-520	22,7	-2.116	26,0	-6.998	13,0
Resto hidráulica[6]	2.109	570	-26,6	2.420	-22,4	6.367	-11,3
Eólica	22.845	3.947	-0,1	19.658	-8,2	48.864	-9,5
Solar fotovoltaica	4.428	745	-1,1	2.350	6,4	7.935	-0,2
Solar térmica	2.300	373	-14,5	1.157	15,2	5.112	8,7
Térmica renovable	1.012	312	-7,7	1.472	0,9	4.731	-1,4
Cogeneración y resto	7.075	2.121	24,0	8.655	4,7	25.986	-10,2
Generación neta		19.635	-1,9	87.301	1,1	254.535	-1,1
Consumo en bombeo		-408	-19,7	-1.910	-24,3	-4.717	-10,9
Enlace Península-Baleares[7]		-88	9,2	-411	16,1	-1.355	8,4
Saldos intercambios internacionales[8]		-304	-53,3	-1.519	13,3	-3.585	-42,4
Demanda transporte (b.c.)	102.266	18.835	0,4	83.460	1,6	244.878	0,1

Figure 8: REE Energy Balanced [2]

 It can be seen in the previous figure the balance of power in April and also the accumulated energy at the end of April.

In the following we will see how each part covers energy demand in ree makes us a comparison between the same month last year and accumulated last year and this
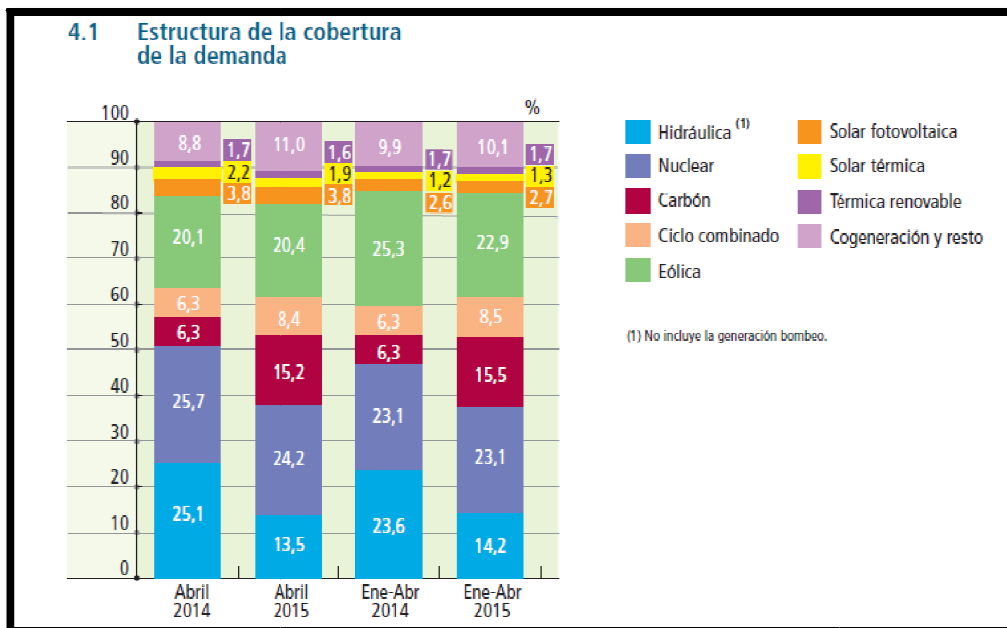
Figure 9: REE Demand Supply [2]

In order to conclude on this last figure is verified how renewable energy is structured only on their total percentage
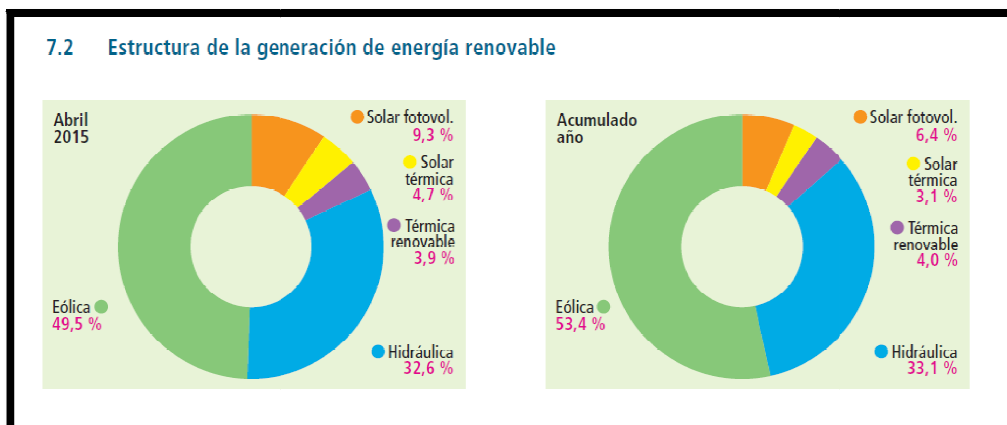
Figure 10: REE Renewable Energy Balance [2]

State of the Art

The state of art on this project has little in common with other references above. The Spanish electrical market is almost unique in the world with only another market or two in Europe that they may seem the same but not exactly.

Wind power is sold as another type of energy. Entering into competition with the other, electric energy needs to make offers in the market like any other energy, making companies have to develop specific strategies for sale.

The difference with other countries is the model in which a strategy, France, for example, wind power is sold at a fixed price in other countries income acquire production companies come framed within certain values defined by the price Daily pool plus a premium or green renewable premium depending on the country.

The main objective of the analysis of sales of wind energy shows a series of results that can be analyzed in depth highlight terms of how companies act according to certain parameters, these are used by each company to maximize profits

The tools that are available for analysis are not too ample, analyzed data however are made public 90 days later, this analysis allows the public data only three days to get an idea of how different competitors are acting , it may be established after those 90 days if the assumptions are correct.

Chapter 2
Designed Tool

The developed tool will be implemented by programming in Visual Basic language in Microsoft Excel, where the following process will take place:

1- Identify programming units and Bid units

Supply units be downloaded from the website of OMIE will give us the ratio format units present in the database market operator, including its code, proprietary information, type of unit and operating status on the market apart from the border area or zone

At this point we must filter a huge amount of agents, about 4,000 agents will be place on the agent list that is available at the website.

The way that performance will be done is first of all filtering, this part will discard the border areas between Portugal and Spain and Portugal and France and then look for wind and company.

Once we have this work done we will identify them within the market, as our work is based on analyzing the competitors, only remarkable units are selected by the interesting level of each agent for the project.

To begin identifying first of all offers of a specific day needs to be downloaded from OMIE, but as mentioned above offers will be the daily ones but after 90 days at least because if you not only have a curve devoid of names of agents who only have offers with price and amount of energy. After that P48 will be download, of the day that will be analyzed, from Red Eléctrica website.

The P48 is the operating time program is the operational program that is set by the system operator every hour until the end of the scheduling horizon and incorporates all assignments and re offices program implemented by the operator system until its publication 15 minutes before the start of each hour of the scheduling horizon.

Right now the comparison between the amount of energy which was offer by each programming unit and the P48. The relationship between bid units and programming units can be obtained. The testing process was performed not only for one day, it has been done by several days in order to found more coincidences over a period of time.

Apart from checking, the company previously had already been identified some of the names in the P48, programming units they were identified, the process in this case was just associate them to bid units. In other cases both bid unit and programming were found. The main units of supply and bid identified were as follows:

Empresa	Uprog	Uof
IBERDROLA	EFIBGES	IBGEVD1
IBERDROLA	ECUENCA	IBGEVD8
W2M	EFWMARK	WMVD088
Enel Green Power	EREGPE + EEGPE	ECYRRE1
ACCIONA	EFEGED+ EYEGED	EGEDVD2
ACCIONA	EAEGA	EGEDVD1
ACCIONA	EMEDI	EGEDVD3
Gas Natural	EFGASN	GASNVD6
Gas Natural	EPGASN	GASNPM1
AXPO	EDANTG	EGVD023
AXPO	EDENR	EGVD060
AXPO	EASURG	EGVD028
AXPO	EECLM	EGVD047
AXPO	ECARRG	EGVD114
AXPO	EPPJAR	EGVD115
AXPO	EAEREG	EGVD012
AXPO	EEBANG	EGVD016
AXPO	EECAPG	EGVD019
AXPO	EEWING	EGVD092
AXPO	ECAROG	EGVD113
ELECNOR	EGAVEG	EGVD021

Table 1: Identified Units

As it was discussed previously the identification only can be performed after 90 days of the current day, because the previous curves, the one taken before these 90 days, only present offered capacity, offered price and if it have been matched or not, is usually called him dumb curve due to the fact of skip the generator bid name.

