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aee
Spanish Wind Energy Association

Wind Power 2008

Sector's Yearbook: Analysis and Data

Sponsored by the Spanish Institute of Foreign Commerce (ICEX)

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3rd PART: THE ASSOCIATION

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Letter from the President

A pillar in the electrical system, a solid industrial sector

What surprises the most those that approach the Wind Power's world for the first time, is not the size and the technical characteristics of our wind turbines – as spectacular as they may be – nor their power capacity, able to provide energy to entire populations. No, the person that further gets into the everyday life of this sector in Spain, discovers that, behind the wind turbines that shape the skyline in many places, there is a basic pillar of our electrical system and, above all, a solid industry that competes at the forefront in the main world markets as few other sectors of our economy do.

When last January the **Wind Power Observatory of the Spanish Wind Energy Association** reported the spectacular growth of the Wind-Power capacity in our country, with 3,522 new MW installed – the second largest growth in the world – we also pointed out that 2007 had been the year in which Spanish Wind Power enterprises consolidated their world leadership, with an important machinery and spare parts exports volume and a sweeping presence of our promoters in the five continents.

Wind Power is a basic pillar in our electrical system, not only because it produced a 9.5 % of the generation last year – which will be close to an 11% at the end of the year –, or because it is the third technology in installed capacity, but because it grants, like no other, a growing and predictable yearly contribution, very significant, to the whole of the generation. Wind Power is not present every day with the same capacity in our electrical generation mix, indeed, but it is the technology that brings most security to the yearly total by not depending on external factors, nor the fossil fuels prices, the supply, the rain, nor the breakdowns that disconnect simultaneously hundreds of megawatts.

The important common effort made in these last years by the System Operator and the Wind Power sector, canalized through this association, has also allowed an integration in the grid of the Wind Power generation that is a model in the world, by its volume, as well as by the special characteristics of our electrical system, almost an island due to the scarce interconnection capacity with our neighbours, specially with France. Many working groups have been formed, a verification procedure of the turbines' adaptation to withstand voltage dips has been set up, control centres have been established and above all, a relationship in which the basic pre-requirement is the understanding of the needs and mutual preoccupations has been consolidated.

The industry

But as important as the size of Wind Power in the energy field or its contribution to the fight against climate change avoiding the emission of over 18 million tons CO_2 last year, it is also its positive impact in the Spanish economy, both in job creation, with 46,000 jobs up to date, and in the creation of industrial centres all over the country, as well as its distinguished contribution to the balance of payments with exports over 2,500 million Euros and the saving of over 1 billion in fossil fuels imports.

If Spain occupies the third place in the world ranking in terms of installed power capacity behind countries like Germany or the USA, the Spanish enterprises earned without a doubt the first place in industrial terms, since promoters or manufacturers and auxiliary firms are the most dynamic in the key growing markets. It is Spanish enterprises that promote new Wind Farms in the United States and Canada, in China and in Chile, in Australia, and of course, in almost all of the European countries and it is our turbines and other components made in our country that daily cross the Atlantic Ocean and seek new seas, to the point that in some countries they speak about a new race of Spanish conquerors. It is, furthermore, a sector that invests in R&D, development and innovation above the average for our national industry.

All these arguments and others telling of the positive returns of our activity for society, our challenges and projects, are gathered in the pages of this yearly report of the **Spanish Wind Energy Association**, that has already become an unavoidable reference for those who work in this field, and an invaluable guide for those who first approach Wind Power that, as it has been noted here, is at the same time a basic pillar of our electrical system and a solid industrial sector.

José Donoso
President
Spanish Wind Energy Association

Chapter I

WIND POWER IN SPAIN

Spain counts, since January 1 2008 with over 15,000 MW of wind power, which puts this technology in 3rd place, behind combined cycle and hydro power in installed capacity. Wind power is a key piece in the Spanish electric system, an energy for the present but with a trajectory for the future. 15,145MW already operating, according to the data of the Spanish Wind Energy Association's Wind Power Observatory, prove that renewable energies are part of our energetic landscape. With a registered growth of 3,522 new MW installed, an important step has been taken to reach the objective set in the Renewable Energies Plan 2005-2010, of 20,155 MW in 2010, and ratifies the viability of AEE's own goal for 2020: 40,000 MW of installed capacity, to meet the objectives of the European Union in 2020 with a 20 percent of final energy consumption.

It is worth mentioning as well, that in 2007, wind power covered almost 10 percent of demand and was the fourth technology in the system over large-scale hydropower. WTG production was over 27,000 GWh. In several occasions it covered over 30 percent of the demand, and during several days it brought over 20 percent. In the months elapsed in 2008 until the publication of this yearbook, there has been a generation record, overcoming widely 10,000 MW of wind power working simultaneously and also the maximal production for a day, reaching 2nd place in the ranking during 24 hours. All these historical maximums have been reached without incident, which shows that the joint work with the system operator that AEE has developed in the last years **allows for a perfect integration of wind power in the system.**

On the socioeconomic side, the incidence of wind power on employment is to be noted. Over **45,000 jobs have been created** with a job to MW produced ratio higher than the rest of technologies by a factor of five, according to studies from the Comisiones Obreras union. On the other side, the Spanish Wind Energy has a world leadership not just by being on the third place in the ranking of installed capacity, but also by the leading role of promoters, manufacturers, engineering companies and other firms in the main world markets exporting knowledge, experience and the Spanish Wind power sector's commitment with the future of this technology.

In our current world, in which both, environmental and strategic issues put energy in the heart of all policies, the bet for a technology that generates electricity in a cleaner, local way, that does not produce residuals, or greenhouse effect gasses is an unavoidable need and at the same time, a great opportunity for Spain.

I.1 Installed Capacity

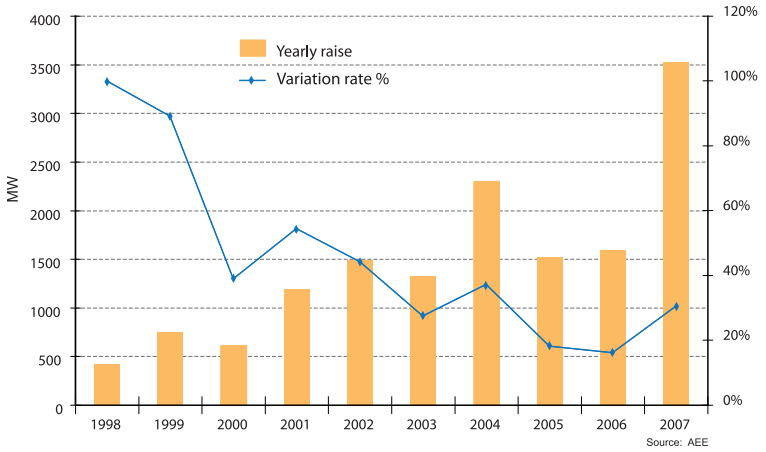
Installed capacity in 2007

Wind Power capacity installed in Spain in 2007, 3,522 MW (see figure I.01 and I.02) implies a 221% raise with regards to the previous year and sites in 15,145 MW the total capacity, 30% more than in 2006. As it can be appreciated in figure I.01, the variation rate is similar to the one achieved in 2004, until now the year of highest growth in Spain.

It is also worth mentioning that the growth of wind power in 2007 has been the second in the world market behind the USA (5,244 installed MW) and practically twice as big as Germany (aprox. 1,600 new MW) a country, that however, remains leader in the ranking of installed power, with over 22,000 MW.

The growth of this year means as well, a strong impulse to meet the Renewable Energies plan 2005-2010, approved by the government in 2005, that sets an objective to the industry to reach 20,155 MW installed by the end of such period (see figure I.03). With the 3,522 MW installed in 2007, previsions in the PER are overrun, and it will suffice to install 1,700 MW per year to achieve that goal, a pace of growth that the sector considers within reach.

Figure I. 01
Annual raise of installed wind power capacity and percentage variation. 1998-2007



The sector considers within reach the objective of 20,155 MW for 2010

Figure I. 02
Yearly evolution of installed wind power capacity. 1997-2007

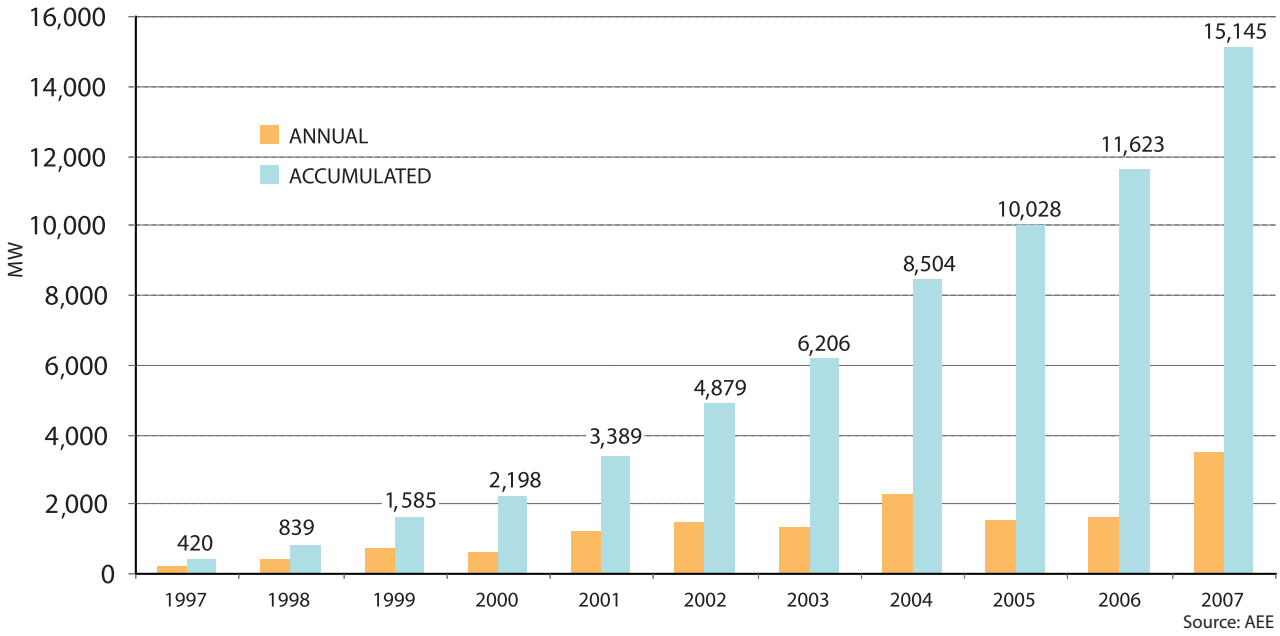
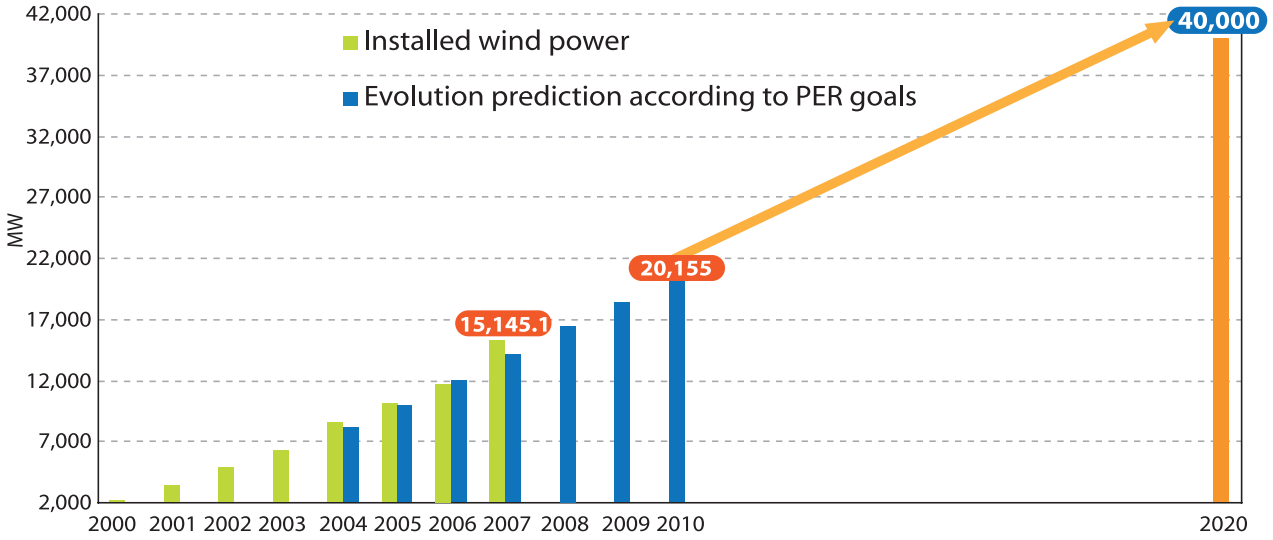


Figure I. 03

Yearly evolution of installed wind power, prediction from PER and expected for 2020



Source: PER 2005-2010 and AEE

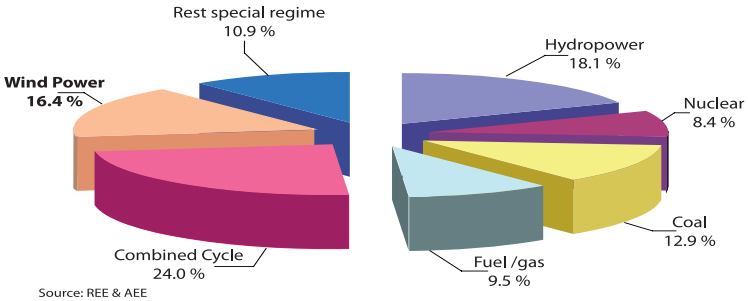
Counting the new installed capacity in Spain in 2007 there is a total of 16,103 turbines distributed in 672 wind farms. The average size of a wind farm installed in 2007 was of 26.4 MW.

Third technology in the electric system

The installed capacity nationwide rose up at the end of 2007 (see Figure I.04) to over 92,000 MW with an increase of over 10 % from 2006, which ended in 82,336 MW. Combined cycle and wind power are the technologies that have contributed the most to this increase, with a rate of 35%, and 30% respectively (see Figure I.05). With the 15,145 MW of wind power installed nationwide, **wind power is in the third position when it comes to installed capacity** with 16.4% of the total in the national electrical system, overtaking coal power.

Figure I. 04

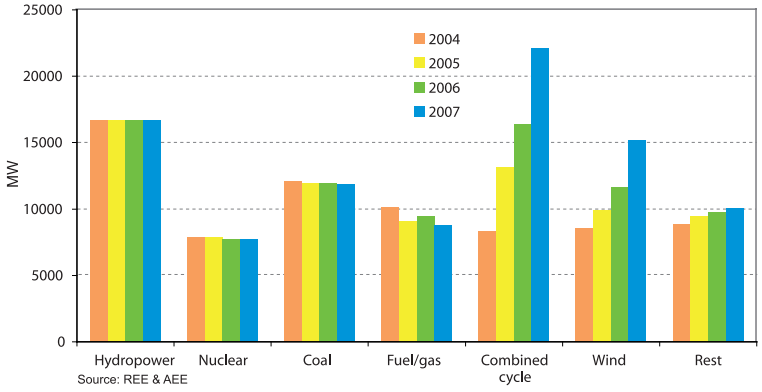
Share of power capacity by technology. National total



Source: REE & AEE

Figure I. 05

Evolution of installed capacity by technology. 2004 - 2007



Source: REE & AEE

Wind power raises as well its presence in the mix of renewable energies, in which it already produces 84.29%, followed by far by small hydropower with 10.52 %, biomass, with 2.89 and solar, with 2.30% (See figures I.06 and I.07)

Spanish Regions

It is worth mentioning in the first place, that wind power is present in 15 out of 17 regions, since in the past year the first wind farms were inaugurated in **Cantabria**, until then one of the three that did not had turbines on its territory, along with **Madrid** and **Extremadura**. That last region has initiated authorization processes of Wind Farms that could be inaugurated in 2009, while the region of Madrid has not, at the present moment, intention of authorizing any of the proposed projects. In absolute terms, **Andalucía**, and **Castilla-La Mancha**, are the regions that have installed more capacity in 2007, with 853.15 and 849.9 MW, respectively (See table I.1). In the case of Castilla-La Mancha this increase helps to achieve national leadership by regions, with 3,131.36 MW, and a 37.25% growth, overtaking **Galicia**, which installed capacity is of 2,951.69 MW and a 12.68% growth rate, followed by **Castilla y León** with 2,818.67 MW and an increase of 32.77%.

In percentage terms, the most important increase is the one in Andalucía, with 140.65%, reaching 1,459.71 installed MW, which involves overtaking Navarra, 937.36 MW (an increase of 2.29%) and becoming the fifth region in that ranking, behind **Aragón**, that now counts with 1,723.54 MW (a raise of 12.47%) and **Murcia**, with a 124.91% growth rate, and 152.31MW working.

Figure I. 06
Share of installed capacity of renewable energies . 2007

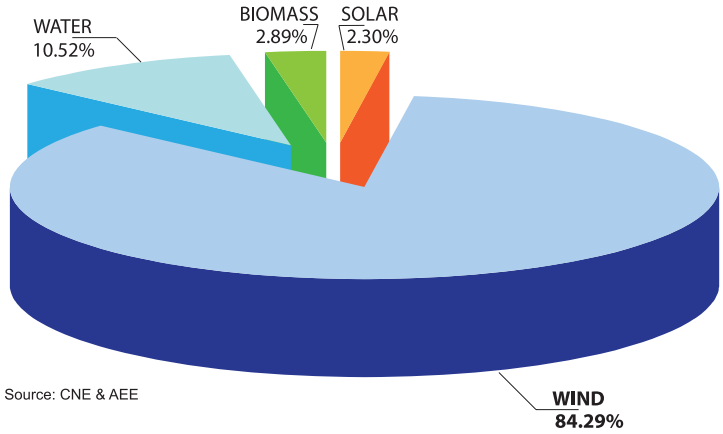


Figure I. 07
Yearly evolution of the installed capacity for renewable energies. 1990-2007

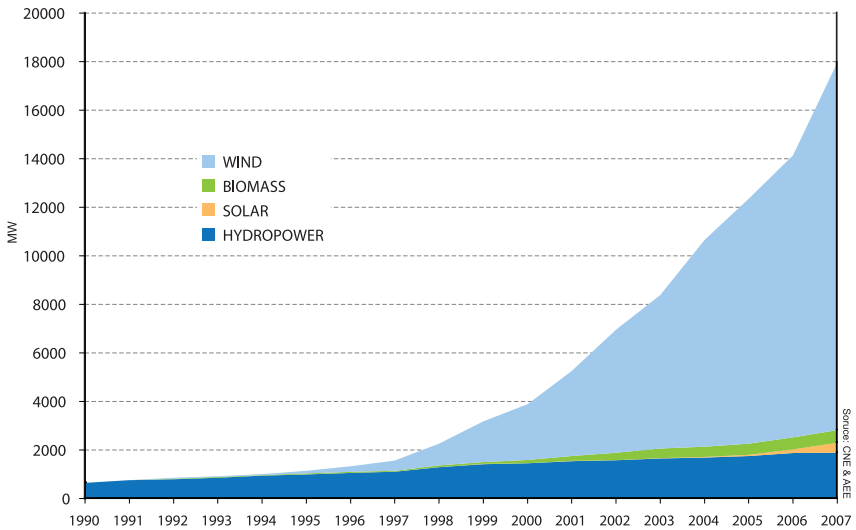


Table I. 01
Installed Capacity by region. 2007

REGION	TOTAL at 01/01/2007*	In 2007	TOTAL at 01/01/2008 (MW)	Growth 2007/2006	Nr Wind Farms
Castilla-La Mancha	2,281.46	849.90	3,131.36	37.25%	99
Galicia	2,619.64	332.05	2,951.69	12.68%	130
Castilla y León	2,122.91	695.76	2,818.67	32.77%	130
Aragón	1,532.44	191.10	1,723.54	12.47%	73
Andalucía	606.56	853.15	1,459.71	140.65%	75
Navarra	916.36	21.00	937.36	2.29%	40
Comunidad Valenciana	333.99	256.95	590.94	76.93%	17
La Rioja	436.62	10.00	446.62	2.29%	14
Cataluña	225.30	122.14	347.44	54.21%	15
Asturias	198.86	79.10	277.96	39.78%	11
País Vasco	144.27	8.50	152.77	5.89%	7
Murcia	67.72	84.59	152.31	124.91%	10
Canarias	133.24	0	133.24	0.00%	47
Cantabria	0.00	17.85	17.85		1
Baleares	3.65	0	3.65	0.00%	3
TOTAL	**11,623.01**	**3,522.09**	**15,145.10**	**30.3%**	**672**

*Errors corrected

Source: AEE

By province, (see table I.02) **Albacete** is the first one, featuring 1,667 MW, followed by **Zaragoza**, with 1,280 MW and **Lugo**, with 1,052 (to which we have to add another 100MW of the 205 she shares with bordering provinces). The following provinces in the ranking of most installed capacity are **La Coruña** with 967MW, Cádiz with 818 MW and **Burgos** with 807 MW.

Figure I. 08
Installed Capacity by region 2004-2007

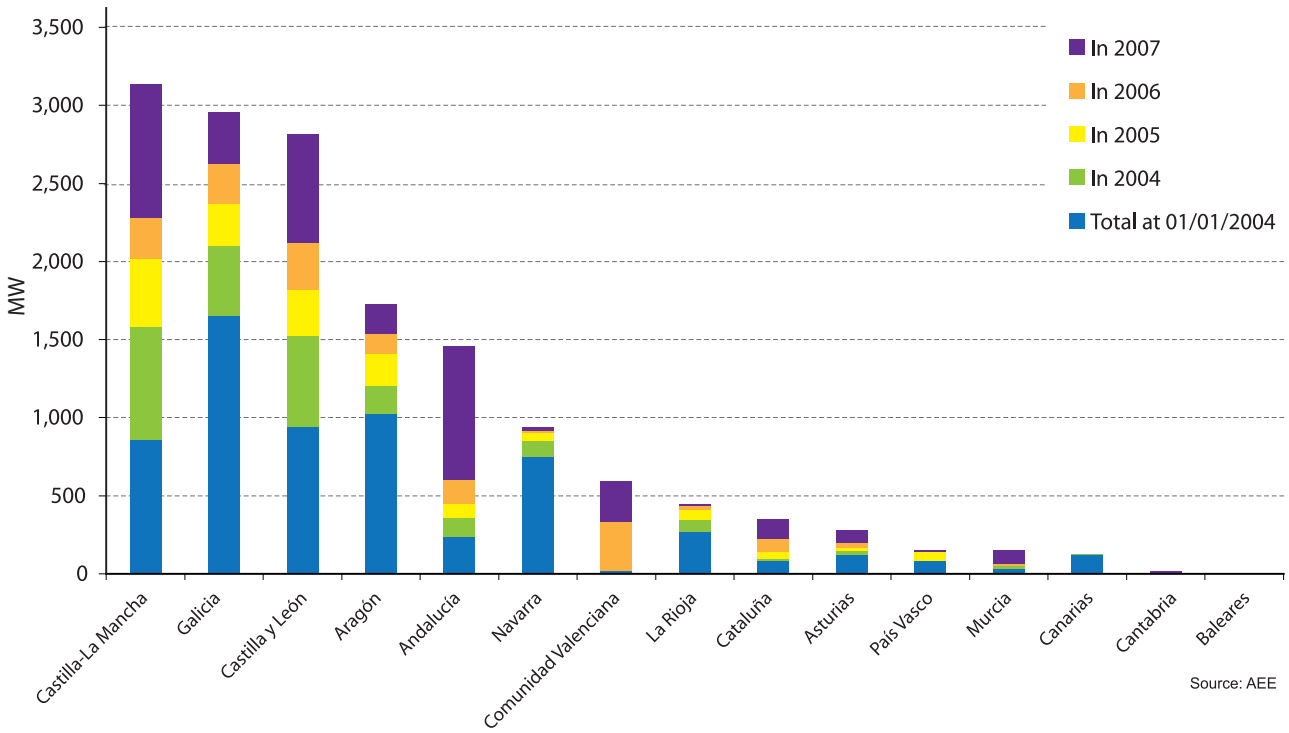


Table I. 02 Installed power by province

Wind power installed capacity and number of wind farms by province at 01/01/2008

REGION	PROVINCE	ACCUMULATED END 2007 (MW)	TOTAL FARMS 2007
Andalucía	Almería	191.2	7
	Cádiz	818.73	49
	Granada	309.3	10
	Huelva	44.2	3
	Jaén	15.18	1
	Málaga	52.6	4
	Sevilla	28.5	1
TOTAL ANDALUCÍA		1459.7	75
Aragón	Huesca	279.15	8
	Teruel	163.5	7
	Zaragoza	1280.885	58
TOTAL ARAGÓN		1723.5	73
Asturias	Asturias	277.96	11
TOTAL ASTURIAS		278.0	11
Baleares	Baleares	3.65	3
TOTAL BALEARES		3.7	3
Canarias	El Hierro	0.1	1
	Fuerteventura	11.605	3
	Gran Canaria	70.49	28
	La Gomera	0.36	1
	La Palma	9.93	5
	Lanzarote	8.775	2
	Tenerife	31.98	7
TOTAL CANARIAS		133.2	47
Cantabria	Cantabria	17.90	1
TOTAL CANTABRIA		17.90	1
Castilla-La Mancha	Albacete	1687.16	52
	Ciudad Real	202	5
	Cuenca	754.1	18
	Guadalajara	404.6	17
	Toledo	83.5	7
TOTAL CASTILLA-LA MANCHA		3131.4	99
Castilla y León	Ávila	132.13	9
	Burgos	807.38	40
	Burgos - Palencia	8.8	1
	León	208.15	9
	Palencia	390	18
	Salamanca	31.45	1
	Segovia	48.52	2
	Segovia - Soria	27.2	1
	Soria	712.13	27
	Valladolid	94	2
	Zamora	358.91	20
TOTAL CASTILLA Y LEÓN		2818.7	130
Cataluña	Barcelona	75	2
	Lleida	40.5	1
	Tarragona	231.94	12
TOTAL CATALUÑA		347.4	15
Comunidad Valenciana	Valencia	20.5	3
	Castellón	570.5	14
TOTAL COMUNIDAD VALENCIANA		590.9	17
Galicia	La Coruña	967.135	53
	La Coruña - Lugo	163.62	6
	Lugo	1052.97	42
	Lugo - Pontevedra	43.83	2
	Ourense	199.87	10
	Ourense - Pontevedra	176.2	5
	Pontevedra	348.06	13
TOTAL GALICIA		2951.7	131
La Rioja	Logroño	446.62	14
TOTAL LA RIOJA		446.6	14
Murcia	Murcia	152.31	10
TOTAL MURCIA		152.3	10
Navarra	Navarra	937.36	40
TOTAL NAVARRA		937.4	40
País Vasco	Álava	81.8	2
	Guipúzcoa	26.97	2
	Vizcaya	44	3
TOTAL PAIS VASCO		152.8	7
TOTAL GENERAL		**15,145.1**	**673**

NOTA: The number of wind farms includes upgradings and experimental wind farms

Source: AEE

PROMOTERS	TOTAL AT 01/01/2007	In 2007	TOTAL AT 01/01/2008	Growth 2007/2006	% at total
IBERDROLA	3567.7	677.2	4244.9	18.98%	28.0%
ACCIONA	2042.2	636.1	2678.3	31.14%	17.7%
ECYR	919.6	347.0	1266.5	37.73%	8.4%
NEO ENERGÍA	775.7	447.3	1223.0	57.66%	8.1%
ENEL UNIÓN FENOSA RENOVABLES	396.8	198.1	594.9	49.93%	3.9%
OLIVENTO	271.8	150.0	421.8	55.19%	2.8%
GAS NATURAL	365.5	17.3	382.8	4.74%	2.5%
ENERFÍN	332.8	0.0	332.8	0.00%	2.2%
EYRA	250.0	12.6	262.6	5.03%	1.7%
MOLINOS DEL EBRO	211.5	23.7	235.2	11.19%	1.6%
EON Renovables	203.9	0.0	203.9	0.00%	1.3%
OTROS	2285.5	1013.0	3298.4	44.32%	21.8%
TOTAL	**11,623.01**	**3,522.09**	**15,145.10**	**30.3%**	**100.0%**

Source: AEE

Table I. 03
Installed capacity by promoter

Promoters

Iberdrola Renovables consolidates its leadership with the biggest capacity of wind power generation with a total of 4,244.9 MW, which means a 28% of installed capacity (see table I.03 and figure I.09). **Acciona** is still the second promoter with a total of 2,678.3 MW (17.7% of total) and a raise last year of 636.1 MW, followed by **ECYR (Endesa)** with a total of 1,266.5 MW, 347 MW of which have been installed in the last twelve months. Up to eleven promoters have an installed capacity of over 200 MW.

In percentage, the major raise goes to **Neo Energia** with 57.7%, with 447.3 installed MW, making a grand total of 1,223 MW, it also goes to **Olivento**, with a 55.2% growth, and the installation of 150 MW in 2007, as well as to **EUFER**, with a 49.93% growth and 198.1 new MW, up to 594.9 MW.

It's important to mention the raise of the number of pro-

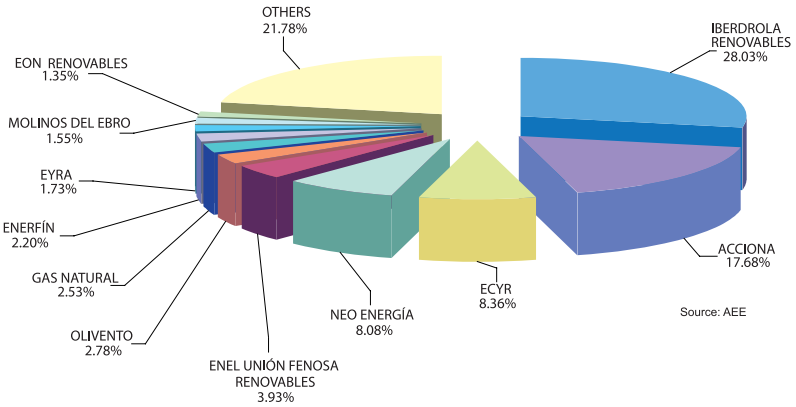


Figure I. 09
Share of promoters of installed wind power capacity accumulated at 01/01/2008

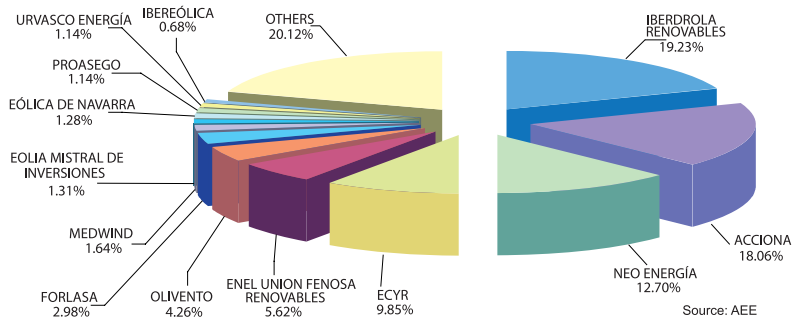


Figure I. 10
Share of promoters of wind power capacity installed in 2007

moters that have installed wind power in 2007, as in the case of Forlasa, with 2.98% (See figure I.10), **Medwind** with a 1.64%, Eolia, with a 1.31%, **Eólica de Navarra**, with a 1.28, while the growth in Iberdrola meant a 19.23% of the total, Acciona's, 18.06% and ECYR, 9.65%

It is important to note the entering in 2007 of new providers, missing until now in Spain

Manufacturers

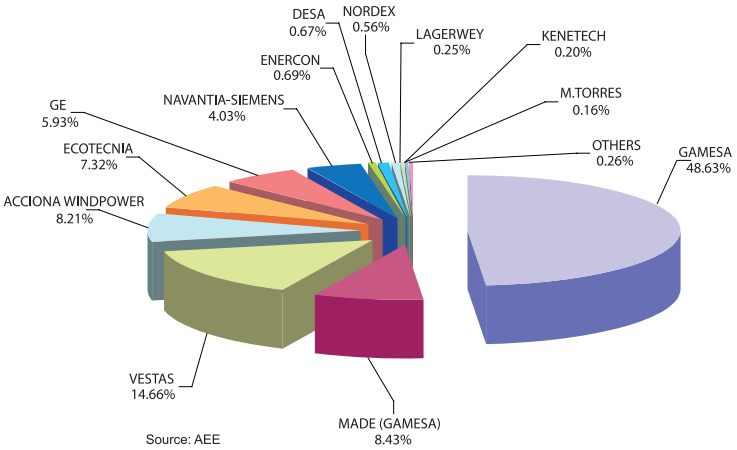
The important growth of wind power capacity in 2007 reveals as well a significant opening of the market to a bigger presence of new providers missing until now in Spain, but that does not affect the consolidation of the main manufacturers, especially **Gamesa** which maintains its leadership. The entering of those new agents may be caused, among other reasons, by the maturity observed in the German market, which has forced several manufacturers to go to a dynamic market such as the Spanish one.

As to the share by manufacturer of the growth in wind power capacity in 2007, it is worth mentioning, according to the information from the AEE's Wind Power Observatory (see table I.04), practically half of the new power capacity in Spain was installed by Gamesa, with 1,670.89 MW, against the 700 MW installed in 2006, a market-wide record that ratifies its leadership with 48.63% of the capacity accumulated, to which we have to add the share of its associated firm's **MADE, 8.43%**. This important growth is produced, furthermore, in a consolidation year for foreign markets, which demanded a bet for exports, while local production of machines and components was getting consolidated.

Table I. 04
Installed capacity by manufacturer

MANUFACTURER	TOTAL AT 01/01/2007	IN 2007	TOTAL AT 01/01/2008	GROWTH 2007/2006	% of TOTAL at 01/01/2008
GAMESA	5694.47	1670.79	7365.26	29.34%	48.63%
VESTAS	1525.31	694.72	2220.03	45.55%	14.66%
MADE (GAMESA)	1276.72	0	1276.72	0.00%	8.43%
ACCIONA WINDPOWER	565.9	678	1243.9	119.81%	8.21%
ECOTECNIA	958.805	150.44	1109.245	15.69%	7.32%
GE	789.75	108	897.75	13.68%	5.93%
NAVANTIA-SIEMENS	460.3	149.5	609.8	32.48%	4.03%
ENERCON	37	68	105	183.78%	0.69%
DESA	101.02	0	101.02	0.00%	0.67%
NORDEX	82.6	2.64	85.24	3.20%	0.56%
LAGERWEY	37.5	0	37.5	0.00%	0.25%
KENETECH	29.7	0	29.7	0.00%	0.20%
M TORRES	23.85	0	23.85	0.00%	0.16%
OTHERS	40.085	0	40.085	0.00%	0.26%
TOTAL	**11,623.01**	**3,522.09**	**15,145.1**	**30.30%**	**100.00%**

Source: AEE



In absolute terms, the second manufacturer in installed capacity in 2007 was **Vestas**, with a power capacity close to 700 MW, over three times the installed capacity in 2006, which makes evident the decisive bet of that firm, world leader, for the Mediterranean market and, specifically, the Spanish one.