2- Download all the remarkable variables

The starting point will be the process of download all the curves of the daily market (in this particular case we have analyzed the months of December, January, February and March, because the unavailability of full data for April) on the OMIE website.

 The process will continue with the collection of any other files that are relevant and necessary due to the tool works properly.

So we must include important information for the complete analysis such as pool price day by day for the chosen period and also the amount of energy that was provide by the bilateral contracts.

Bilateral as explained in the introduction is not directly enter the daily market. Its not necessary to introduce any bid in the system but the system will take in account the quantity that is kept for it.

Bilateral contracts can be made by any company but there is only one company, Iberdrola, which makes this bilateral contract. Is going to be consider in the calculation of their market shares and when behavior is analyzed.

3- How macro will operate

The tool generated will allow us to perform filtering and sorting offers of the different companies

The sort of classification will plot the amount of energy each hour, the bid offer price, if the bid unit was match or not. It also gives the percentage of the total energy matched and not matched. These outputs will be new Excel tabs that help in order to check just one by one.

As a resume tab market share hour by hour and by companies will be implemented in such a helpful tab that provides interesting conclusions.

Every day the behavior of each bid unit will be obtained. Why does not every company? Because the company may have different strategies for their bids unit.

The operation is made following these steps:

1- Select day and analyze the curve

Once the day is chosen macro will find the file that its necessary to open they will copy the curve of selected day and make the filter units selected offer.

Every day the selected curve covering a range of deals usually higher than 60000.Althoug adequate filtering is applied and the number is substantially reduced that amount to values close to 1500 but can be higher or lower depending on the day. Small range of real curve it can be seen on Fig.11. The filtered curve will appear in the first tab of the day file that it's created when this day analysis is running.

Pool Price will be also taken from another tab like bilateral contracts in order to continue later on an adequate analysis

Hora	Fecha	Pais	Unidad	Tipo	Energía C/V	Precio C/V	O/C
1	03/12/2014	MI	JCMCC02	C	0,6	0	O
1	03/12/2014	MI	JCMCC01	C	0,7	0	O
1	03/12/2014	MI	MONDEGB	C	180	0	O
1	03/12/2014	MI	IGESC01	C	4.053,50	0	O
1	03/12/2014	MI	VIEECA1	C	0,1	0	O
1	03/12/2014	MI	JCMRC06	C	0,9	0	O
1	03/12/2014	MI	NEXVD22	V	21,6	0	O
1	03/12/2014	MI	NEXVD07	V	50,5	0	O
1	03/12/2014	MI	NEXVD05	V	30,6	0	O
1	03/12/2014	MI	NEXVD23	V	12	0	O
1	03/12/2014	MI	NEXVD25	V	13,8	0	O

Table 2: Curve Appearance

2- Resume Tab

Data and percentages, as the number of matched and non matched blocks and the percentage of matched and non matched energy of each unit will be available on a tab, but placing one under another because is going to be a helpful hint to have a look of it.

In this following figure it's possible to appreciate for example the W2M bid unit

WMVD088							
HORA	POOL	Bloques C	Bloques O	Energia C	Energia O	% C	% NO C
1	26,21	5	7	679,9	699,9	97,14%	2,86%
2	20,79	4	6	647,8	667,8	97,01%	2,99%
3	12,6	3	6	569,9	612,7	93,01%	6,99%
4	14,27	4	6	547,7	567,7	96,48%	3,52%
5	14,05	4	6	529,4	549,4	96,36%	3,64%
6	20	4	6	509,4	529,4	96,22%	3,78%
7	28,68	5	7	504,2	524,2	96,18%	3,82%
8	50	7	7	542,3	542,3	100,00%	0,00%
9	51,64	8	8	582,6	582,6	100,00%	0,00%
10	53,1	8	8	610,2	610,2	100,00%	0,00%
11	52,29	8	8	629,6	629,6	100,00%	0,00%
12	51,59	8	8	641,4	641,4	100,00%	0,00%
13	51,09	8	8	655,2	655,2	100,00%	0,00%
14	50,59	8	8	683,3	683,3	100,00%	0,00%
15	48,99	8	9	727,7	736,7	98,78%	1,22%
16	48,5	8	9	764,3	773,3	98,84%	1,16%
17	49	8	9	802,4	815,9	98,35%	1,65%
18	51,1	8	9	872,5	902,5	96,68%	3,32%
19	55,01	8	9	859,6	889,6	96,63%	3,37%
20	58,93	9	9	866,6	866,6	100,00%	0,00%
21	54,46	8	9	808,1	838,1	96,42%	3,58%
22	52	8	9	782,6	812,6	96,31%	3,69%
23	52,29	8	9	699	711	98,31%	1,69%
24	47,1	7	9	687,8	703,8	97,73%	2,27%

Table 3: Resume Tab

3- Unit distribution per Tabs

At this point each bid unit was ordered on a tab and display the blocks matched each hour with the price at which it was matched and the amount of energy

EGEDVD1	Hora	Bloque1	Bloque2	Bloque3	Bloque4	Bloque5	Bloque6	Bloque7	Bloque8	Bloque9	Bloque10
Energía		425,1	13,9	97	451,3	238,1	39,6	126,9	107,9	7,3	85,3
Precio	1	0,7	1,5	2	4,8	5	5,5	6,5	7,5	8	9
Energía		413,9	13	72,1	425,3	221,5	40,7	119,1	98	7,6	81,8
Precio	2	0,7	1,5	2	4,8	5	5,5	6,5	7,5	8	9
Energía		407,1	11,6	52,5	406,1	205,6	40,1	111,1	88,3	7,3	79,5
Precio	3	0,7	1,5	2	4,8	5	5,5	6,5	7,5	8	9
Energía		404,8	10,8	40,8	390,2	189,8	39,1	103,4	81,9	6,9	77,3
Precio	4	0,7	1,5	2	4,8	5	5,5	6,5	7,5	8	9
Energía		405,4	10,9	34,3	378,6	176,2	38,7	100,1	77,4	7,2	50,2
Precio	5	0,7	1,5	2	4,8	5	5,5	6,5	7,5	8	9
Energía		407,7	11	32,2	379,9	165,7	38,6	100,4	76,7	7,4	47,9
Precio	6	0,7	1,5	2	4,8	5	5,5	6,5	7,5	8	9
Energía		412,5	11,3	33,4	386,1	160,2	38,3	102,7	80,6	7,4	48,3
Precio	7	0,7	1,5	2	4,8	5	5,5	6,5	7,5	8	9
Energía		418,5	11,6	35,7	390,8	163,9	38,5	105	84,6	7,5	51
Precio	8	0,7	1,5	2	4,8	5	5,5	6,5	7,5	8	9

Table 4: Offer Unit Tab

4- Market Share

Finally a table with market shares grouped by companies, compared with total wind power that was produced that day