Figure I. 11
Share by manufacturers of accumulated installed wind power capacity 01/01/2008

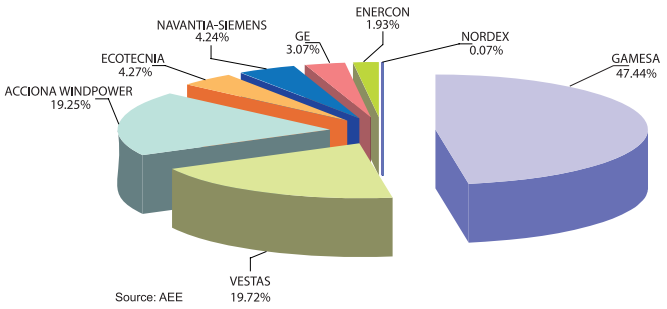


Figure I. 12
Share by manufacturers of installed wind power capacity in 2007

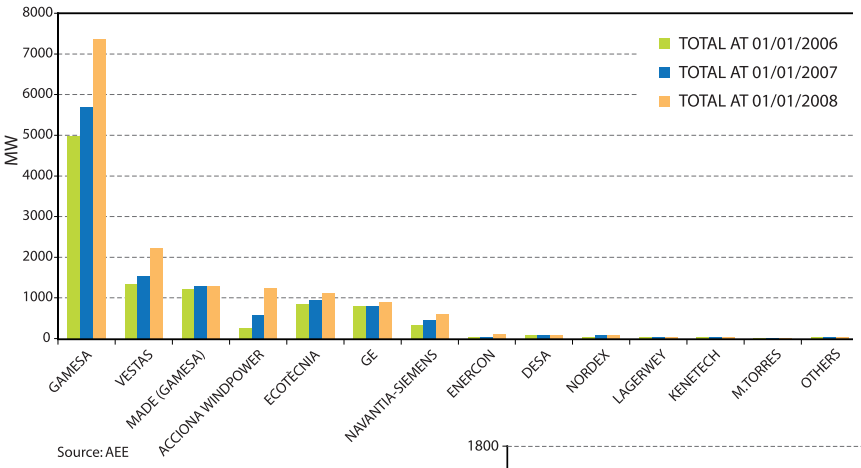


Figure I. 13
Yearly evolution of installed wind power capacity by manufacturers. 2004-2007

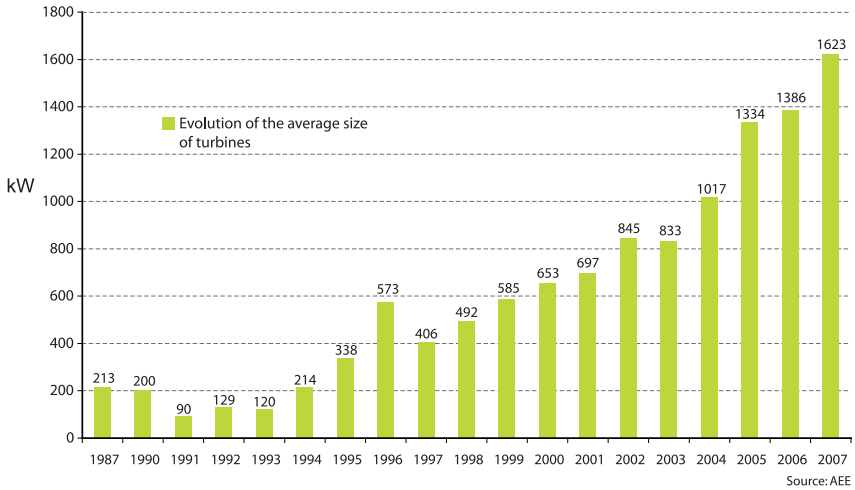
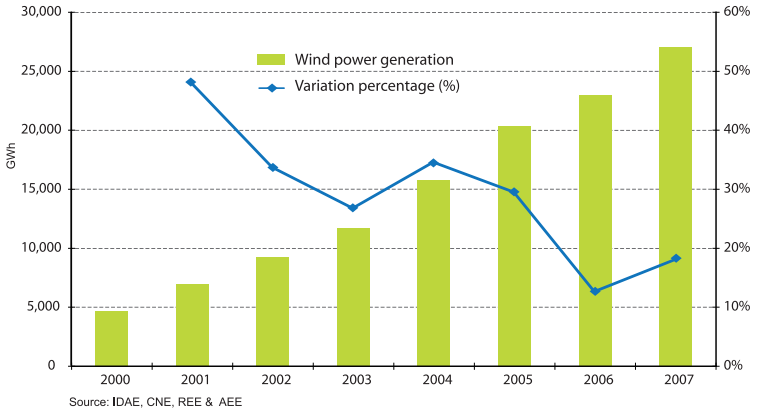


Figure I. 14
Yearly evolution of the average size of a turbine. 1987-2007

Another important growth has been **Acciona Windpower's**, with an increase of 678 MW, which brings it close in accumulated power capacity, to the third national provider, held by MADE.

The number of installed turbines in 2007 was of 2,204 units, most of them (18%) with a power capacity of 2,000 kW, 26% of 1,500kW and 16% of 850kW. The average size of the installed turbine in 2007 (See figure I.14) has risen up to 1,623 kW.

Figure I. 15. Yearly evolution of wind power generation in Spain and variation percentage



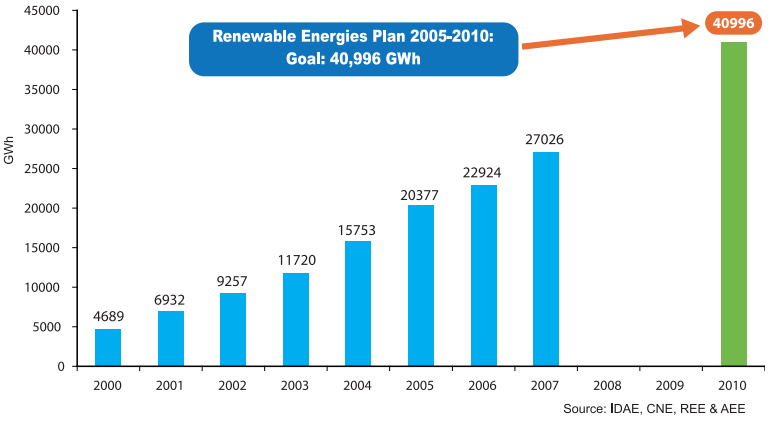
I.2 Generation

The energy demand during 2007 was of 260,838 GWh, 2.8% more than the precious year, according to data by Red Eléctrica de España. This **growth in the demand** means, according to the system operator, 4% if the influence of working factors and temperatures in the year, in relation with the precedent years, is taken into account. The instant power demand registered a historical record of 45,450 in December 17, at 18:53, due to, mainly, the low temperatures that the country was suffering. That peak meant a raise of 4% respect to the precedent record, on January 27 2005, when 43,876 MW were achieved at 19:56 hours.

On December 17, another record for hourly average power capacity, between 19:00hs and 20:00hs was registered: 44,876 MW. Besides, on December 18, the maximum of produced energy was reached: 902 GWh. The precedent record had been on January 26, that same year: 881 GWh.

On March 19, the historical record in wind power production was beaten: 169,194 MWh, covering 23.2% of the electric demand, which peaked at 17:47hs, reaching 8,375MW. The former

Figure I. 16. Yearly evolution in wind power generation in Spain and PER prediction. 2000-2010



Wind Power is already 9.5% of total generation

record for daily production had been on December 8 2006, with 159,291 MWh. Those maximums have been widely overtaken in the first months of 2008. Wind power production during 2007 was of 27,026 GWh (see Figure I.15) against the 22,924 GWh from 2006, that is 4,102GWh more, which mean a 17.89% raise against the 15.5% in 2005

The same as installed capacity growth, the evolution of the annual growth of wind power generation permits to meet the goal for the Renewable Energies Plan (PER) 2005-2010 (See figure I.16) set for wind power in 40,996 GWh in 2010. It is presumable besides, that the important growth in installed capacity in 2007 (3,522 MW) will mean in a significant raise in generation in 2008, as the

Figure I. 17. Generation distribution by technology. Total peninsular. 2007

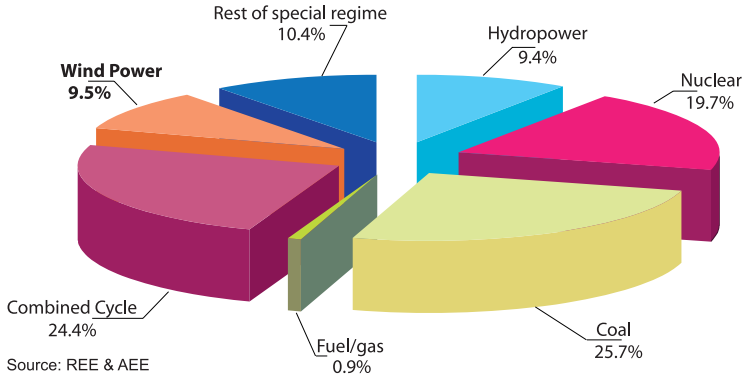
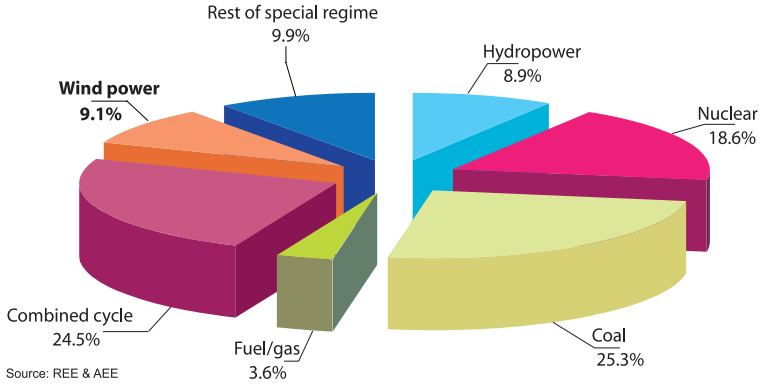


Figure I. 18. Generation distribution by technology Total national. 2007



bigger part of that new capacity was installed at the end of the year, and does not figure in 2007 production. As a matter of fact, in the months elapsed from the beginning of the year and the publishing of this yearbook, all generation records have been beaten, as in absolute terms as well as in percentage terms, from the last years.

In 2007, in the peninsular system, **wind power was 9.5% of total generation** (see figure I.17), while at national level, (adding to the peninsular system production the one in the islands, Ceuta and Melilla) it represents 9.1% of the total production (see figure I.18), overtaking for the first time, when it comes to production, large hydropower. The leading technology was coal, raising its

participation up to 25.3%, while in 2006 was of 23.82%, thanks to the crack in the price of CO_2 in the market of emission rights.

In the annual evolution of generation (see figure I.19), only combined cycle and wind power maintain a clear tendency to the raise in the last four years, while hydropower production and nuclear energy have been beneath 2004 generation levels in the 2005-2007 period. Coal too keeps an

Figure I. 19.
Yearly evolution of generation by technology. 2004-2007

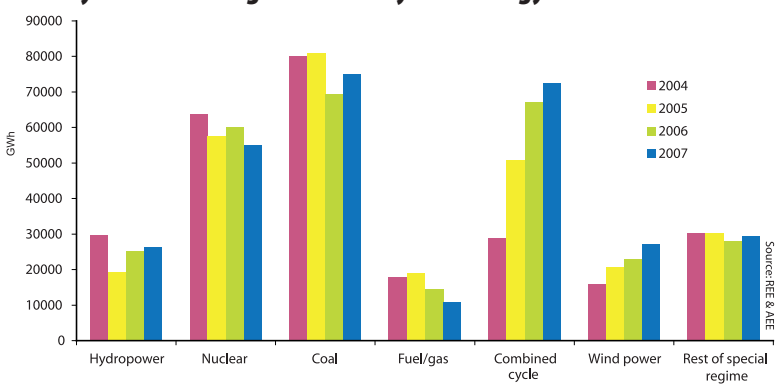
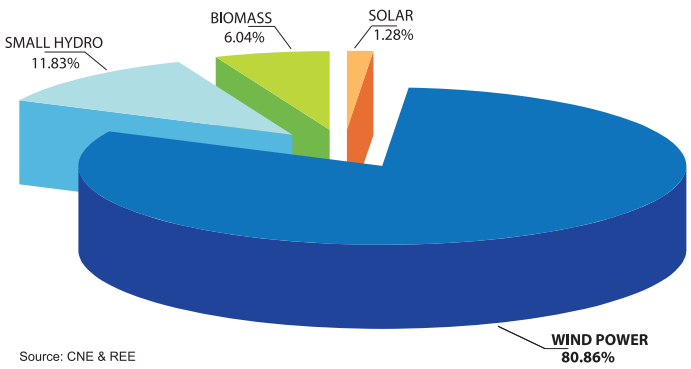
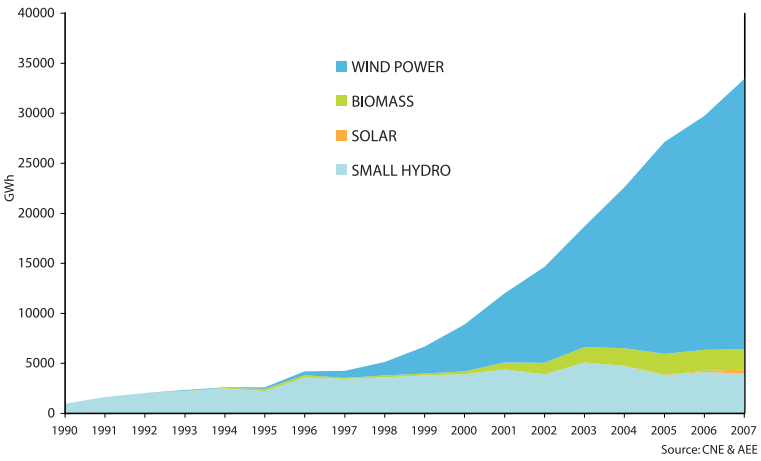


Figure I. 20
Generation distribution by renewable technology source. 2007



Source: CNE & REE

Figure I. 21
Yearly evolution of renewable energies generation. 1990-2007



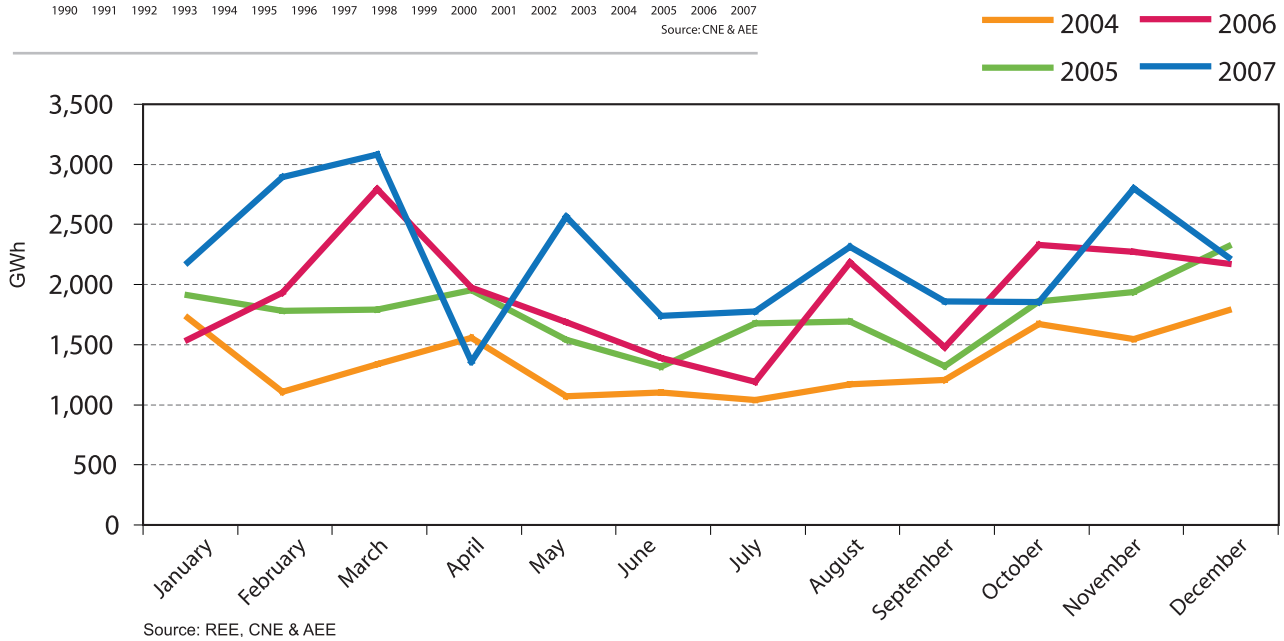
Source: CNE & AEE

irregular evolution due to the mentioned factor of the prices of CO_2 in the market of emission rights.

As to the share of the generation by renewable Technology, (see figures I.20 y I.21), wind power is 80.86%, small hydro power 11.83%, Biomass 6.03% and solar, 1.28%.

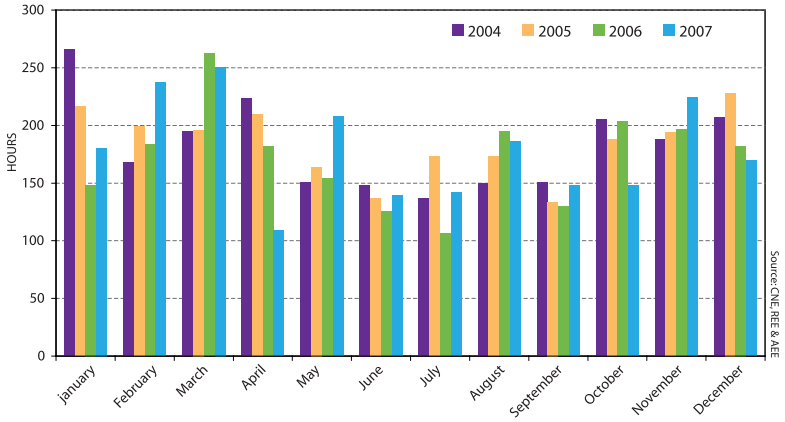
In the figure for monthly evolution of wind power (see figures I.22 y I.23) it might be noted the abnormal behavior in April, last year, when generation was even lower than in 2004 even counting 4,000 MW of installed capacity, a low production that was compensated in May. It can also be appreciated that, while the production lines of 2004 and 2005 never cross, which means that all the months in this last year overtake in production the same months the precedent year, ever since 2005, that evolution is broken with more significant monthly oscillations, a tendency confirmed in 2007. In the evolution of demand coverage by wind power, it can be appreciated the raising

Figure I. 22
Monthly evolution of wind power generation. 2004-2007



Source: REE, CNE & AEE

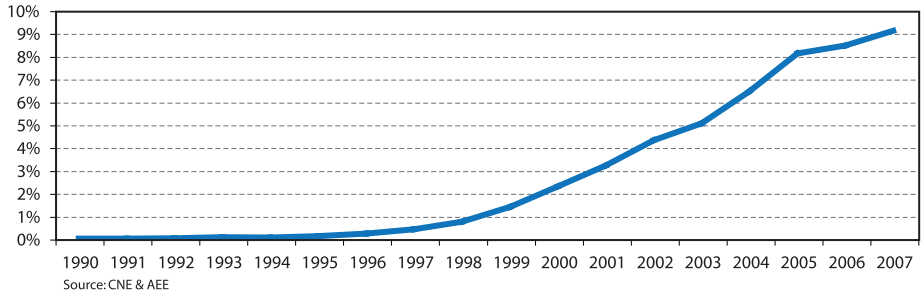
Figure I. 23
Number of working hours. 2004-2007



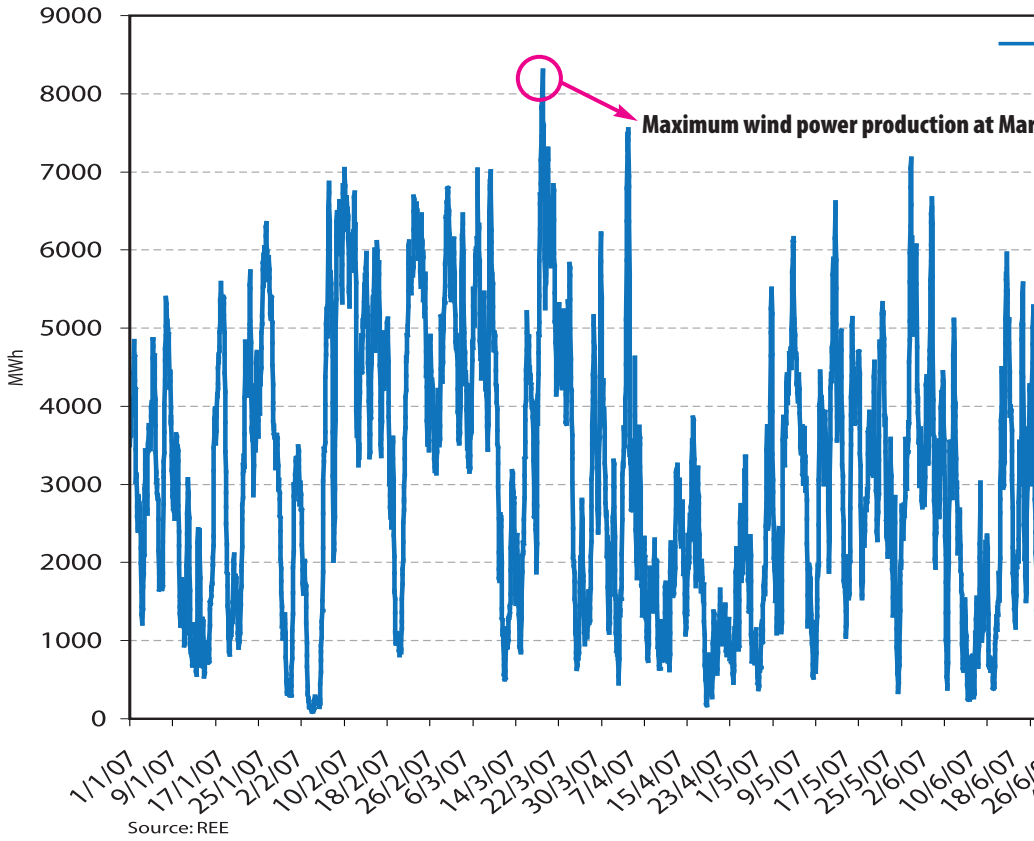
curve, in percentage terms, had stabilized in those two last years, because of a slow down in the installation of new capacity.

As it's been said before, the peak for wind power production in 2007 took place in March 19, at 17:37h, when 8,375 MWh were generated simultaneously (see figure I.25). During the year the 7,000 MW of generation record was overtaken up to ten times. As to the percentage of demand covering, the peak was reached on March 27 with 32.13% (see figure I.26), while in numerous occasions the 20% coverage was overtaken with the common condition of **absence of incidents in the system operation**. Those coverage indexes are only met in Denmark, but in very different conditions because of the high grade of interconnection in the Nordic country.

Figure I. 24
Electricity demand covered by wind power. 1990-2007

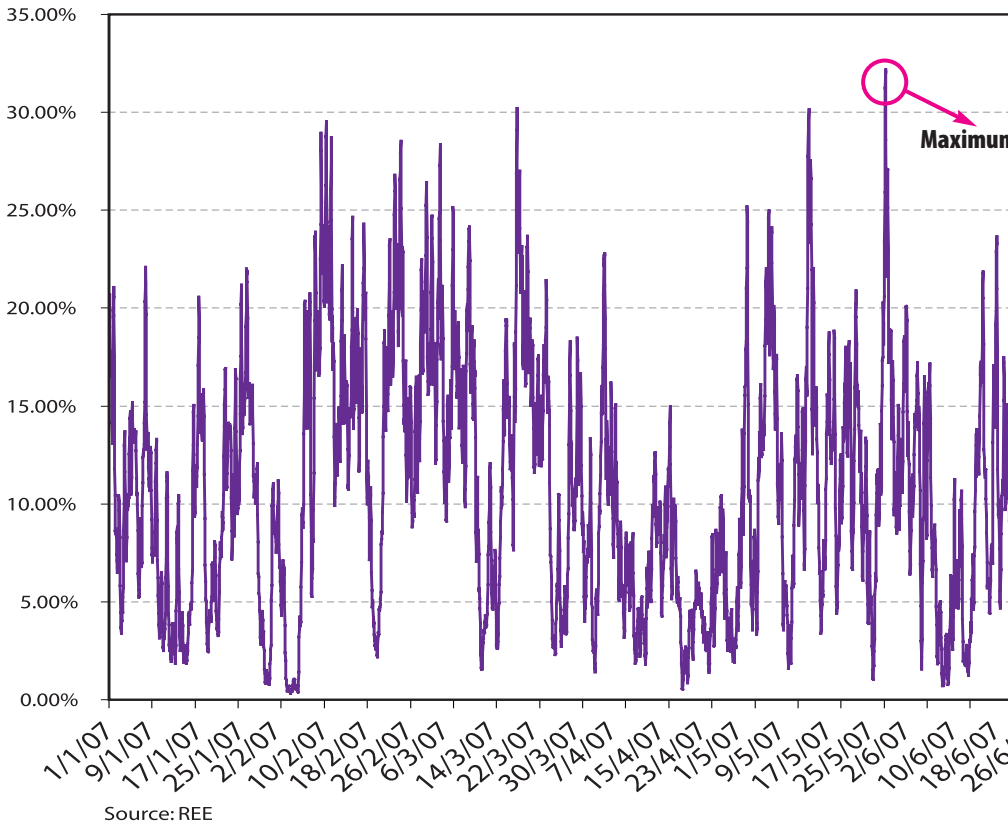


Source: CNE & AEE



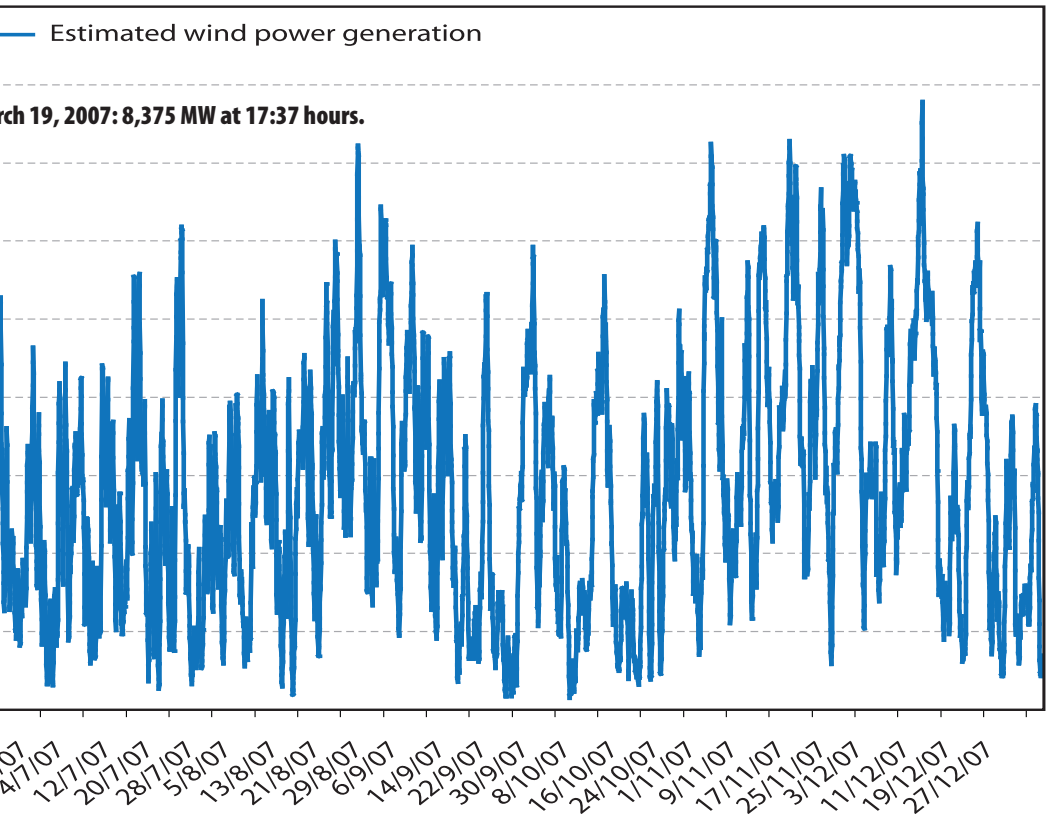
Source: REE

Figure I. 25
Hourly wind power generation. 2007



Source: REE

Figure I. 26
Hourly demand coverage. 2007


Estimated wind power generation
rch 19, 2007: 8,375 MW at 17:37 hours.
4/7/07
12/7/07
20/7/07
28/7/07
5/8/07
13/8/07
21/8/07
29/8/07
6/9/07
14/9/07
22/9/07
30/9/07
8/10/07
16/10/07
24/10/07
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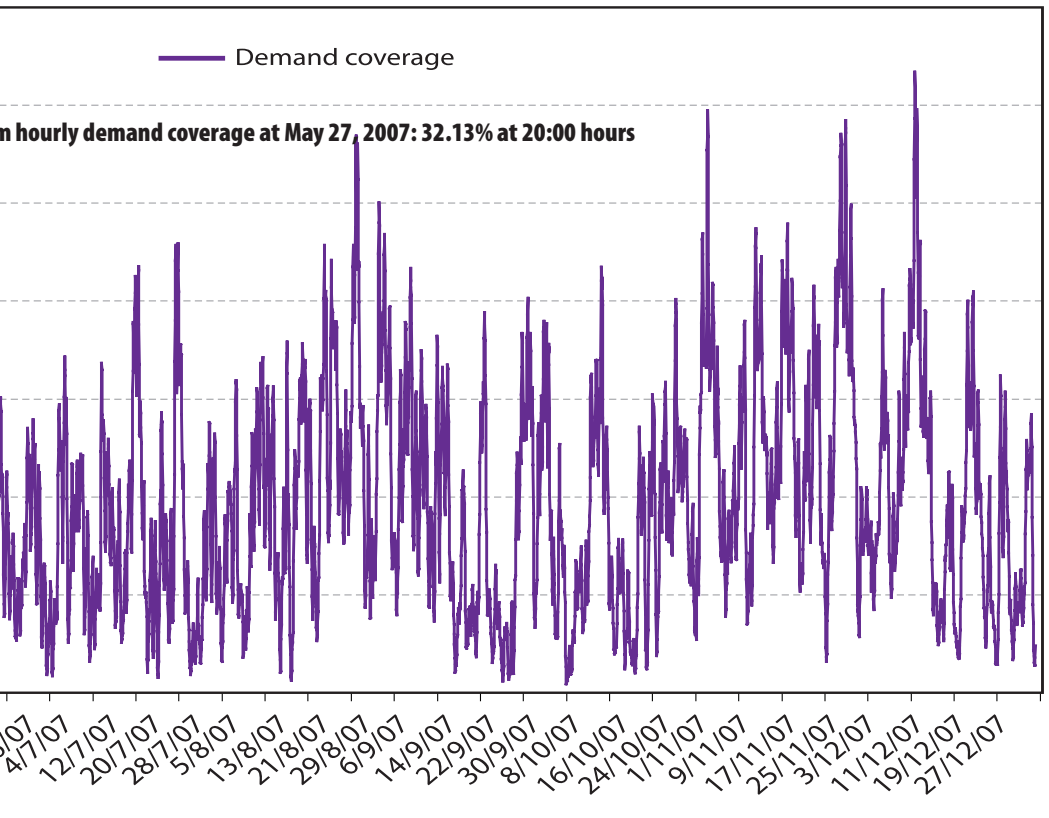
9/11/07
17/11/07
25/11/07
3/12/07
11/12/07
19/12/07
27/12/07


Demand coverage
n hourly demand coverage at May 27, 2007: 32.13% at 20:00 hours
4/7/07
12/7/07
20/7/07
28/7/07
5/8/07
13/8/07
21/8/07
29/8/07
6/9/07
14/9/07
22/9/07
30/9/07
8/10/07
16/10/07
24/10/07
1/11/07
9/11/07
17/11/07
25/11/07
3/12/07
11/12/07
19/12/07
27/12/07

CHAPTER II

WIND POWER AROUND THE WORLD

II.1 Global growth: 27%

Installed wind power worldwide at January 1, 2008 is over 94,000 MW (see figure II.01), meaning a 27% increase over the previous year when 74,288 MW had been installed (see figure II.02). This increment is slightly higher than the one registered in 2006, which was 26%. Spain, with 3,522 new MW, along with China and U.S.A., has led this growth, which shows the strength of the wind power development, keeping growth rates consistently over 25%, with the sole exception of 2004.

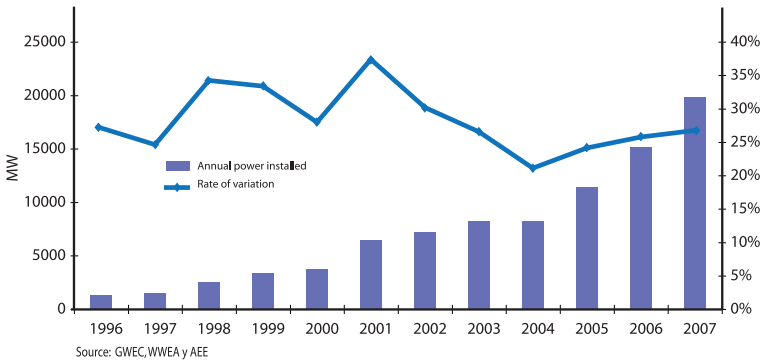
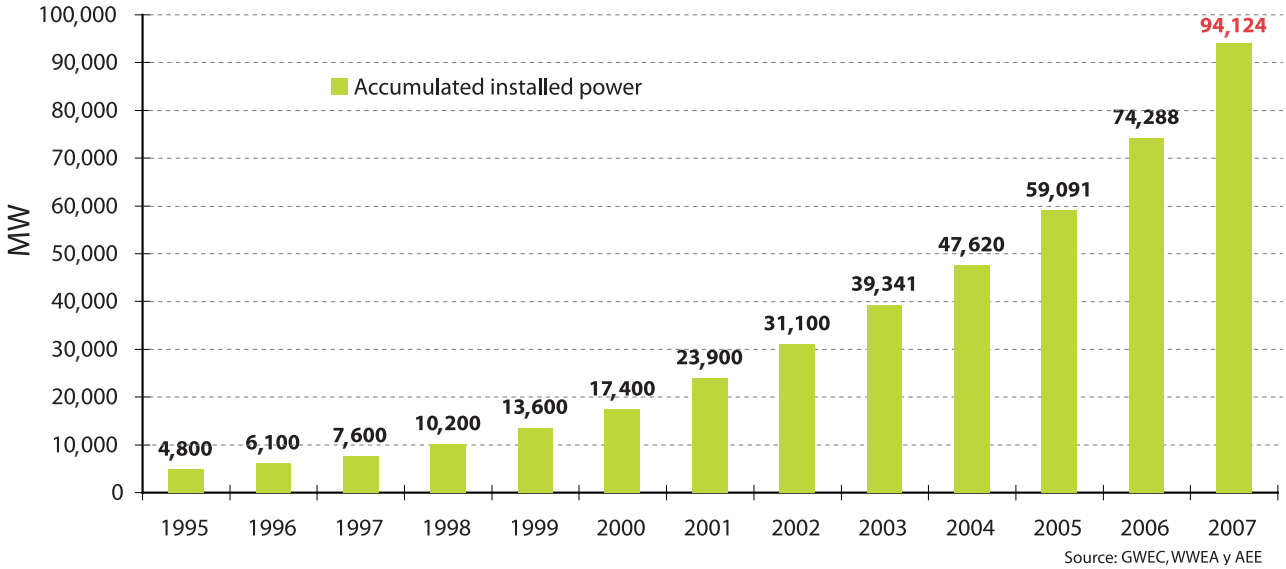


Figure II.02
Annual power installed at world-wide level and rate of variation. 1995-2007

Figure II.01
Accumulated installed wind power worldwide. 1995- 2007



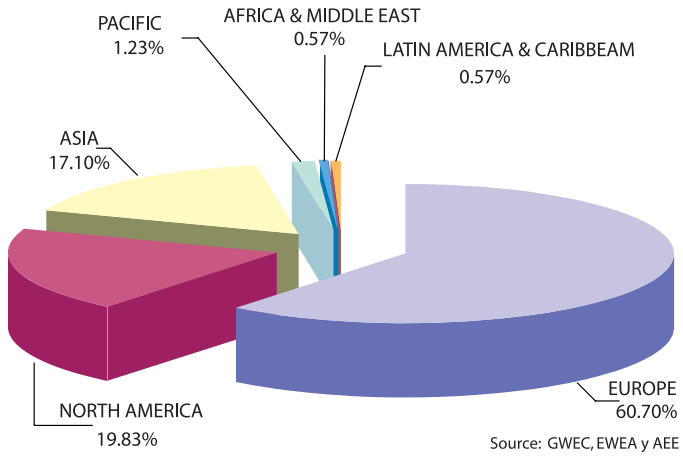
As for installed power in the different regions, according to the data published by the Global Wind Energy Council (GWEC) (see table II.01), the greatest growth corresponds to Europe with 8,500 new MW, over 3,500 MW of which correspond to Spain, while the region with the highest growth in percentage has been Asia, with 51%, with China leading said increment. The amount of wind power currently under development in the Asian giant reaches 4,200 MW.