VIENTO	HORA	Bilaterales	IBERDROLA	TOTAL	W2M	ENEL	ACCIONA	GN	AXPO	SUMA
11940	1	0,00%	23,32%	23,32%	5,69%	6,15%	18,36%	2,69%	3,59%	59,81%
10990	2	0,00%	25,36%	25,36%	5,89%	6,66%	18,98%	2,84%	3,99%	63,72%
10440	3	0,00%	26,69%	26,69%	5,46%	6,96%	19,11%	2,75%	4,28%	65,25%
10140	4	0,00%	27,41%	27,41%	5,40%	7,09%	19,00%	2,74%	4,52%	66,16%
9600	5	0,00%	28,48%	28,48%	5,51%	7,35%	19,26%	2,67%	4,90%	68,17%
9340	6	0,00%	28,62%	28,62%	5,45%	7,22%	19,69%	2,59%	5,13%	68,71%
10040	7	0,00%	26,08%	26,08%	5,02%	6,34%	18,42%	2,38%	4,92%	63,16%
10150	8	18,98%	7,25%	26,23%	5,34%	6,06%	18,37%	2,43%	4,77%	63,20%
9910	9	19,43%	7,76%	27,19%	5,88%	6,17%	19,11%	2,64%	4,77%	65,76%
9770	10	19,71%	8,19%	27,91%	6,25%	6,37%	20,25%	2,80%	4,67%	68,24%
9700	11	19,86%	9,20%	29,05%	6,49%	6,58%	21,09%	2,91%	4,64%	70,76%
10150	12	18,98%	9,77%	28,74%	6,32%	6,47%	21,40%	2,86%	4,53%	70,33%
10980	13	17,54%	10,32%	27,86%	5,97%	6,22%	20,64%	2,70%	4,32%	67,71%
11290	14	17,06%	10,67%	27,73%	6,05%	6,36%	20,50%	2,66%	4,27%	67,56%
12300	15	15,66%	10,34%	26,00%	5,92%	6,08%	18,96%	2,48%	4,00%	63,43%
12960	16	14,86%	10,19%	25,05%	5,90%	5,92%	18,60%	2,40%	3,82%	61,68%
13050	17	14,76%	9,98%	24,74%	6,15%	5,91%	18,80%	2,39%	3,71%	61,70%
13120	18	14,68%	9,74%	24,42%	6,65%	5,84%	18,84%	2,38%	3,72%	61,83%
13050	19	14,76%	9,58%	24,34%	6,59%	5,87%	18,94%	2,37%	3,58%	61,69%
13040	20	14,77%	9,71%	24,48%	6,65%	5,95%	18,84%	2,37%	3,55%	61,83%
12730	21	15,13%	9,93%	25,06%	6,35%	6,29%	19,32%	2,44%	3,75%	63,19%
12620	22	15,26%	9,92%	25,19%	6,20%	6,56%	19,38%	2,47%	3,94%	63,74%
12450	23	15,47%	9,21%	24,68%	5,61%	6,76%	19,44%	2,51%	4,07%	63,08%
12670	24	15,20%	8,18%	23,39%	5,43%	6,58%	18,90%	2,51%	3,94%	60,75%

Table 5: Market Share

Chapter 3
Daily Market Results

The daily market behavior of different programming units is more or less identical during the period under the analysis from December 2014 to March 2015, it will proceed to discuss the strategies follow by companies trying to give a clear view of behavior.

The results will be split by companies:

A- IBERDROLA

Iberdrola has two supply units, as shown in Table 1.The first IBGEVD1-EFIBGES presents a particularity is that the amount of energy is not coincident many days between the curve and the P48 offers. The explanation is, as explained in the introduction, that there is a amount of energy does not enter in the daily market auction, but is directly involved. Therefore for checking it had to be added to the amount of energy matched in a day plus the bilateral contract hour by hour of the same day and after that procedure to check with the P48.

Both units use the same strategy, make a single block each hour in which the number of MW offered in the case of IBGEVD1 the amount of MW is very high, the most likely cause is selling together almost whole wind energy available from the company.

The offer price is an instrumental price of 2.3 €, it is virtually matched in the market as the pool price rarely reaches low values

It is possible to assure that this company in the daily market has not a speculative strategy.

B- ACCIONA

Acciona is responsible for the operation of three units each one of them will have a completely different behavior.

Starting with the EGEDVD1 the normal operation of this unit is as follows:

This unit send 10 bids each hour with different prices, prices remains similar price till mid-February although there were some changes but keeping the most part of block prices like previous months

From December to first term of February → 0.7/1.5/2/4.8/5/5.5/6.5/7.5/8/9
From second Term of February to March → 0.51/2.5/4.5/5.1/5.2/5.4/6.5/7.2/8/9

In this case some of the higher priced units do have problems to be match if the pool prize is under this value at that time.

Although some of the block won't be matched it is important to say that the first offers each hour blocks are larger than the last blocks. The matching of most of the energy in the first block is assured, being the last non-disturbing quantities.

The second unit of this company EGEDVD2 always matched their block each hour in the market because is setting its energy block price equal to 0€ and in a single block, thus ensuring matching of all your energy.

Finally the third unit EGEDVD3 always generates a single bid per hour and a fixed price. That price normally was 7.04 € but some days values of the blocks change to 12.4€ but this value is kept for whole day repeated each hour.

C- ENEL GREEN POWER

The distribution of the offers in this case is the same for every hour just 4 blocks of energy of which the largest energy block is always be offered in the third position, the amount of energy in this block is above 50% of the total energy per hour that the company offer each hour

Offer prices moves in this range:

Till February   → 0/1/4/38
February to March   → 0/1/4/37.3

This unit offers a significant fact is that the first two blocks are fixed amounts of energy for a few days, let's say that is something strange as it is virtually impossible to produce the same amount of energy and always rounded to zero as sometimes happens.

In this case I think the first two blocks belong to a kind of strategy where it is introduced on the market small quantities of energy but they don't introduce until the third block the generated power that they really expected and in this case provide the benefit.

D- GAS NATURAL

Natural gas has two units with different strategies, while the first one GASNPM1 offer 1 block per hour at 0€.

GASNVD6 second unit performs a high number of bids per hour, 20 each hour and repeated every hour of the day. Handling prices rankings moves from 0 € to € 13.34 and are as follows:

20 Blocks Price → 0/ 1.1/ 1.32/ 1.36/ 1.63/ 1.7/ 1.82/ 2.03/2.56/ 2.91/ 3.19/ 3.53/ 3.59/ 4.99/ 7.94/ 8.59/ 9.34/ 9.85/ 12.36/ 13.34

The amount offered by natural gas along the daily market is distributed in 20 blocks usually commented on the daily market matched many or almost all of the bids, although some days some block is out from the market is not a remarkable value to take in account.

E- W2M (WIND TO MARKET)

W2M is not a purely company from the power sector, is part of CIMD group, which is an intermediary services consulting, management and energy.

On its website you can read that its purpose is to transfer value to each of its customers representing them in the electricity market.

Its supply unit is therefore probably the conglomerate of several wind farms, of which they are the representatives, energy sold together in a single unit.

It is probably the most difficult company to analyze and seek some sort of predefined pattern.

The name of the unit is WMVD088, to explain part of its operation say that performs several blocks per hour with various prices, most of the days repeat their first prices would block 1/5/8/9/12 / 13 €.

From that block prices changes from a range of prices without finding fixed ones varying between 20 values, some of them with peaks or more than 60 €.

The only pattern that has gotten as a conclusion is that the energy blocks of the first hours covered a percentage higher than 70% of final energy offered hourly, while the following blocks have energy values, not too consistent that can be consider as wind energy generation blocks.

Most likely it would be that every hour blocks result of speculation, we mean by this, that they would calculations would bring them a profit selling more energy than they actually have in a downstream market by buying at a cheaper price. Sell power they really do not have it.

Surely his strategy relates to the forecast of the pool price of the day, although it is not possible to make a conclusive statement, and therefore the values of the last block of the day vary its price in this large range.

F- AXPO

Axpo in Spain is part of a European subsidiary EGL, is dedicated to both the sale of electricity and gas, power management producers of special arrangements and trading of electricity, but also has some assets, as a percentage of participation in some wind farms in Spain.

From its 11 units , 8 of them made a single offer per hour with a price equal to 0€ as seen in other companies, always will be matched, two other units maintain the strategy of a block per hour but the price is 0,57 €.

The single unit which is slightly different is EGVD028 the price of the energy block is 10.1 € but keeping as in the others units one block per hour.

IntraDaily Market Results

Within the period under review some special days where the behaviour does not correspond to what we have taken as a standard.

In those days especially another analysis is done but this time also the first intradaily market, this analysis is in process of automation and some days are analyzed manually.