Table II.01
Total Capacity by region. 2006-2007

TOTAL CAPACITY BY REGION	At 01/01/2007	At 01/01/2008	Variation Rate
EU	48,536	57,136	18%
NORTH AMERICA	13,063	18,664	43%
ASIA	10,659	16,091	51%
PACIFIC REGION	1,000	1,158	16%
MIDDLE EAST	378	538	42%
LATIN AMERICA & CARIBBEAN	507	537	6%
TOTAL (In MW)	**74,143**	**94,124**	**27%**

Source: EWEA, GWEC y AEE

Figure II.03
Distribution by world region of accumulated wind power capacity at 01/01/2008



Source: GWEC, EWEA y AEE

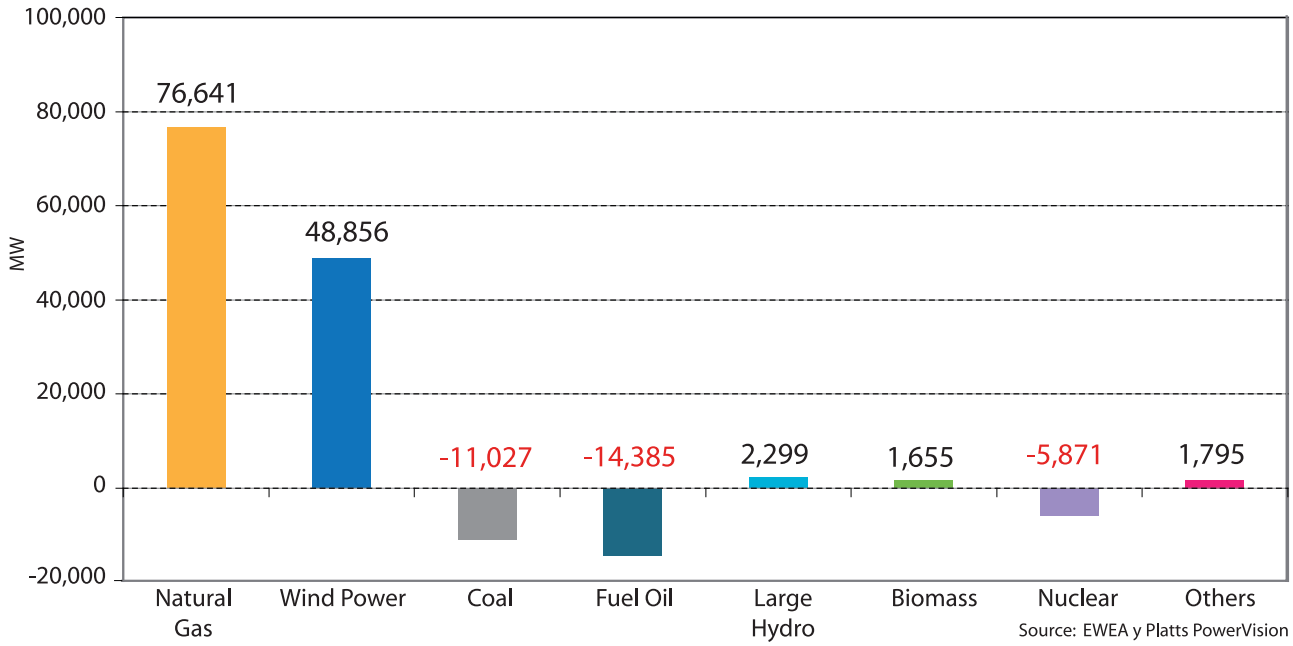
As for accumulated power by world region (see figure II.03), Europe leads the ranking with 60.7% of the total installed wind power, North America is in second place with a 19.83% and Asia in third with a 17.10%. The list finishes with Africa and Latin America with a 0.57% each.

At EU level, wind power is the second technology with the biggest growth during 2000-2007, according to the Pure Power report by the European Wind Energy Association (EWEA). The growth during these years (see figure II.04) has been 48,856 MW, only exceeded by gas thermal power plants (including combined cycle) while capacity has been reduced in coal thermal power plants (-11,027 MW), fuel oil (-14,385 MW) and nuclear (-5,871 MW).

By country, (see figure II.05) Spain (15,145 MW) is still the second at European level behind Germany (22,247 MW), but is already third world wide in installed power, behind the United States which with an increase of 5,244 MW installed in 2007 has reached a total of 16,970 MW. We must point out though, that as shown in chapter III, a big part of the US wind power growth, as in many other countries, has been lead by Spanish enterprises which are the most dynamic worldwide.

Figure II.04

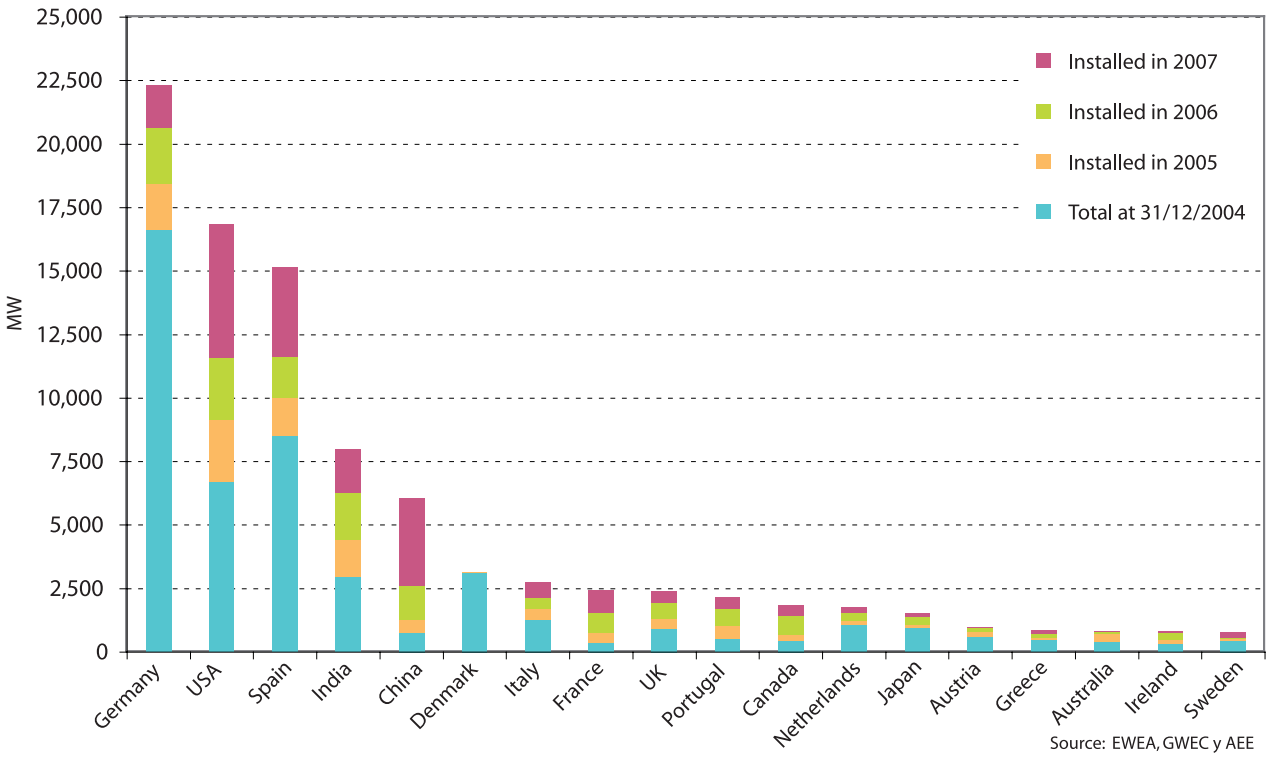
Net variation of installed capacity in the European Union in 2000-2007



Source: EWEA y Platts PowerVision

Figure II.05

Distribution by country of worldwide installed wind power



Source: EWEA, GWEC y AEE

U.S.A. with 5,244 new MW and a growth of a 44.9%, China with 3,449 new MW and a 132.3% growth (provisional data) and Spain with 3,522 new MW and a 30.33% growth have led in installed power (see table II.02). A certain slowing down can be seen in Germany, even though it still leads with 22,247 installed MW, it has only increased by 1,667 MW in 2007. India stays in fourth place with an increment of 1,730 MW reaching up to a total of 8,000 MW.

With 888 installed MW in 2007 and a 56.6% increment, France has got to the eighth position worldwide. Other countries with significant growths have been Sweden, with 217 new MW in 2007 and a 38% growth rate, Italy with a 28.4% growth (603 new MW), Canada with 386 new MW and a 26.4% growth and Portugal with a 25.3 growth rate and 434 MW installed in 2007.

Table II.02

Installed wind power by country (MW)

Country	Total at 31/12/2006	Ranking at 31/12/2006	Installed in 2007	Total at 31/12/2007	Variation rate 2007/2006	Ranking at 31/12/2007
Germany	20,622	1	1,667	22,247	7.9%	1
USA	11,603	3	5,244	16,818	44.9%	2
Spain	11,623	2	3,522	15,145	30.3%	3
India	6,270	4	1,730	8,000	27.6%	4
China	2,604	6	3,449	6,050	132.3%	5
Denmark	3,136	5	3	3,125	-0.4%	6
Italy	2,123	7	603	2,726	28.4%	7
France	1,567	11	888	2,454	56.6%	8
UK	1,962	8	427	2,389	21.8%	9
Portugal	1,716	9	434	2,150	25.3%	10
Canada	1,460	12	386	1,846	26.4%	11
Netherlands	1,558	10	210	1,746	12.1%	12
Japan	1,394	13	139	1,538	10.3%	13
Austria	965	14	20	982	1.8%	14
Greece	746	16	125	871	16.8%	15
Australia	817	15	7	824	0.9%	16
Ireland	746	17	59	805	7.9%	17
Sweden	571	18	217	788	38.0%	18
Rest of the Word	2,660		947	3,620	36.1%	
TOTAL	**74,143**		**20,076**	**94,124**		

Source: EWEA, GWEC y AEE

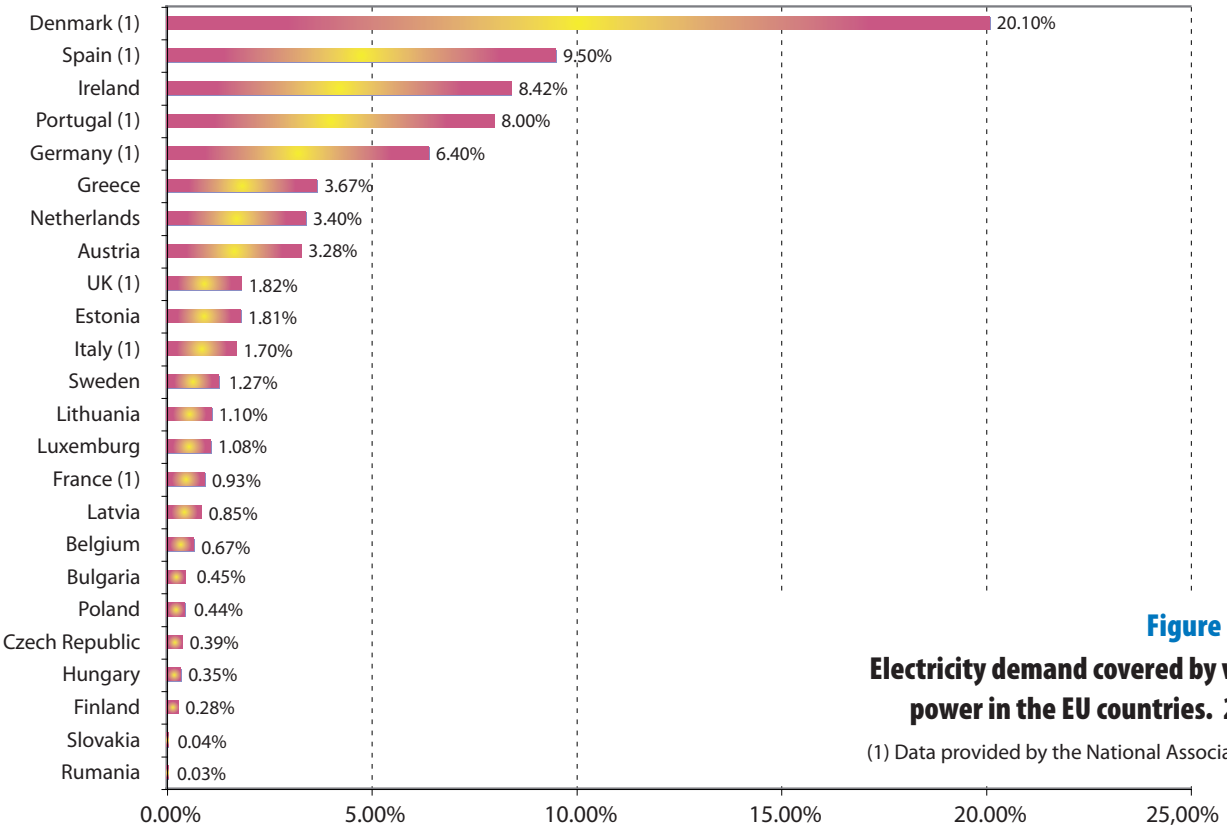


Figure II.06

Electricity demand covered by wind power in the EU countries. 2007

(1) Data provided by the National Associations.

Table II.03
Installed wind power, number of WTGs, average size, wind power production, demand and % of demand covered by country. 2006

Country	Total installed Wind power Capacity	Installed offshore Wind power capacity	New yearly Wind power capacity	Total number of WTGs	Average size of the WTGs	Wind power generation	Electricity demand	Percentage of electricity covered by Wind power
	(MW)	(MW)	(MW)	(WTGs)	(kW)	(GWh)	(TWh)	%
Australia	817	0.0	109.00	544	1,750	2,504	208.0	1.20%
Austria (1)	965		146.00					
Canada	1,460	0.0	776.00	1,186	1,230	3,800	***550.0***	0.69%
Denmark	3,137	423.0	8.00	5,274	1,287	6,108	36.4	16.78%
Finland	86	0.0	4.00	96	2,000	154	90.0	0.17%
Germany	20,622	7.0	2,207.00	18,685	1,848	30,500	540.0	5.65%
Greece	749	0.0	142.00	1,051	1,146	***1,580***	***51.0***	3.10%
Ireland	744	25.0	251.00			1,617	28.9	5.60%
Italy	2,123	0.0	405.00	2,575	1,148	3,215	338.0	0.95%
Japan	1,574	1.0	494.00	1,358	1,159	1,910	882.6	0.22%
Korea	175	0.0	77.00	118		247	381.2	0.06%
Mexico	86	0.0	83.00	105				
Netherlands	1,559	108.0	335.00	1,792	2,248	2,747	116.0	2.37%
Norway	325	0.0	57.00	163	2,280	671	122.0	0.55%
Portugal	1,698	0.0	634.00	964	2,400	2,962	***49.0***	6.04%
Spain	11,615	0.0	1,587.00	13,842	1,375	23,372	268.0	8.72%
Switzerland	571	23.0	62.00	812	1,879	986	150.0	0.66%
Sweden	12	0.0	0.00	34	0	15	58.0	0.03%
United Kingdom	1,963	340.0	631.00	0	2,103	4,591	408.0	1.13%
United States	11,575	0.0	2,454.00		1,600	31,000	4,027.0	0.77%
Total	**61,856**	**927.00**	**10,462.00**	**48,599**	**1,591**	**117,979**	**8,304.1**	**1.42%**

Values in ***italics*** are estimations. Underscored values are from 2005/2004,
% of national electricity demand from wind= (wind generated electricity/national electricity demand)* 100
Source: International Energy Agency
(1) Numbers from Wind Power Monthly

The weight of wind power in each country

In the following table (see table II.04), we can see the weight wind energy has in each country, not in absolute terms, but this time related to other concepts, such as inhabitants, area or total production. In this sense, it is remarkable the role of wind power in Denmark, leading worldwide in MW by million inhabitants, with 586.3, in installed capacity by area in kW/km$_2$, with 72.51, and in percentage of total electricity production covered by wind power with 20.10%. Spain is second in two of those ratios, like the MW by million inhabitants one, with 335.06 and the electricity coverage by wind power, with almost a 10%, in contrast with the one percent coverage of the 31,000 GWh produced by wind power, against the 4,428 TWh of total production in the US.