Intraday analyzed has been able to reach a conclusion with respect to Iberdrola as shown in the following figure:

HORA	POOL	INTRA1	DIFERENCIA	C/V	Energia	Precio	O/C	Variacion
22	51,53	51,53	0	Venta	2,7	36,07	C	-30,00%
23	53,87	54,42	0,55	Venta	7,1	37,71	C	-30,00%
24	45,87	45,87	0	Venta	19	32,11	C	-30,00%
1	43,5	40,22	-3,28	Venta	79,7	36,98	C	-14,99%
2	38,47	38,47	0	Venta	52,3	32,7	C	-15,00%
3	35	34	-1	Venta	41,5	29,75	C	-15,00%
4	30,57	30	-0,57	Venta	46,2	25,98	C	-15,01%
5	30,57	29,04	-1,53	Venta	68,4	30,57	O	0,00%
6	35,85	33	-2,85	Venta	40,4	35,85	O	0,00%
7	42,26	38,11	-4,15	Compra	7,2	42,26	C	0,00%
8	58,93	58,93	0	Compra	4,8	58,93	C	0,00%
9	60,69	60,69	0	Venta	11,2	60,69	C	0,00%
10	61,64	60,64	-1	Venta	13,4	61,64	O	0,00%

Table 6: Iberdrola intradaily Strategy

This table is only part of a bigger one, the conclusion is that the bid unit in question for the first few hours of the relevant market, the closer hours to close in which there can be another possibility of managing them again with downstream markets, makes an offer at a price 30% lower to daily market pool prize.

In the following hours that have to manage them another market offer price reduction stands at only 15%.

Other hours a day, with several intraday ahead will be offered at the same price as the pool the day in question.

Chapter 4
Variables which affect the Market

As mentioned previously, companies are still defined strategies, but also to our analysis we found that day in particular there are variations in the way of acting of each bid unit.

These variations of which we are discussing may be changes in the generation system offers, significant decrease or increase in power or discordant market shares.

The variables that we have to take in account have a relationship between them and therefore be interesting to talk about the relationship between them.

To start all know the wind energy production will depend on the wind and offers of each bid unit will be based on wind productions which will be available the day before. The dependence of meteorology in this case is a key issue.

Different programs with different forecasts which the company in question will work with, will be more reliable as you approach to the day. But as other bids offers are sent a day before, the forecast which is used is the day before, and that's the most important point. The more accurate the forecast is better in order to make a better offer and greater benefits will be obtained.
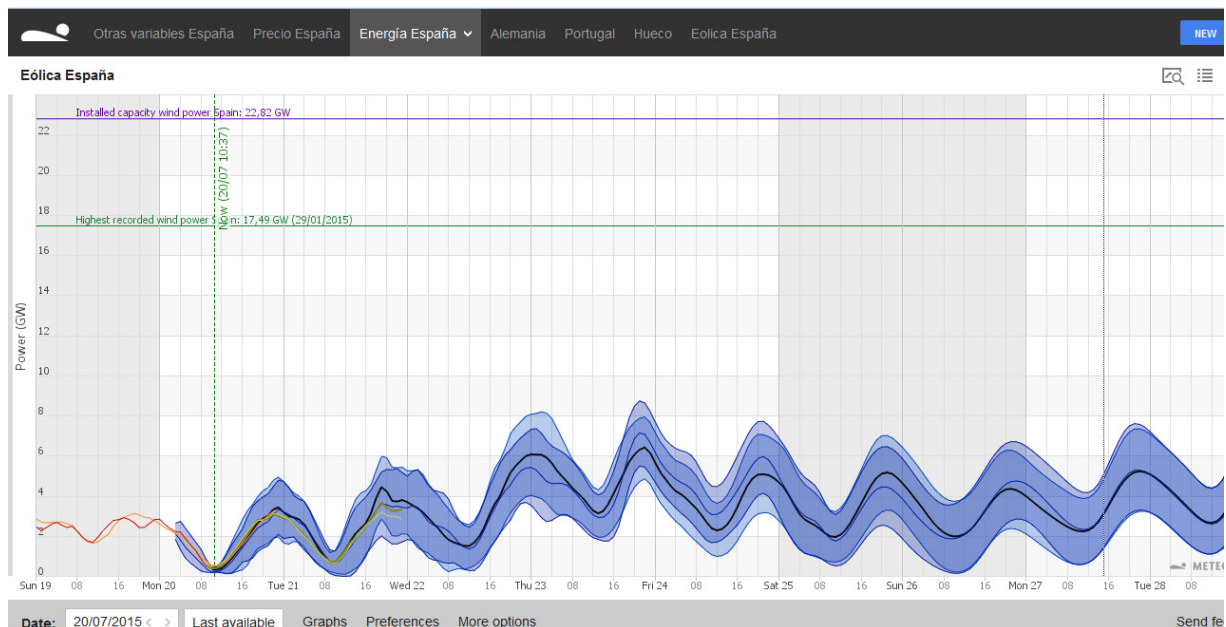

Figure 11: Wind Energy [6]

To get an idea of the variations that can be experienced, expected forecasts for each day of our test period has been downloaded. Forecast are available in the website Xtraders . The final energy generated from wind power of this day it's also available. Checking both parameters it's possible to realize how large these differences are some days.

We selected the highest and lowest values indicating when it occurred, these values are the sum total of the differences of day that may have both positive and negative differences. The table values are in Mw

MINIMOS			MAXIMOS		
jueves	29/01/2015	-32426	martes	06/01/2015	105160
domingo	11/01/2015	-31640	miércoles	07/01/2015	105076
miércoles	25/03/2015	-31526	lunes	02/02/2015	77857
sábado	06/12/2014	-29992	lunes	05/01/2015	72646
jueves	05/03/2015	-28151	jueves	08/01/2015	55250
lunes	23/02/2015	-27370	lunes	06/04/2015	52242
martes	17/02/2015	-26345	domingo	18/01/2015	48872
viernes	16/01/2015	-25745	viernes	09/01/2015	47771
jueves	01/01/2015	-24669	sábado	10/01/2015	45201
miércoles	31/12/2014	-23979	martes	07/04/2015	41561
sábado	28/02/2015	-22637	sábado	07/02/2015	37784
domingo	04/01/2015	-21918	domingo	01/02/2015	37316
sábado	14/02/2015	-21752	viernes	06/02/2015	36531
miércoles	04/03/2015	-21504	jueves	25/12/2014	28881
martes	02/12/2014	-20967	jueves	19/03/2015	23030

Table 7: Wind Variation

If it's talking about the highest variation in both sides, the maximum positive and the maximum negative in a specific hour during the period, the maximum negative one occurred on January 11st at 10:00, while the maximum positive increase over the forecast was 5th January at 23:00.

This point as mentioned have a capital importance and the following variable to analyze is closely related to this.

The second variable is the Pool price. The direct relationship that these two variables have is as follows, with high wind power generation, which is around 20% of the installed energy in Spain, energy prices will be cheaper.

This relationship between variables has many more variables that affect the final price of the pool but could make the simplification of which we speak, the other variables are those related to other plants also dependent on the weather such as solar power generation and of course the generation of hydropower.

Meteorological factors as sun, rain and wind are highly influential in generating electricity.

Therefore price variations pool as we have said will be very important. As it is seen in the strategies of some companies, specific energy blocks are offered at different prices different to 0 € and some values are even much higher.

The pool price falls have a direct impact on these units.

Also an increase in pool prices can generate speculation interests for higher profits using an easy model, first of all buying energy at a lower price and subsequent sale at a higher price when the demand increase.

In order to have an overview of how the pool price vary, the information is downloaded from Red eléctrica website, obtaining prices of the daily and intraday markets.

The aspect that will be presented after some changes made by us give this result:

Fecha	Periodo	Diario	Intradiario 1	Intradiario 2
01/12/2014	1	26,21	22,28	22,21
01/12/2014	2	20,79	17,67	14,55
01/12/2014	3	12,6	0,5	0
01/12/2014	4	14,27	0,01	0
01/12/2014	5	14,05	0,1	4,05
01/12/2014	6	20	12,01	14,98
01/12/2014	7	28,68	25	24,38
01/12/2014	8	50	45	45,33
01/12/2014	9	51,64	48	49,64
01/12/2014	10	53,1	53	53,1
01/12/2014	11	52,29	52,29	54,91
01/12/2014	12	51,59	52	55,89
01/12/2014	13	51,09	52,79	56,19
01/12/2014	14	50,59	52,29	54,89
01/12/2014	15	48,99	50	52,44
01/12/2014	16	48,5	48,5	48,5
01/12/2014	17	49	49	49
01/12/2014	18	51,1	47,2	47,69
01/12/2014	19	55,01	50,02	53
01/12/2014	20	58,93	56,93	58,71
01/12/2014	21	54,46	50,46	52,96
01/12/2014	22	52	48,01	50,22
01/12/2014	23	52,29	48,79	48,79
01/12/2014	24	47,1	42,72	42,05

Table 8: Pool Price

In the figure only they have presented the values of the daily market and the first intradaily market, but the following markets are also available

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Chapter 5
Market Share

The market shares have been the result of one of the tabs which were created by the macro. Day by day we have been checking and analysing data company by company. As a result of this analysis this table could be done.

Table will make and average of all the range of the month by companies but without the market share of EDP values, approximately values are around about 10%.

The result as described in chapter two, Figure 14, performs the following calculation:

Sum of the matched energy on the daily market, in the case of Iberdrola also bilateral contracts must be added to the other bid units of the company and then divided by the wind energy produced at that time. The results will be a percentage hour by hour of the wind power market share.

The final market share obtained is not real because it assumes only daily market analysis and no subsequent purchases and sales that can be made. Although the values are going to be close to real, because as it was quoted in the introduction, the daily market moves about 71% of total energy, an approximation of that target values are obtained.

	2014	2015			PROMEDIO
	DICIEMBRE	ENERO	FEBRERO	MARZO	
IBERDROLA	23,07%	24,31%	24,82%	22,09%	23,57%
ACCIONA	20,93%	21,11%	20,36%	23,38%	21,45%
W2M	5,76%	6,34%	7,22%	6,88%	6,55%
GAS NATURAL	2,53%	2,85%	3,02%	2,79%	2,80%
AXPO	4,39%	3,71%	3,29%	4,28%	3,92%
ENEL GREEN POWER	6,85%	7,62%	7,36%	8,03%	7,47%

Table 9: Split Market Share

The variation during the period are quite similar there isn't any big difference, that thing suggest that the calculations are done correctly.

Let's compare them with the data observed with some data from wind business association [7]. The values that they present shows a market shares for each company quite similar to data that we have obtained.

So Iberdrola values in the wind business association give a market share value of 24%, 18.6% for Acciona, Enel Green Power 6.5% and 4.3% in the case of Gas Natural.

The values are roughly coincident least in the case of Gas Natural where there is a slightly more generous difference. Possibly a bid unit of the company is not identified or natural gas might let another company is responsible for selling part of its production, reporting profits.

Some days the results of the shares yielded data that were completely inconsistent. Knowing that you are not taking into account the market share of EDP was not possible shares above 80% market, anyway other days few hours in particular the share of generation are higher than the 100% wind energy production and some peaks higher than 200%.

	23-dic-14		07-ene-15		10-mar-15	
HORA	VIENTO	SUMA	VIENTO	SUMA	VIENTO	SUMA
1	4850	54,24%	2410	46,29%	2800	57,09%
2	4980	53,64%	2010	51,80%	2620	60,62%
3	4860	53,22%	1560	58,15%	2320	64,61%
4	4490	55,54%	1120	69,39%	2080	66,17%
5	4200	55,94%	790	89,44%	1660	74,80%
6	3910	56,54%	660	102,21%	1290	87,40%
7	3590	57,59%	690	97,36%	1140	90,04%
8	3410	58,34%	890	77,21%	1050	85,79%
9	3280	59,14%	1200	58,83%	890	84,73%
10	3320	57,74%	1160	62,36%	540	126,37%
11	3270	54,74%	770	80,44%	310	193,00%
12	3070	52,68%	510	98,43%	250	238,04%
13	2940	48,91%	430	88,95%	290	203,86%
14	2750	48,48%	380	93,08%	420	152,36%
15	2440	50,54%	340	102,00%	560	127,07%
16	2070	55,77%	300	122,60%	650	126,20%
17	1760	63,27%	330	140,03%	730	131,18%
18	1670	64,76%	420	151,45%	810	122,56%
19	1680	64,61%	690	111,78%	880	120,97%
20	1460	72,82%	810	99,02%	1070	101,74%
21	1140	93,86%	860	91,03%	1030	108,39%
22	1100	99,01%	810	95,32%	1110	97,49%
23	1080	103,30%	850	96,54%	1230	89,05%
24	990	111,49%	880	103,49%	1260	88,99%

Table 10: Wrong Market Share Values

As it was quoted in the previous chapter the forecast are the main issue which makes appear this impossible parameters. Every company will made its own assumptions and at the end they offer a generation higher than the one that will be available to produce

Conclusion

This project allow us to it clearly discover several interesting aspects, perhaps more important and useful for the business term related energy sector, like the company where I am doing my internship, rather than if only the analysis is done from a fully academically point of view.

The introduction aims to place the reader in the Spanish electrical system, how it works in a simplify way. Because many aspects that are involved on the perfect operation of the system are not so simple and are most difficult of understanding. Omitting some that explanations are purely technical.

In the second part of this thesis designed tool try to extract for us the values that are optimal in order to conclude how is the trading strategy of the different companies and finally a small sample of results, probably of easier understanding.

Till the point where we could get the information of most value to the purely electric companies do not have a high development on a speculative strategy, that is currently implemented as representation companies as the company W2M.

Electrical companies are more worried about the sale of all its energy produced, trying to maximize benefits and reducing risks. They don't want to deal with Purchase and sale of energy at least in the wind sector.

Companies in the sector with a market share up to 10% are obtaining the remuneration that provides the sales of its energy blocks at pool price courage.

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Future developments

This project is ongoing, this part is the point that has been reached till today but is however not a completely finished project.

The analyzes are implemented every day trying to check the variation in the type of business strategy, that is if they have an annual, biannual or if it is a strategy that will vary month to month.

Intraday market information is a bit more complicated to get due to the number of intraday available for analysis, as it is to analyze six days but remain on the same day.

From my point of view I think that improvements can be made on this subject are important:

The main one would be the implementation of another program to analyze intradaily curves and automatize a little more the one that it's used for the daily. It would be interesting to launch for weeks or even months because all the files have been downloaded previously. This process will be the one I will try to focus for the remaining time of the internship.

A substantial improvement would also implement another software that could analyze both offers daily market and intradaily and thus obtain a complete analysis of each day. The programming of this program has several problems that have to be resolved and is not at all a simple   process.

If one could carry out this program, we provide an analysis with more variables which could be used to try to define patterns for another program could make an analysis of the 3 days ahead curve, and thus have a report data with a high percentage of probability of being correct on a much smaller margin of time.

Reference

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4. www.omie.es
5. http://ec.europa.eu/clima/policies/package/index_en.htm
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Annex