Table II.04
Ratios for the countries with the most installed capacity. 2007

Country (Data 2007)	Inhabitants (Millons)	Area (km2)	Net Electrical generation (TWh)	Installed Wind power (MW)	Wind power generation	MW/Milion inhabitants	Installed capacity /Area (kW/km2)	Wind power production/total production
Germany	83	357,021	617.19	22,247	39,500	269.66	62.31	6.40%
USA	301	9,826,630	4,428.57	16,818	31,000	55.85	1.71	0.70%
Spain	45	504,782	271.114	15,145	27,026	335.06	30.00	9.97%
India	1029	3,287,590	n.a.	8,000	n.a.	7.78	2.43	
China	1322	9,600,000	n.a.	6,050	12,100	4.58	0.63	
Denmark	5	43,096	35.62	3,125	7,159	586.30	72.51	20.10%
Italy	59	301,171	256.47	2,726	4,360	46.60	9.05	1.70%
France	64	675,418	450	2,454	4,200	38.34	3.63	0.93%
UK	60	244,820	274.50	2,389	4,996	39.62	9.76	1.82%
Portugal	10	92,072	50	2,150	4,002	206.97	23.36	8.00%

Estimated for 2007
Source: ANEV, APREN, BWE, BWEA, DWIA, EWEA, GWEC, SER, WWEA and AEE

Growth forecast

According to the *Pure Power* report by EWEA, installed wind power in Europe will reach 80 GW by 2010, 4.4% of which will be offshore wind farms. In order to reach the 20% by 2020 goal set by the Directive, EWEA considers that installed wind power will exceed 180 GW, among which 35 GW will be offshore, under the condition that the Directive of Renewable Energy establishes stable and predictable regulatory frameworks in the Member States. By 2030, total offshore wind power will be 120GW of the total 300 GW installed.

Table II.05
Installed power by the main manufacturers worldwide

	ACCUMULATED 2006 (MW)	IN 2007	SHARE IN 2007 %	ACCUMULATED IN 2007	ACCUMULATED SHARE %
VESTAS (DK)	25,005	4,503	22.8%	29,508	31.4%
ENERCON (GE)	11,001	2,769	14.0%	13,770	14.6%
GAMESA (ES)	10,258	3,047	15.4%	13,305	14.2%
GE WIND (US)	9,696	3,283	16.6%	12,979	13.8%
SIEMENS (DK)	5,605	1,397	7.1%	7,002	7.4%
SUZLON (IND)	2,642	2,082	10.5%	4,724	5.0%
NORDEX (GE)	3,209	676	3.4%	3,885	4.1%
ACCIONA (ES)	798	873	4.4%	1,671	1.8%
GOLDWIND (PRC)	627	830	4.2%	1,457	1.5%
SINOVEL (PRC)	75	671	3.4%	746	0.8%

Source: BTM

EWEA considers that installed wind power will exceed 180 GW

II.2 Offshore wind power

Accumulated offshore wind power at the end of 2007 was 1,080 MW, according to the European Wind Energy Association (see table II.05). The development of this kind of wind energy is slow because the necessary technologies for installing wind turbine generators in deep waters are still under development. On the other side, the CAPEX costs (inversion) are very high and the effect of the OPEX costs (operation) on the viability of the project must still be studied. Still, in order to meet the goals set by the Directive for 2020, it is necessary to develop this technology.

Table II. 06
Offshore wind farms

Project	Location	Region	Power (MW)	Number of WTGs	Depth (m)	Distance to land (km)	Commissioning year
Denmark							
Vindeby	Blæsenborg Odde, NW off Vindeby, Lolland		4.95	11	2.5 to 5	2.5	1991
Tunø Knob	off Aarhus, Kattegat Sea		5	10	0.8 to 4	6	1995
Middelgrunden	Oresund, east of Copenhagen harbour		40	20	5 to 10	2 to 3	2001
Horns Rev	Blåvandshuk, Baltic Sea		160	80	6 to 14	14-20	2002
Nysted Havmøllepark	Rødsand, Lolland		165.6	72	6 to 9	6	2003
Samsø	Paludans Flak, South of Samsø		23	4	11 to 18	3.5	2003
Frederikshavn	Frederikshavn Harbour		10.6		3	0.8	2003
Rønland*	Lim fjord, off Rønland peninsula,		17.2	8	3		2003
* near shore projects			426.35				
UK							
Barrow	7km Walney Island	Off England	90	30	>15	7 km	2006
Beatrice	Beatrice Oilfield, Moray Firth	Off Scotland	10	2	>40	unknown	2007
Blyth Offshore	1km Blyth Harbour	Off England	3.8	2	6	1 km	2000
Burbo Bank	5.2km Crosby	Off England	90	25	10	5.2 km	2007
Kentish Flats	8.5km offshore from Whitstable	Off England	90	30	5	8.5 km	2005
North Hoyle	7.5km Prestatyn & Rhyl	Off Wales/England	60	30	5 to 12	7.5 km	2003
Scroby Sands	3km NE Great Yarmouth	Off England	60	30	2 to 10	3 km	2004
Netherlands							
Offshore Wind Farm Egmond aan Zee (OWEZ)	Egmond aan Zee		108	36	17-23 m	8 to 12 km	2006
Sweden							
Bockstigen	Gotland		2.8	5	6-8 m	3 km	1998
Utgrunden I	Kalmarsund		10.5	7	4-10 m	7 km	2001
Yttre Stengrund	Kalmarsund		10	5	8-12 m	4 km	2002
Lillgrund	Malmö		110	48	2.5-9 m	10 km	2007
Ireland							
Arklow Bank	off Arklow, Co Wicklow		25.2	7	15	7	2004

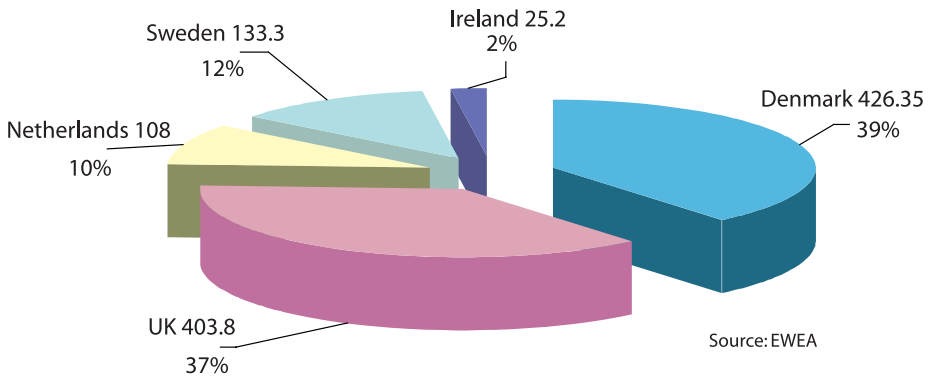
Source: EWEA

According to the information published by EWEA, there have been three offshore wind farms installed in 2007, two of them in the United Kingdom: Beatrice Wind Farm with 10 MW and Burbo Bank with 90 MW and the remaining one in Sweden, the Lillgrund wind farm with 110 MW.

Offshore wind power development is necessary in order to meet 2020 objectives

According to data by EWEA (see figure II.07), Denmark still leads in installed offshore wind power with 426.25 MW (39% worldwide), very close to the U.K. with 403.9 MW (37% of the total).

Figure II.07
Distribution by country of offshore installed wind power. 2007



Source: EWEA

Chapter III

THE SPANISH WIND ENERGY INDUSTRY, A REFERENCE AT WORLD WIDE LEVEL

In this chapter of **Wind Power 2008**, we wish to point out the two characteristics that make Spain a world referent for its development model on wind power. On one side, the leadership of the Spanish businesses, already present in 25 countries, in both promotion and operation. On the other side, the wind power grid integration, with high penetration levels in a electrical system like the Spanish one, almost an electrical island. Both aspects are emphasized internationally in all conferences, workshops and published studies.

III.1 Leadership in promotion and operation

The Spanish wind energy sector is going through an excellent spell. And it is not just because Spain is the third country in installed capacity, as shown in previous chapters, but also because the sector has been able to exit our borders with great dynamism so that Spanish enterprises are present in several markets throughout the five continents. This growth is led by the big promoters as well as the national manufacturers and many auxiliary businesses that follow them in this international expansion. The total capacity installed by our promoters worldwide, 8,500 MW (see table III.01); the number of countries, 25, in which Spanish companies are present; and the export capacity of our manufacturers – Gamesa alone installed 1,600 MW outside Spain last year – allow us to state, that the Spanish wind industry leads nowadays the development of wind power throughout the world. A leadership that can be consolidated thanks to the high number of projects outside our borders both short and medium term which exceed widely the capacity currently installed in Spain, that is, 15,145 MW.

The Spanish presence in the U.S.A., where our country is the main foreign investor in wind power must be pointed out. The examples of Spanish presence in the American wind power market speak by themselves: Gamesa is the fourth WTG manufacturer; Acciona owns two wind farms and Iberdrola has bought Community Energy and PPM through Scottish Power.

As for **China**, Spain has long taken positions in a country that will soon install at least 25,000 MW in the next 10 years. Gamesa, for example, has installed 15 wind farms in 2007 for a combined power of 518 MW and FERSA is trying to undertake the largest investment by a Spanish company in China with a wind farm between 1,000 and 2,000 MW of total power. Acciona inaugurated in Nantong, southeast China, in 2006 the first WTG plant with Spanish technology in the country. The plant, placed in one of the most promising areas for the wind market (Asia-Pacific Area) has a capacity of 400 units/year of the AW-1500 WTG.

PROMOTER	MW
IBERDROLA	3,145
ACCIONA	3,030
NEO ENERGÍA (*)	2,001
ENDESA	320
TOTAL	**8,496**

(*) Neo Energía is a subsidiary of the Portuguese company EDP Renováveis, but its headquarters are in Spain

Table III.01
Wind power capacity installed by the main promoters outside Spain

Gamesa installs over 1,600 MW outside Spain in 2007

Gamesa maintains its bet on overseas investments. The company business plan launched in 2006 foresaw the starting up of nine production centres, which became a reality halfway through last year and which included seven facilities in Europe, USA and China. Of its 7,000 strong staff, 1,200 employees are in the USA and 900 in China.

PROMOTION. Gamesa has already built wind farms for an aggregated power of 2,307 MW (see table III.02), almost a third of them built in 2007 among them 460 MW installed in the USA.

MANUFACTURE. More than half of the 3,000 MW installed by Gamesa in 2007, specifically 1,650 MW, have been installed outside of Spain, a clear sign of the growing internationalization of the company. Besides, the company manufactured **over a thousand MW in its production facilities in China and the USA.**

Table III.02
Wind farms installed by Gamesa at the end of 2007

WIND FARMS INSTALLED BY GAMESA		
COUNTRY	Nr of WIND FARMS	POWER (MW)
Germany	20	146.25
Italy	21	327.45
Portugal	10	260.00
USA	14	794.40
China	15	518.00
France	14	129.00
Egypt	1	80.00
UK	2	1.00
India	1	8.00
Cuba	1	5.00
Morocco	1	3.00
Ecuador	1	2.00
Greece	3	22.00
TOTAL	**104**	**2,307.10**

Source: GAMESA

For its activity inside of **Europe**, Gamesa has sealed two new multiyear alliances with the companies Generación Eólica Internacional and Eólica Bulgaria, both companies of the ENHOL group, for the supply of 90 new WTG for the Polish and Bulgarian market, for a total capacity of 180 MW. The multiyear agreement for Poland means the supply, installation, deployment, operation and maintenance of sixty Gamesa G90-2.0MW WTGs between 2009 and 2010.

The second agreement involves the supply, installation and deployment of thirty Gamesa G90-2.0MW WTGs, as well as its operation and maintenance in the Bulgarian wind farm of Suvorovo in 2010. The contract considers the installation of a second phase of a hundred additional MW for the Bulgarian market. The company has announced the sale of ten WTGs to the Indian company Pioneer Asia Wind Turbines, for a total of 8.5 MW.

Iberdrola Renovables, 3,134 MW outside our borders

The company, considered the first wind energy producer worldwide, has multiplied by seven its total installed capacity outside of Spain, from 440 MW at the end of 2006 to 3,134 MW at the end of 2007. 382 MW of those are in the United Kingdom, acquired with the local electrical company Scottish Power; and 2,145 MW are in the USA, mainly thanks to the contribution of PPM Energy, a subsidiary of Scottish Power.

The remaining 607 MW of installed wind power are mainly in Europe: 218 MW are placed in Greece, 126 MW in France, 105 MW in Poland, 60 MW in Germany, 50 MW in Portugal and the last 49 MW are located in Brazil.

WIND FARMS BUILT BY ACCIONA			
COUNTRY	Nr of WIND FARMS	TOTAL POWER (MW)	OWNED POWER (MW)
USA	3	266.13	191.88
Canada	3	136.00	58.00
Germany	13	124.30	124.30
Australia	2	72.00	36.00
Italy	2	58.65	58.65
Greece	2	36.55	36.55
Hungary	1	24.00	11.35
India	1	13.20	13.20
Portugal	1	24.00	11.35
Total	**28**	**754.83**	**541.28**

Table III.03
Wind farms built by Acciona at the end of 2007
Source: ACCIONA

Last March, its largest wind farm worldwide, **Klondike III**, was deployed. This wind farm, placed in the state of Oregon, has a 223.6 MW capacity. Klondike III has WTGs of different technologies. Specifically there are 80 1.5 MW GE WTGs, 44 2.3 MW Siemens WTGs and one 2.4 MW Mitsubishi WTG. The building of this wind farms puts the Spanish company in an optimal starting position to conquer the American market where it is already the second wind power operator.

As of April 2008, 195 MW have already been connected in two wind farms in the USA. The first one, known as **MinnDakota** is located between the states of Minnesota and South Dakota. It consists of a hundred 1.5 MW GE WTGs for a combined 150 MW total capacity. The second one, called Dillon, is placed in California with 45 1 MW Mitsubishi WTGs.

The total production for these two wind farms will be equivalent to the demand of about hundred thousand households, avoiding the emission of four hundred thousand tons of CO_2 (a main greenhouse gas) a year.

Iberdrola Renovables points to the United States as a key market for its growth strategy for the next three years. The company is developing a wind power project portfolio that amounts to 22,000 MW, over half its worldwide portfolio. Iberdrola states that its renewable generation in that country grew last year to 5,234 GWh, 36% of its total electrical generation.

Furthermore, Iberdrola has finished some corporate operations, as the acquisition of the American CPV Wind Ventures and the integration of the renewable actives of Scottish Power-PPM Energy. Also, Iberdrola has carried out an increase in its share in the Greek society Rokas to over half its capital and subscripted strategic agreements with the Italian company API.

Acciona: 80% of its projects are overseas

At the end of 2007 Acciona had already built 28 wind farms (see table III.03) and put its aim in international projects for good. Wind farms built by Acciona overseas are located in the USA, Canada, Germany, Australia, Italy, Greece, Hungary,

France, India, Portugal and Morocco. Of the total 134 of them, reaching 3,824 MW, 3,030 MW belong to the company. Wind farms built for third parties, amount to 1,472 MW in 58 locations.

Currently, Acciona is building wind farms in most of the previously listed countries and in others, such as Mexico and South Korea (see table III.04). Among its projects in process, there are some in other countries, such as the UK, Croatia, Poland and Slovenia.

The total wind power in construction belonging to Acciona Energía at December 31, 2007 added up to 607 MW in international wind farms. The company has currently wind farms under construction in eight countries, two of them without prior wind farms by Acciona – South Korea and Mexico – as said before.

Among them there is the wind farm Waubra in Australia with 186 MW, 50% belonging to Acciona, expected to be finished in 2008. There is also the Eurus wind farm in Oaxaca (Mexico), with 300 MW which belongs to Acciona and was started at the end of 2007 and will last through 2008 and 2009. Acciona is building in Korea the Yeong Yang wind farm with 61.5 MW.

Acciona has installed three wind farms in the USA: Tatanka, with 180 MW, between North and South Dakota; Velva with (11.88 MW) in North Dakota, both with a 100% share, and Blue Canyon in Oklahoma, with 72.5 MW with a small share. Therefore, Acciona's wind farms in the country add to 266.13 MW, 191.88 of which belong to the company. Acciona is developing more than 60 projects in 20 states of the USA, which amount to over 10,000 MW.

As for manufacturing facilities, Acciona has a WTG assembly plant in West Brach (Iowa) that started in 2007. By 2009 it will produce 450 WTGs a year.

Acciona is building the Anabaru wind farm with 16.5 MW. It is also building another three wind farms that began construction in 2007:

- 18 MW in the Sardinha wind farm (Portugal)
- 12.75 MW in the Isola wind farm (Italy)
- 11.9 MW in the Panachaiko II wind farm (Greece)

Table III.04
Wind farms in construction by Acciona

WIND FARMS IN CONSTRUCTION BY ACCIONA			
COUNTRY	Nr of WIND FARMS	TOTAL POWER (MW)	OWNED POWER (MW)
Australia	1	186.00	93.00
Mexico	1	300.00	300.00
Italy	1	12.75	12.75
South Korea	1	61.50	61.50
Portugal	1	18.00	18.00
Greece	1	11.90	11.90
India	1	16.50	16.50
Total	**7**	**606.65**	**513.65**

Source: ACCIONA

Endesa´s developments in Portugal, Greece and Latin America

The international wind power development of Endesa is organic and has been focused in three separate matters:

- Grow from its own portfolio in mature markets with stable regulatory frameworks (Portugal).
- Market development through joint-ventures with representative companies from each country (Greece).
- Promotion of more stable regulatory frameworks for less developed markets where Endesa has a strong territorial presence (Latin America).

Endesa installed 128 MW in 5 wind farms in Portugal during 2007, increasing its installed power to 321 MW at the end of the year, a 39% increase. The participation of Endesa in the consortium Eólicas de Portugal, which was awarded 1,200 MW in a tender in 2006, will allow Endesa to keep on growing fast and secure in the country for the next few years.