CODE

```
Sub Abrircurva()
'
' Macro4 Macro
'
' Acceso directo: CTRL+m
'
Dim i As Long
Dim j As Long
Dim fecha As String
Application.ScreenUpdating = False
    fecha = Worksheets("Macro").Cells(1, 2).value
    Sheets("Curva").Select
    With ActiveSheet.QueryTables.Add(Connection:= _
        "TEXT;                                              " _
        , Destination:=Range("$B$1"))
        .Name = "curva_pbc_uof_20141201.1"
        .FieldNames = True
        .RowNumbers = False
        .FillAdjacentFormulas = False
        .PreserveFormatting = True
        .RefreshOnFileOpen = False
        .RefreshStyle = xlInsertDeleteCells
        .SavePassword = False
        .SaveData = True
```

```
        .AdjustColumnWidth = True

        .RefreshPeriod = 0

        .TextFilePromptOnRefresh = False

        .TextFilePlatform = 932

        .TextFileStartRow = 1

        .TextFileParseType = xlDelimited

        .TextFileTextQualifier = xlTextQualifierDoubleQuote

        .TextFileConsecutiveDelimiter = False

        .TextFileTabDelimiter = True

        .TextFileSemicolonDelimiter = True

        .TextFileCommaDelimiter = False

        .TextFileSpaceDelimiter = False

        .TextFileColumnDataTypes = Array(1, 1, 1, 1, 1, 1, 1, 1, 1)

        .TextFileTrailingMinusNumbers = True

        .Refresh BackgroundQuery:=False

    End With

    Range("A4").Select

    ActiveCell.FormulaR1C1 = "=RC[1]&RC[2]&RC[3]&RC[4]&RC[5]&RC[6]&RC[7]"

    Range("A4").Select

    Selection.AutoFill Destination:=Range("A4:A100000")

Worksheets("Curva").Range("E3").Select

Selection.AutoFilter

ActiveSheet.Range("$A$3:$I$100000").AutoFilter Field:=5, Criteria1:=Array( _

    "EGEDVD2", "IBGEVD1", "IBGEVD8", "WMVD088", "ECYRRE1", "EGEDVD1",
"EGEDVD3", "GASNVD6", "GASNPM1", "EGVD023", "EGVD060", _

    "EGVD028", "EGVD047", "EGVD012", "EGVD016", "EGVD019", "EGVD092",
"EGVD113", "EGVD114", "EGVD115"), Operator:=xlFilterValues

    Range("A1:I100000").Select

    Selection.Copy
```

```vba
    Sheets.Add After:=ActiveSheet

    ActiveSheet.Paste

    ActiveSheet.Name = "Curvafiltrada"
For i = 4 To 5000

    For j = i + 1 To 5000

        If Worksheets("Curvafiltrada").Cells(i, 1).value = Worksheets("Curvafiltrada").Cells(j, 1).value Then

          If Cells(j, 9) = "O" Then

            Worksheets("Curvafiltrada").Cells(j, 10).value = "x"

            Exit For

          Else

            Worksheets("Curvafiltrada").Cells(i, 10).value = "x"

            Exit For

          End If

        End If

    Next j

  Next i
'

Range("J3").Select

Selection.AutoFilter

ActiveSheet.Range("$A$3:$J$5000").AutoFilter Field:=10, Criteria1:="="

Range("A1:I7500").Select

Selection.Copy

Sheets.Add After:=ActiveSheet

ActiveSheet.Paste

ActiveSheet.Name = "Curvafinal"

Range("E3").Select

ActiveWorkbook.Worksheets("Curvafinal").Sort.SortFields.Clear

ActiveWorkbook.Worksheets("Curvafinal").Sort.SortFields.Add Key:=Range("E3") _
```

```vba
, SortOn:=xlSortOnValues, Order:=xlAscending, DataOption:=xlSortNormal

With ActiveWorkbook.Worksheets("Curvafinal").Sort

    .SetRange Range("A4:I7500")

    .Header = xlNo

    .MatchCase = False

    .Orientation = xlTopToBottom

    .SortMethod = xlPinYin

    .Apply

    End With

Sheets("Curvafinal").Select

Sheets("Curvafinal").Copy

Range("B4").Select

Range(Selection, Selection.End(xlDown)).Select

Selection.NumberFormat = "General"

Columns("A:A").Select

Selection.Delete Shift:=xlToLeft

ActiveWorkbook.SaveAs     "███████████████████████████████
████████████████████████████████"

Windows("cuotas mercado2015.xlsm").Activate

Sheets("Curva").Select

Selection.AutoFilter

Cells.Select

Selection.ClearContents

'probar para que no pregunte

Application.DisplayAlerts = False

Sheets("Curvafiltrada").Select

ActiveWindow.SelectedSheets.Delete 'borra hoja sin preguntar

Application.DisplayAlerts = False

Sheets("Curvafinal").Select
```

```vba
ActiveWindow.SelectedSheets.Delete 'borra hoja sin preguntar

Application.DisplayAlerts = False

End Sub

Sub hojaresumen()

Dim fecha As String

Dim cont As Integer

Dim cont2 As Integer

Dim i As Integer

Application.ScreenUpdating = False

Windows("cuotas mercado2015.xlsm").Activate

fecha = Worksheets("Macro").Cells(1, 2).value

Windows("competencia_" & fecha & ".xls").Activate

Sheets("Curvafinal").Select

Sheets.Add After:=ActiveSheet

ActiveSheet.Name = "Resumen"

Windows("cuotas mercado2015.xlsm").Activate

Sheets("Pool").Select

Range("E5:G24").Select

Selection.Copy

Windows("competencia_" & fecha & ".xls").Activate

Sheets("Curvafinal").Select

Range("K3").Select

ActiveSheet.Paste

Windows("cuotas mercado2015.xlsm").Activate

Sheets("Pool").Select

Range("A4:C28").Select

Selection.Copy

Windows("competencia_" & fecha & ".xls").Activate
```

```vba
Sheets("Resumen").Select

Range("A4").Select

Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
    :=False, Transpose:=False

ActiveWindow.SmallScroll Down:=-3

Range("D4").Select

ActiveCell.FormulaR1C1 = "Bloques Casados"

Columns("D:D").EntireColumn.AutoFit

Range("E4").Select

ActiveCell.FormulaR1C1 = "Bloques Ofertados"

Columns("E:E").EntireColumn.AutoFit

Range("F4").Select

ActiveCell.FormulaR1C1 = "Energia Casada"

Columns("F:F").EntireColumn.AutoFit

Range("G4").Select

ActiveCell.FormulaR1C1 = "Energia Ofertada"

Columns("G:G").EntireColumn.AutoFit

Range("H4").Select

ActiveCell.FormulaR1C1 = "% Casada"

Columns("H:H").EntireColumn.AutoFit

Range("I4").Select

ActiveCell.FormulaR1C1 = "% Ofertada NO Casada"

Columns("I:I").EntireColumn.AutoFit

Range("J4").Select

ActiveCell.FormulaR1C1 = "% TOTAL"

Columns("J:J").EntireColumn.AutoFit

Range("D5").Select
```

```
ActiveCell.FormulaR1C1                                    =                    _
"=COUNTIFS(Curvafinal!R4C4:R2000C4,""IBGEVD1"",Curvafinal!R4C8:R2000C8,""C"",Cu
rvafinal!R4C1:R2000C1,Resumen!RC[-2])"

Range("D5").Select

Selection.AutoFill Destination:=Range("D5:D28")

Range("D5:D28").Select

Range("E5").Select

ActiveCell.FormulaR1C1 = _


"=COUNTIFS(Curvafinal!R4C4:R2000C4,""IBGEVD1"",Curvafinal!R4C1:R2000C1,Resumen
!RC[-3])"

Range("E5").Select

Selection.AutoFill Destination:=Range("E5:E28")

Range("E5:E28").Select

Range("F5").Select

ActiveCell.FormulaR1C1                                    =                    _
"=SUMIFS(Curvafinal!R4C6:R2000C6,Curvafinal!R4C4:R2000C4,""IBGEVD1"",Curvafinal!R
4C1:R2000C1,Resumen!RC[-4],Curvafinal!R4C8:R2000C8,""C"")"

Range("F5").Select

Selection.AutoFill Destination:=Range("F5:F28")

Range("F5:F28").Select

Range("G5").Select

ActiveCell.FormulaR1C1                                    =                    _
"=SUMIFS(Curvafinal!R4C6:R2000C6,Curvafinal!R4C4:R2000C4,""IBGEVD1"",Curvafinal!R
4C1:R2000C1,Resumen!RC[-5])"

Range("G5").Select

Selection.AutoFill Destination:=Range("G5:G28")

Range("G5:G28").Select

Range("H5").Select

ActiveCell.FormulaR1C1 = "=RC[-2]/RC[-1]"

Range("H5").Select
```

```
Selection.AutoFill Destination:=Range("H5:H28")

Range("H5:H28").Select

Selection.NumberFormat = "0.0%"

Range("I5").Select

ActiveCell.FormulaR1C1 = "=(RC[-2]-RC[-3])/RC[-2]"

Range("I5").Select

Selection.AutoFill Destination:=Range("I5:I28")

Range("I5:I28").Select

Selection.Style = "Percent"

Selection.NumberFormat = "0.0%"

Range("A5").Select

ActiveCell.FormulaR1C1 = "=MAX(RC[3]:R[23]C[3])"

cont = 32

For i = 6 To 24

Range("B4:C29").Select

Selection.Copy

Range("B" & cont).Select

ActiveSheet.Paste

Range("A" & i).Select

Selection.Copy

Range("A" & cont).Select

ActiveSheet.Paste

    ActiveWindow.SmallScroll Down:=-3

    Range("D" & cont).Select

    ActiveCell.FormulaR1C1 = "Bloques Casados"

    Columns("D:D").EntireColumn.AutoFit

    Range("E" & cont).Select

    ActiveCell.FormulaR1C1 = "Bloques Ofertados"
```

```vba
    Columns("E:E").EntireColumn.AutoFit

    Range("F" & cont).Select

    ActiveCell.FormulaR1C1 = "Energia Casada"

    Columns("F:F").EntireColumn.AutoFit

    Range("G" & cont).Select

    ActiveCell.FormulaR1C1 = "Energia Ofertada"

    Columns("G:G").EntireColumn.AutoFit

    Range("H" & cont).Select

    ActiveCell.FormulaR1C1 = "% Casada"

    Columns("H:H").EntireColumn.AutoFit

    Range("I" & cont).Select

    ActiveCell.FormulaR1C1 = "% Ofertada NO Casada"

    Columns("I:I").EntireColumn.AutoFit

    Range("J" & cont).Select

    ActiveCell.FormulaR1C1 = "% TOTAL"

    Columns("J:J").EntireColumn.AutoFit

cont = cont + 1

cont2 = cont + 23

    Range("D" & cont).Select

    ActiveCell.FormulaR1C1 = _

        "=COUNTIFS(Curvafinal!R4C4:R2000C4,Resumen!R"              &              i              &
"C1,Curvafinal!R4C8:R2000C8,""C"",Curvafinal!R4C1:R2000C1,Resumen!RC[-2])"

    Range("D" & cont).Select

    Selection.AutoFill Destination:=Range(Cells(cont, 4), Cells(cont2, 4))

    Range(Cells(cont, 4), Cells(cont2, 4)).Select

    Range("E" & cont).Select

    ActiveCell.FormulaR1C1 = _

        "=COUNTIFS(Curvafinal!R4C4:R2000C4,Resumen!R"              &              i              &
"C1,Curvafinal!R4C1:R2000C1,Resumen!RC[-3])"
```

```
Range("E" & cont).Select

Selection.AutoFill Destination:=Range(Cells(cont, 5), Cells(cont2, 5))

Range(Cells(cont, 5), Cells(cont2, 5)).Select

Range("F" & cont).Select

ActiveCell.FormulaR1C1 = _

    "=SUMIFS(Curvafinal!R4C6:R2000C6,Curvafinal!R4C4:R2000C4,Resumen!R" & i &
"C1,Curvafinal!R4C1:R2000C1,Resumen!RC[-4],Curvafinal!R4C8:R2000C8,""C"")"

Range("F" & cont).Select

Selection.AutoFill Destination:=Range(Cells(cont, 6), Cells(cont2, 6))

Range(Cells(cont, 6), Cells(cont2, 6)).Select

Range("G" & cont).Select

ActiveCell.FormulaR1C1 = _

    "=SUMIFS(Curvafinal!R4C6:R2000C6,Curvafinal!R4C4:R2000C4,Resumen!R" & i &
"C1,Curvafinal!R4C1:R2000C1,Resumen!RC[-5])"

Range("G" & cont).Select

Selection.AutoFill Destination:=Range(Cells(cont, 7), Cells(cont2, 7))

Range(Cells(cont, 7), Cells(cont2, 7)).Select

Range("H" & cont).Select

ActiveCell.FormulaR1C1 = "=RC[-2]/RC[-1]"

Range("H" & cont).Select

Selection.AutoFill Destination:=Range(Cells(cont, 8), Cells(cont2, 8))

Range(Cells(cont, 8), Cells(cont2, 8)).Select

Selection.NumberFormat = "0.0%"

Range("I" & cont).Select

ActiveCell.FormulaR1C1 = "=(RC[-2]-RC[-3])/RC[-2]"

Range("I" & cont).Select

Selection.AutoFill Destination:=Range(Cells(cont, 9), Cells(cont2, 9))

Range(Cells(cont, 9), Cells(cont2, 9)).Select

Selection.Style = "Percent"
```

```vba
    Selection.NumberFormat = "0.0%"
Range("A" & cont).Select
ActiveCell.FormulaR1C1 = "=MAX(RC[3]:R[23]C[3])"
cont = cont + 30
Next i
End Sub
Sub bloquesprecios()
Dim i As Integer
Dim j As Integer
Dim k As Integer
Dim fecha As String
Dim uof As String
Dim cont As Integer
Dim cont2 As Integer
Dim tam As Integer
Dim pos As Integer
Dim max As Integer
Application.ScreenUpdating = False
Windows("cuotas mercado2015.xlsm").Activate
fecha = Worksheets("Macro").Cells(1, 2).value
Windows("competencia_" & fecha & ".xls").Activate
Sheets("Resumen").Select
Sheets.Add After:=ActiveSheet
ActiveSheet.Name = "tramit"
cont = 4
For i = 3 To 22
    uof = Sheets("Curvafinal").Range("K" & i).value
    pos = Sheets("Curvafinal").Range("L" & i).value
```

```vba
max = Worksheets("Resumen").Range("A" & (pos + 1)).value

Windows("competencia_" & fecha & ".xls").Activate

Sheets("Resumen").Select

Sheets.Add After:=ActiveSheet

ActiveSheet.Name = uof

Range("A3").value = uof

Range("B3").value = "Hora"

Range("B3").Select

Selection.Font.Bold = True

Selection.Font.Underline = xlUnderlineStyleSingle

With Selection

    .HorizontalAlignment = xlCenter

    .VerticalAlignment = xlBottom

    .WrapText = False

    .Orientation = 0

    .AddIndent = False

    .IndentLevel = 0

    .ShrinkToFit = False

    .ReadingOrder = xlContext

    .MergeCells = False

End With

For k = 1 To max

 Cells(3, (3 + k - 1)) = "Bloque" & k

 Cells(3, (3 + k - 1)).Select

 Selection.Font.Bold = True

Selection.Font.Underline = xlUnderlineStyleSingle

With Selection

    .HorizontalAlignment = xlCenter
```

```
        .VerticalAlignment = xlBottom

        .WrapText = False

        .Orientation = 0

        .AddIndent = False

        .IndentLevel = 0

        .ShrinkToFit = False

        .ReadingOrder = xlContext

        .MergeCells = False

End With

Next k

Sheets("Curvafinal").Select

Range("D3").Select

Selection.AutoFilter

ActiveSheet.Range("$A$3:$H$1392").AutoFilter Field:=4, Criteria1:=uof

ActiveSheet.Range("$A$3:$H$1392").AutoFilter Field:=8, Criteria1:="C"

Worksheets("Curvafinal").Range("A1:I10000").Select

Selection.Copy

Worksheets("tramit").Select

Range("A1").Select

ActiveSheet.Paste

cont2 = 4

For j = 1 To 24

    Sheets(uof).Select

    Range("B" & cont).value = j

    Range("B" & cont).Select

    With Selection

    .HorizontalAlignment = xlCenter

    .VerticalAlignment = xlBottom
```

```vba
    .WrapText = False

    .Orientation = 0

    .AddIndent = False

    .IndentLevel = 0

    .ShrinkToFit = False

    .ReadingOrder = xlContext

    .MergeCells = False

    End With

    Range("A" & cont).value = "Energía"

    Range("A" & cont).Select

    Selection.Font.Bold = True

With Selection

    .HorizontalAlignment = xlCenter

    .VerticalAlignment = xlBottom

    .WrapText = False

    .Orientation = 0

    .AddIndent = False

    .IndentLevel = 0

    .ShrinkToFit = False

    .ReadingOrder = xlContext

    .MergeCells = False

End With

Range("A" & (cont + 1)).value = "Precio"

    Range("A" & (cont + 1)).Select

    Selection.Font.Bold = True

With Selection

    .HorizontalAlignment = xlCenter

    .VerticalAlignment = xlBottom
```

```vba
        .WrapText = False

        .Orientation = 0

        .AddIndent = False

        .IndentLevel = 0

        .ShrinkToFit = False

        .ReadingOrder = xlContext

        .MergeCells = False

    End With

        tam = Sheets("Resumen").Range("D" & (pos + j)).value

        Sheets("tramit").Select

        Range(Cells(cont2, 6), Cells((cont2 + tam - 1), 7)).Select

        Selection.Copy

        Sheets(uof).Select

        Range("C" & cont).Select

        Selection.PasteSpecial Paste:=xlPasteAll, Operation:=xlNone, SkipBlanks:= _

        False, Transpose:=True

        cont = cont + 3

        cont2 = cont2 + tam

    Next j

    Sheets("Curvafinal").Select

    Range("D3").Select

    Selection.AutoFilter

    Sheets("tramit").Select

    Cells.Select

    Selection.ClearContents

    cont = 4

Next i

Application.DisplayAlerts = False
```

```vba
Sheets("tramit").Select

ActiveWindow.SelectedSheets.Delete 'borra hoja sin preguntar

End Sub

Sub cuotasmercado()

Dim fecha As String

Dim i As Integer

Dim emp As String

Dim j, k1, k2 As Integer

Dim text As String

Dim texto1 As String

Application.ScreenUpdating = False

Windows("cuotas mercado2015.xlsm").Activate

fecha = Worksheets("Macro").Cells(1, 2).value

text = "competencia_" & fecha & ".xls"

Windows(text).Activate

Sheets("Resumen").Select

Sheets.Add After:=ActiveSheet

ActiveSheet.Name = "Cuotas_mercado"

'Pegar las horas

Sheets("Resumen").Select

Range("B4:B28").Select

Selection.Copy

Sheets("Cuotas_mercado").Select

Range("B4").Select

ActiveSheet.Paste

'Pegar viento

Windows("cuotas mercado2015.xlsm").Activate

Sheets("Pool").Select
```

```vb
Range("D4:D28").Select

Selection.Copy

Windows(text).Activate

Sheets("Cuotas_mercado").Select

Range("A4").Select

Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
    :=False, Transpose:=False

'Poner las empresas en horizontal

Windows(text).Activate

Sheets("Curvafinal").Select

Range("M3:M8").Select

Selection.Copy

Sheets("Cuotas_mercado").Select

Range("D4").Select

Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
    :=False, Transpose:=True

'For i = 3 To 8
'   emp = Worksheets("Curvafinal").Cells(i, 13).value
'   Sheets("Cuotas de mercado").Select
'   Cells(i, 4).value = emp
'Next i

For j = 1 To 24

k1 = j + 4

k2 = j + 32

Worksheets("Cuotas_mercado").Cells(j + 4, 4).Select

ActiveCell.FormulaR1C1 = _
  "=(Resumen!R" & k1 & "C6+Resumen!R" & k2 & "C6)/Cuotas_mercado!R" & k1 & "C1"

Next j
```

```vba
' texto1 = "=(Resumen!R[" & k & ")]C[6]+Resumen!R[" & 32 + j & ")]C[6])/Cuotas_mercado!R[" & k & ")]C[1]"

' Resumen!RC[3]+Resumen!R[28]C[3])/Cuotas_mercado!RC[-2]

Windows("cuotas mercado2015.xlsm").Activate

Sheets("Bilaterales").Select

Range("B1:B25").Select

Selection.Copy

Windows(text).Activate

Sheets("Cuotas_mercado").Select

Range("M4").Select

Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
    :=False, Transpose:=False

 Range("M4").Select

   Selection.Copy

   Range("C4").Select

   ActiveSheet.Paste

For j = 1 To 24

k1 = j + 4

Worksheets("Cuotas_mercado").Cells(j + 4, 3).Select

ActiveCell.FormulaR1C1 = "=Cuotas_mercado!R" & k1 & "C13/Cuotas_mercado!R" & k1 & "C1"

Next j

For j = 1 To 24

k1 = j + 4

k2 = j + 63

Worksheets("Cuotas_mercado").Cells(j + 4, 5).Select

ActiveCell.FormulaR1C1 = "=(Resumen!R" & k2 & "C6)/Cuotas_mercado!R" & k1 & "C1"

Next j

For j = 1 To 24
```