Endesa is developing an important wind power growth plan in Greece through the joint-venture with Endesa Hellas, where Endesa owns a 50.01% share. The 17 MW wind farm in the West Macedonia region constitutes the first landmark.

The total wind power installed by Endesa in Italy increased greatly in 2007 with the commissioning of 188 MW, finishing the year with 246 working MW in 9 wind farms, though two of them had not yet reached nominal capacity. In France, Endesa started a 10 MW wind farm and owns a portfolio of wind farms in development and construction of 174 MW.

Endesa has started its development with the construction of 18 MW in Canela (Chile), while working actively for the establishing of specific regulatory frameworks throughout the region.

WIND FARMS OWNED BY EDP RENOVÁVEIS	Nr of Wind Farms	Total Power (MW)	Proyect develop-ment	Acquired projects in construction or active
France	8	87	42	44
Portugal	31	424	321	103
USA	11	1,490	1,478	12
Total	**50**	**2,001**	**1,841**	**159**

Table III.05
Wind farms, power and projects by Neo Energía

Neo Energía, third operator in France

Neo Energía has recently acquired wind power shares from the Eole 76 group and Eurocape, both in France. The acquisition consists in three operating wind farms in the Normandy region with a total capacity of 35 MW and an average capacity factor of 27%, as well as several wind farm development projects, mainly in the Rhones-Alps and Normandy regions. With this operation, Neo Energía becomes the third renewable operator in France.

From the total developing projects, there are currently 8 MW in construction, 12.5 MW have all the necessary construction permits and the commissioning is expected between 2009 and 2010. Also, 43 MW have already construction licenses.

Other Companies

Ecotècnia has installed 20 wind farms during 2007 and has 11 in construction. The company keeps expanding with wind farms in France, Italy, Portugal, India, Cuba and Japan.

Unión Fenosa, the third electrical company in Spain, seeks to build two wind farms in Mexico, a 500 MW one, which could be enlarged to 1,000 MW in Baja California and a 250 MW one in Oaxaca. There are developing projects in Panama for a combined 10 MW, 50 MW in Costa Rica and 60 MW in Brazil.

The Barcelonan company **Fersa Energías Renovables** is expecting to carry out the largest investment of an Spanish company in China, with a project for the development of one of the largest wind farms in the world, between 1,000 and 2,000 MW.

Eozen, devoted to the manufacturing and commercialization of WTGs and large wind blades has recently finished the manufacture of the first WTGs (synchronous generators, power electronics, nacelles and control systems) for the Indian company Nuziveedu Seed Limited for the wind farm Bhimasamudra, in the state of Karnataka (south India). This wind farm will be finished by the second trimester of 2008 and will have in its first phase, a capacity of 18 MW.

Garrad Hassan, devoted to engineering and technical consultancy in the wind power sector, has confirmed that the Moroccan Grid Operator has hired them as technical consultants for the international call for projects for the installation of a 300 MW wind farm in the southern region of Tarfaya.

III.2 Pioneers in Grid Integration

Control centres make wind power integration compatible with system security

The significant growth of wind power in Spain during 2007 has made this energy source the fourth technology in electricity generation, overtaking large hydro in total production for the first time.

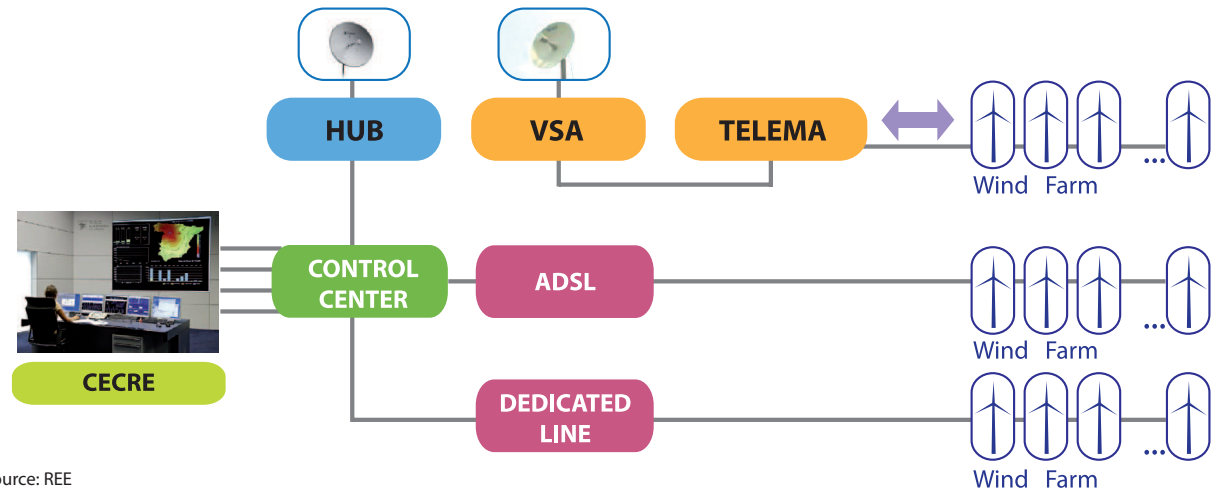
Also the Ministry of Industry, Tourism and Commerce in the electricity and gas sector planning 2008-2016, foresees by 2016 a total of about 29,000 MW installable wind power. Both facts make the collaboration between the wind power sector, the electricity distribution companies and the Spanish system operator (REE) necessary in order **to increase wind power grid penetration in the best security conditions.**

In order to achieve this common goal, it is necessary the establishment of control centres and the connection to them, the adequacy in the response to voltage dips for new wind farms and the finding of solutions for older ones, according to the Procedure for Verifying, Validating and Certifying the response of wind farms according to the P.O. 12.3 and reactive power control.

Generation control centres

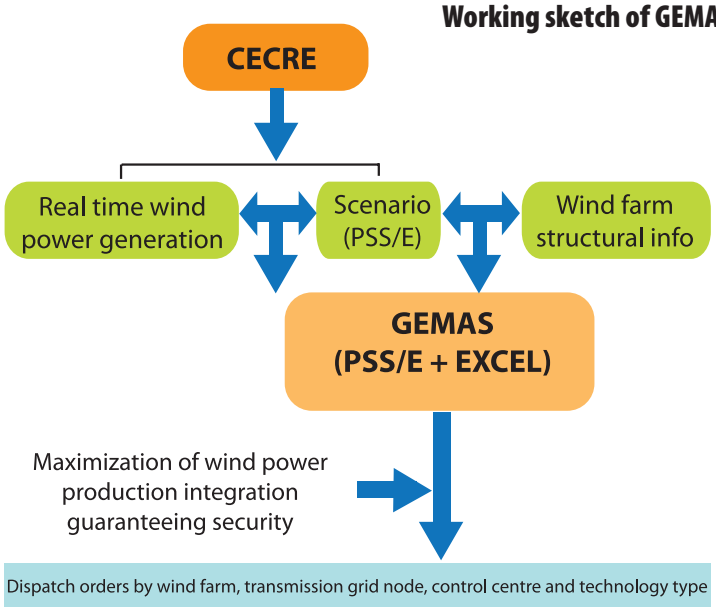
Due to the importance level of electricity demand coverage reached by wind power it is necessary a certain control over the wind farms by

Diagram III.01
Sketch of the CECRE work



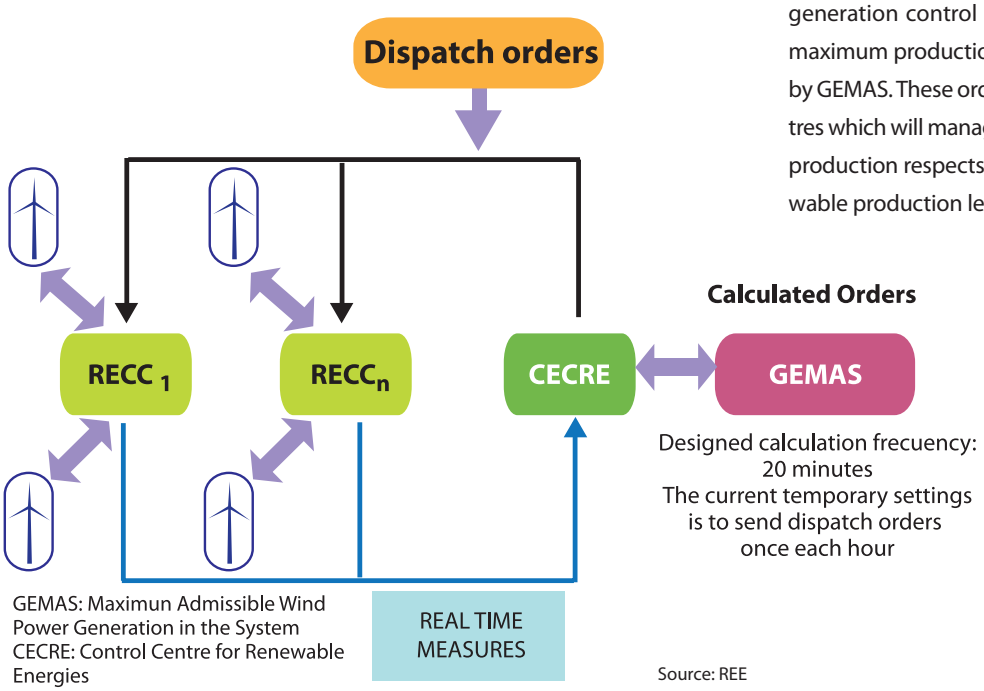
Source: REE

Diagram III.02
Working sketch of GEMAS



Source: REE

Diagram III.03
GEMAS dispatch order calculation



Source: REE

the System Operator in order facilitate the integration of wind power in a compatible way with system security depending on its needs. Therefore, Red Eléctrica has developed the CECRE, a control centre for renewable energies, the only one worldwide with these characteristics from which the generation of all wind power producers in our country (see diagram III.01) can be controlled and coordinated. With this wind farm management tool, Spain becomes the first country to have all of its wind farms with a capacity larger than 10 MW connected to a control centre.

According to REE, by the end of February 2008, the system had already 21 generation control centres with 13,154 MW wind power generation connected to them.

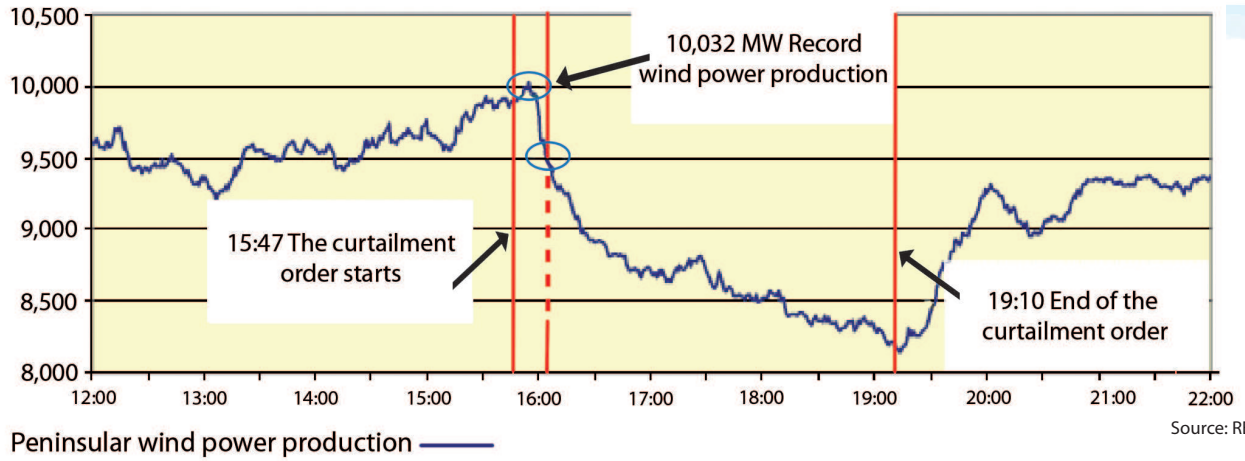
The CECRE allows a greater integration of Special Regime generation in a way compatible with system security, since it allows replacing hypotheses of local or global simultaneity and preventive criteria with real time control of the production. For that purpose, the **GEMAS (Maximum Admissible Wind Power Generation in the System** in its Spanish acronym) tool has been designed and developed by REE.

Once the wind farms are connected to the generation control centres, the CECRE sends the maximum production limits calculated in real time by GEMAS. These orders are sent to the control centres which will manage them so that the wind farms' production respects the calculated maximum allowable production levels.

Production curtailment in March 2008

Figure III.01

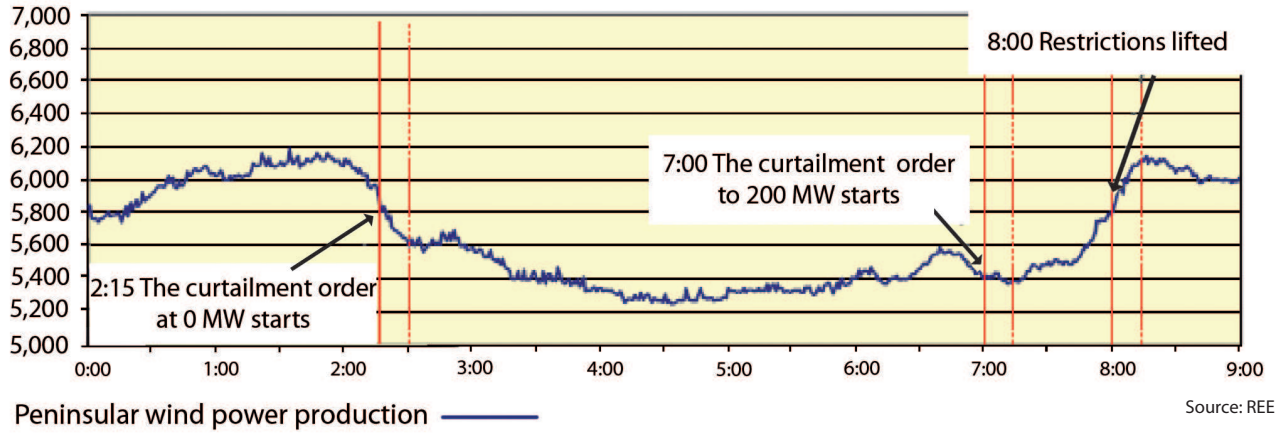
Production curtailment because of voltage dips (04/03/2008)



Source: REE

Figure III.02

Production curtailment because of overloads (07/03/2008)



Source: REE

Gemas is an application established automatically and cyclically, it executes every 20 minutes and is prepared to do it every 10. Its input variables are the real time productions of each of the wind farms – currently about 450 – and the current state of the transport-generation system (output in PSS/E format of the state estimator). It also accesses structural data from the wind farms: connecting node, installed power, fault ride-through capacity, etc. Its output variables are the maximum production levels – dispatch orders – for each wind farm and the aggregated order for each control centre, Transport Grid node and technology type (see diagrams III.02 and III.03).

The calculus process by GEMAS comprises the following stages:

This year's new wind farms must comply with O.P. 12.3 in order to receive the premium

- To identify the current maximum possible wind power production loss.
- In case this loss is higher than the maximum admissible, to determine the dispatch orders so as to maximize wind power integration in the system.
- To apply filters in order to strengthen and give temporal stability to the dispatch order emissions. To transform the mathematical solution into a physical operative one.
- To aggregate the calculated dispatch orders at wind farm level according to current normative, so that the dispatch orders are sent by control centre, transport grid node and technology type.

Current situation of the wind farm adjustment to withstand voltage dips. Verification Procedure (O.P. 12.3 and R.D. 661/2007)

Royal Decree 661/2007 states that any new wind farm, that is, those registered in the special regime registry RAIPRE after 01/01/2008, not adapted to comply with the O.P. 12.3 cannot receive the special regime premium. Wind farms with an earlier RAIPRE inscription have to adapt before 01/01/2010 unless they have been specifically excluded from doing it, for which they have to apply before 01/01/2009 to the Ministry, which will then send a report either admitting or rejecting exclusion based in prior consultation with REE. Old wind farms adapted may receive the corresponding bonus for up to five years.

Table III.06
Certified wind power at April 2008

MODEL	CERTIFIED POWER
AW 77/1500	154.5
AW-1500	123
ECO-74 (1.67 MW)	195.29
ECO-80 (1.67 MW)	70.38
G30 (2MW)	76
G52 (850 kW)	209.85
G52 (850 kW) and G58 (850 kW)	104.55
G52 (850 kW) and G87 (2 MW)	48.7
G58 (850 kW)	511.56
G58 (850 kW) and AE-56-800 kW	99
G58 (850 kW) and G52 (850 kW)	17.85
G58 (850 kW) and G80 (2 MW)	11.4
G80 (2MW)	278
G80 and G90 (2MW)	30
G83 (2MW)	154
G87 (2 MW)	28
G87 (2MW)	641
G87 (2MW) and G80 (2MW)	68
G87 and G90 (2MW)	49.5
G90 (2MW)	451.5
V90 (1.8 MW)	19.8
V90 (1.8 MW) and V90 (2 MW)	63
V90 (1.8 MW) and V90 (3 MW)	36.4
V90 (1.875 MW)	88.125
V90 (2 MW)	116
V90 (850 kW)	17
TOTAL	**3,662.405**

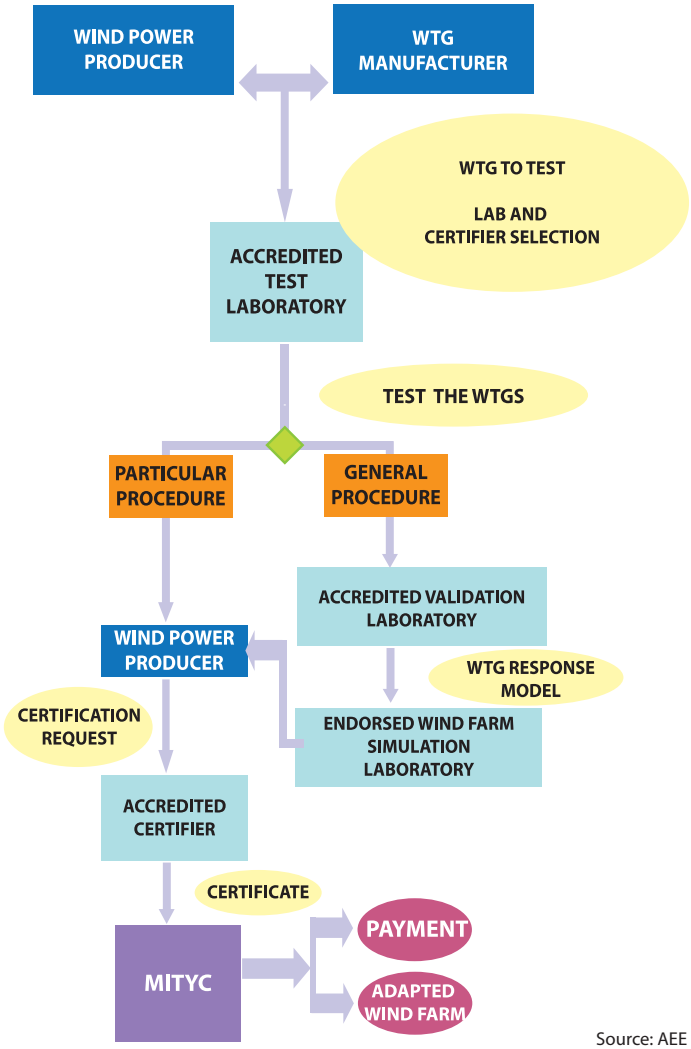
Source: AEE

In any case, failure to comply limits collecting the special regime premium, though the wind farms may connect and access the grid.