k1 = j + 4

k2 = j + 94

Worksheets("Cuotas_mercado").Cells(j + 4, 6).Select

ActiveCell.FormulaR1C1 = "=(Resumen!R" & k2 & "C6)/Cuotas_mercado!R" & k1 & "C1"

Next j

For j = 1 To 24

k1 = j + 4

k2 = j + 125

k3 = j + 156

k4 = j + 187

Worksheets("Cuotas_mercado").Cells(j + 4, 7).Select

ActiveCell.FormulaR1C1 = "=((Resumen!R" & k2 & "C6)+(Resumen!R" & k3 & "C6)+(Resumen!R" & k4 & "C6))/Cuotas_mercado!R" & k1 & "C1"

Next j

For j = 1 To 24

k1 = j + 4

k2 = j + 218

k3 = j + 249

Worksheets("Cuotas_mercado").Cells(j + 4, 8).Select

ActiveCell.FormulaR1C1 = "=((Resumen!R" & k2 & "C6)+(Resumen!R" & k3 & "C6))/Cuotas_mercado!R" & k1 & "C1"

Next j

For j = 1 To 24

k1 = j + 4

k2 = j + 311

k3 = j + 342

k4 = j + 373

k5 = j + 404

```vba
k6 = j + 435

k7 = j + 466

k8 = j + 497

k9 = j + 528

k10 = j + 559

k11 = j + 590

Worksheets("Cuotas_mercado").Cells(j + 4, 9).Select

ActiveCell.FormulaR1C1 = "=((Resumen!R" & k2 & "C6)+(Resumen!R" & k3 &
"C6)+(Resumen!R" & k4 & "C6)+(Resumen!R" & k5 & "C6)+(Resumen!R" & k6 &
"C6)+(Resumen!R" & k7 & "C6)+(Resumen!R" & k8 & "C6)+(Resumen!R" & k9 &
"C6)+(Resumen!R" & k10 & "C6)+(Resumen!R" & k11 & "C6))/Cuotas_mercado!R" & k1 &
"C1"

Next j

Columns("C:J").Select

  Range("C2").Activate

  Selection.NumberFormat = "0.00%"

 Columns("M:M").Select

  Selection.EntireColumn.Hidden = True

  Range("E4:I28").Select

  Selection.Cut Destination:=Range("F4:J28")

  Range("F4:J28").Select

  ActiveWindow.SmallScroll Down:=-15

  Range("E4").Select

  ActiveCell.FormulaR1C1 = "IBERDROLA TOTAL"

  Range("K4").Select

  Selection.NumberFormat = "0.00%"

  ActiveCell.FormulaR1C1 = "SUMA"

  Range("E5").Select

  ActiveCell.FormulaR1C1 = "=RC[-2]+RC[-1]"

  Range("E5").Select
```

```
Selection.AutoFill Destination:=Range("E5:E28"), Type:=xlFillDefault

Range("E5:E28").Select

ActiveWindow.SmallScroll Down:=-18

Range("K5").Select

ActiveCell.FormulaR1C1 = "=SUM(RC[-6]:RC[-1])"

Range("K5").Select

Selection.AutoFill Destination:=Range("K5:K28"), Type:=xlFillDefault

Range("K5:K28").Select

ActiveWindow.SmallScroll Down:=-12

Range("A4:K28").Select

ActiveWindow.SmallScroll Down:=-15

With Selection

    .HorizontalAlignment = xlCenter

    .VerticalAlignment = xlBottom

    .WrapText = False

    .Orientation = 0

    .AddIndent = False

    .IndentLevel = 0

    .ShrinkToFit = False

    .ReadingOrder = xlContext

    .MergeCells = False

End With

Range("A4:K4").Select

Selection.Font.Bold = True

Columns("C:C").EntireColumn.AutoFit

Range("B5:B28").Select

Selection.Font.Bold = True

Columns("E:E").EntireColumn.AutoFit
```

```
Range("G4").Select

ActiveWindow.SmallScroll Down:=-9

Columns("G:G").EntireColumn.AutoFit

ActiveWindow.SmallScroll Down:=0

Columns("I:I").EntireColumn.AutoFit

ActiveWindow.SmallScroll Down:=-18

Range("K4:K28").Select

ActiveWindow.SmallScroll Down:=-18

Range("K4:K28").Select

Selection.Borders(xlDiagonalDown).LineStyle = xlNone

Selection.Borders(xlDiagonalUp).LineStyle = xlNone

With Selection.Borders(xlEdgeLeft)

    .LineStyle = xlContinuous

    .ColorIndex = 0

    .TintAndShade = 0

    .Weight = xlMedium

End With

With Selection.Borders(xlEdgeTop)

    .LineStyle = xlContinuous

    .ColorIndex = 0

    .TintAndShade = 0

    .Weight = xlMedium

End With

With Selection.Borders(xlEdgeBottom)

    .LineStyle = xlContinuous

    .ColorIndex = 0

    .TintAndShade = 0

    .Weight = xlMedium
```

```
End With

With Selection.Borders(xlEdgeRight)

    .LineStyle = xlContinuous

    .ColorIndex = 0

    .TintAndShade = 0

    .Weight = xlMedium

End With

Selection.Borders(xlInsideVertical).LineStyle = xlNone

Selection.Borders(xlInsideHorizontal).LineStyle = xlNone

Range("L4").Select

End Sub
```