In April 2008, there were already 129 certified wind farms, meaning 3,662 MW. About 700 MW request certification every month.

10,000 MW are in evaluation processes for technical solution or certification. About 6,000 of them are in principle adaptable through the general or the particular procedure. The remaining 3,500 MW (G47 models and squirrel-cage rotors whether old or new) are been actively studied for viable solutions.

Diagram III.04
General design for PVVC compliance



Source: AEE

Chapter IV

WIND POWER ACCOUNTING: RETRIBUTION AND RETURNS

IV.1 Retribution

The **Royal Decree 661/2007** was passed on May 26, 2007. It substitutes RD 436/2004 **and regulates electricity production in the special regime**. The new Royal Decree is in place since June 1, 2007 and keeps the retribution structure of RD 436/2004: regulated tariff and market.

Additionally, the **Royal Decree-Law 7/2006** of June, 23, **by which urgent measures in the electrical system are adopted**, established in section 2 of the second Transitory Disposition that the revision of the average tariff by the Government will not be applied to prices, premiums, bonuses and tariffs belonging to the retribution of electricity production in the special regime. Therefore, the calculation of the premiums, bonuses and tariffs from RD 436/2004 will be made based on the Average Reference Tariff (TMR in its Spanish acronym) of 2006, that is, on 76.59 €/MWh.

January 1, 2008 is a key date after the approval of the RD 661/2007, since wind farms with the definitive certificate for setting up installation prior to January, 1 2008 may choose before January 1, 2009 in which retribution option they whish to remain: either select the retribution stated in the RD 661/2007 or keep in the transition regime allowed by the first Transitory Disposition of the RD 661/2007. New wind farms though, will hold to the retributive system detailed in the RD 661/2007.

The former wind farms, the ones with the definitive certificate for setting up installation prior to January 1, 2008, will therefore be able to opt for the RD 661/2007 or for the TD 1 of the RD 661/2007, which is defined as:

Regulated tariff from 436/2004: if this option is selected, it will be for the remainder of the wind farm's lifespan, without the chance to swap options.

Market according 436/2004: if this is the chosen option, the wind farm may retain the values for premiums and incentives established in the RD 436/2004, up to December 31, 2012. From then on, they change automatically to the RD 661/2007.

New wind farms will opt for the new retributive system stated in the RD 661/2007, which keeps both retributive options (article 24): regulated tariff (the same regardless the starting year of the wind farm) and market, both options irrespective of capacity values of the wind farm. In the latter, a cap and floor system is introduced to the premium depending on market prize evolution:

Regulated tariff according to the RD 661/2007 (option *a*) of article 24 of the RD 661/2007): to give the energy to the system through the distribution or transport grid and to receive a regulated tariff for it, the same one for all time periods. This tariff is:

- 7.3228 cent€/kWh for the first 20 years.
- 6.12 cent€/kWh from 20 years on.

The market according to the RD 661/2007 (option *b*) of article 24 of the RD 661/2007): all installations regardless of installed capacity will receive a variable premium depending on the reference

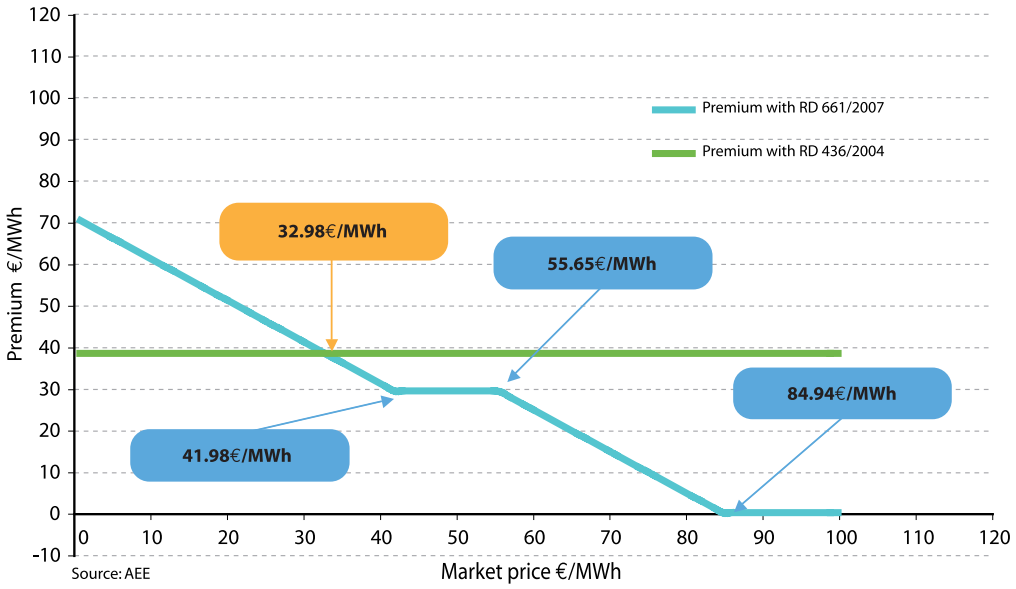


Figure IV.01
Evolution of the premium depending on market price. Values for 2007

market prices. There are also a cap and a floor for the sum of the reference market price and the premium during the first 20 years of the installation.

Furthermore, the calculation of the premium will be made according to the hourly price of the reference market as indicated in the section 2 of the article 27 of the RD 661/2007: in the case of selling the energy through the offer system managed by the electrical market operator OMEL, as well as for the acquisition contracts between the owners of the installations and the market agents whose energy is sold in the offer system, the market reference price will be the hourly price of the daily market. For the remaining possibilities, the reference price will be the one resulting from the bidding system regulated by the Order ITC 400/2007.

Figure IV.01 shows the evolution of the premium according to the following outline:

Where:

P: Price

Pref: Reference Premium

Pr: Premium

LL: Lower Limit

UL: Upper Limit

The evolution of the premium of the RD 661/2007 with the reference to the market price, compared with the one from the RD 436/2004, fixed for all market prices (38.295 €/MWh), has the following phases:

• For prices lower than 32.98 €/MWh, the premium with the RD 661/2007 is higher than the one with the RD 436/2004.

• For market prices lower than 41.98 €/MWh

- **If P + Pref ≤ UL → Pr = LL – P**
- **If LL ≤ P + Pref ≤ UL → Pr = Pref**
- **If UL – Pref ≤ P ≤ UL → Pr = UL - P**
- **If P ≥ UL → Pr = 0**

Only for market prices lower than to 32.98 €/MWh, the premiun with Royal Decree 661/2007 is higher tjan the one with teh Royal Decree 436/2004

the premium with the RD 661/2007 decreases and is set on the retribution floor.

• For market prices between 41.98 €/MWh and 55.65 €/MWh the premium is constant at the reference level.

• For prices between 55.65 €/MWh and 84.95 €/MWh the premium decreases and is set on the retribution cap.

• For prices higher than 84.94 €/MWh, the premium is zero.

In the following figure (see figure IV.02), the evolution of the regulated tariff and the market price plus the premium is shown, comparing the RD 436/2004 with the RD 661/2007.

Figure IV.02
Evolution of Pool+Premium depending on market price. Values for 2007

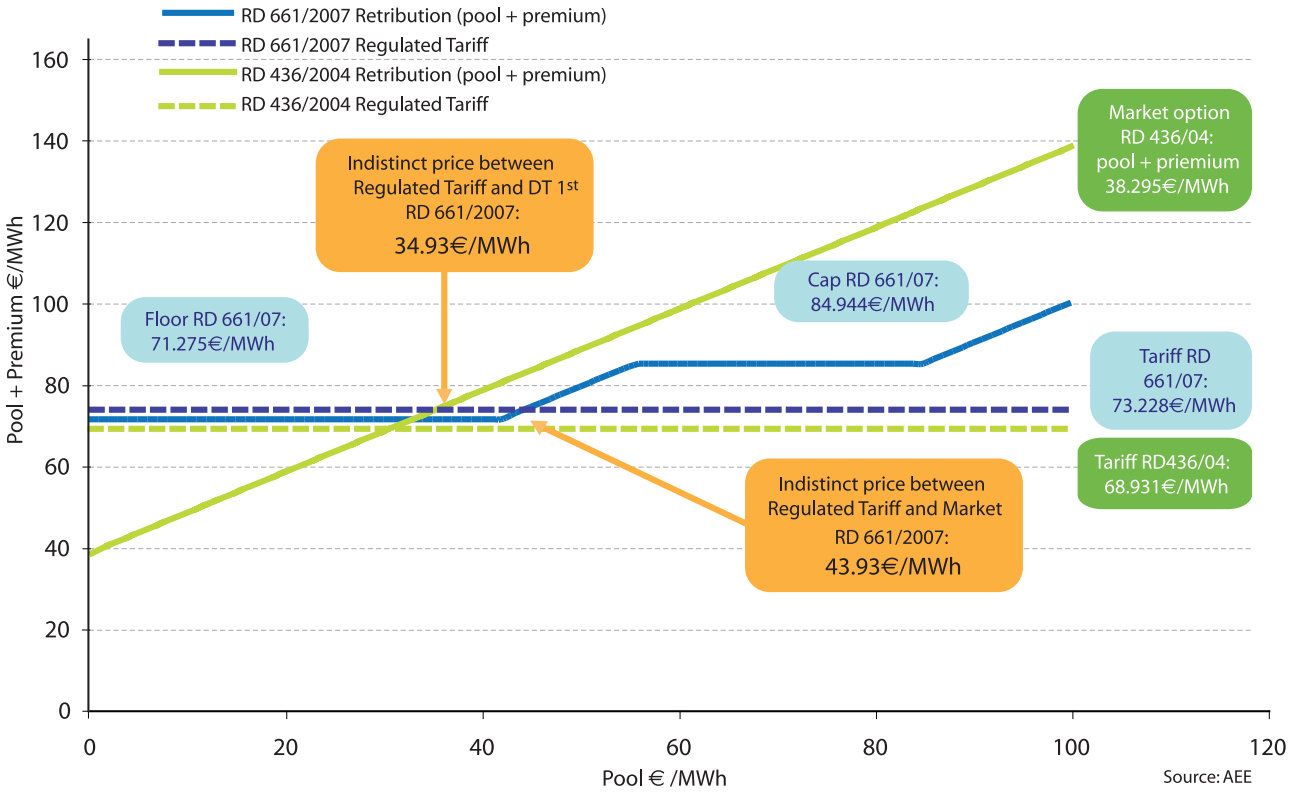


Table IV.01
Evolution of the regulated tariff, reference premium, upper limit and lower limit

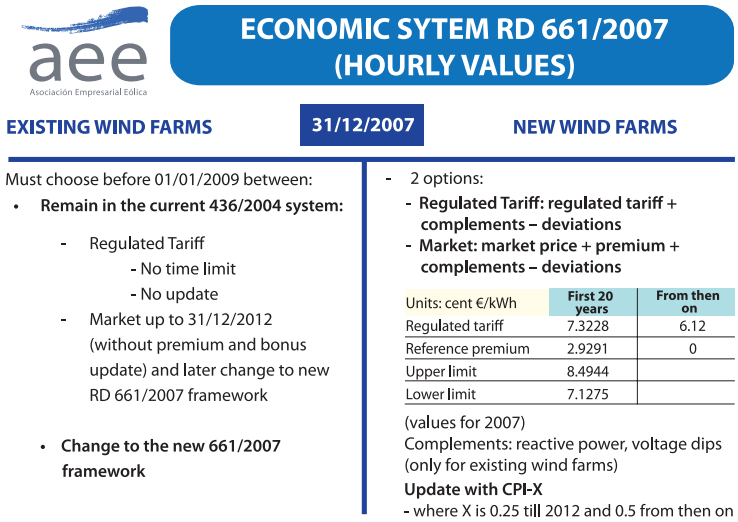
	Units: €/MWh	2007	2008	2009	2010	2011	2012	2013	2014	2015
RD 661/2007	Regulated Tariff	73.228	75.681	77.762	79.901	82.098	84.356	86.465	88.626	90.842
	Reference Premium	29.291	30.272	31.105	31.960	32.839	33.742	34.586	35.450	36.337
	Upper limitt	84.944	87.790	90.204	92.684	95.233	97.852	100.298	102.806	105.376
	Lower limit	71.275	73.663	75.688	77.770	79.909	82.106	84.159	86.263	88.419
	CPI*		3.0%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
	X Factor		0.25%	0.25%	0.25%	0.25%	0.25%	0.50%	0.50%	0.50%

* Value for 2008 updated in RD 222/2008, of February 15, by which the retributive regime of electricity distribution is established. For later years the values are estimated.

Future evolution of the previous concepts is shown in table IV.01.

As summary, the outline of the different retribution systems is shown in figure IV.03.

Figure IV.03
Economic system RD 661/2007



Generally speaking, the retributive scheme is considered adequate since it guarantees the viability of the wind farms if maintenance costs and investments keep the foreseen path.

Retribution for complements. Capacity guarantee

Since the enforcement date of the RD 661/2007, technologies with non-dispatchable primary energy, as the wind power is according to REE criteria, will not have the right to claim retribution for capacity guarantee (second additional disposition RD 661/2007).

Since the enforcement date of the RD 436/2004 and until May 31, 2006, and if there have not been five years of measured net production, the capacity guarantee retribution for said installations will be calculated valuing net production 0.48 cent€/kWh (ninth transitory disposition RD 661/2007).

The payment of the capacity guarantee of Royal Decree 661/2007 is considered discriminative for the Wind Energy Sector

The wind energy sector considers this situation discriminating if compared to other generation sources and also, given that the different wind basins are complementary, wind farms are able to guarantee a minimum coverage of the demand.

Complement for reactive power

The new complement for reactive power has a similar scheme as the previous one (see table IV.02), based on a reference value established in the article 29 of the RD 661/2007, which is updated based on CPI minus a correction value.

Hourly values are used instead of quarter of hourly ones and dispatches are introduced. This latter point is important, since dispatches seek results at the wind farm's grid connecting point but measurements are made at the wind farm's substation which may cause linearity problems between cause and effect.

Table IV.02
Comparative of the complement for reactive power in RD 436/2004 and RD 661/2007

	Royal Decree 436/2004	Royal Decree 661/2007
CONCEPT	Calculated as a % of the average reference tariff	Fixed as a % of the reference value
Value (cent€/kWh)	TMR year 2006: 7.659	7.8441 * (value for 2007)

*Updated by CPI-X; where X is 25 basic points until 31/12/2012 and 50 basic points from then on.

Complement for voltage dips

Wind farms with definitive registration in the Administrative Registry of Special Regime Production Installations (RAIPRE) prior to January 1, 2008 that prove compliance with voltage dip re-

quirements may receive a specific complement for a maximum period of five years or at the latest until December 31, 2013.

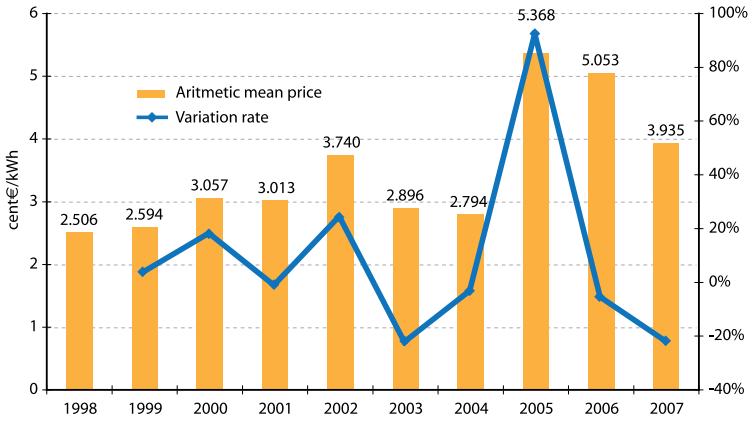
This complement will be of 0.38 cent€/kWh, revised every year according to CPI increase minus 25 basic points until December 31, 2012 and 50 basic points from then on (Seventh Additional Disposition).

Evolution of the daily market

The arithmetic average price of the daily market in 2007 (see figure IV.04) has been of 39.3462 €/MWh, a 22% decrease over 2006, with 50.53 €/MWh and a little more over 2005, which with 53.68 €/MWh is until now the year with the highest average price. The 39.3462 €/MWh price of 2007 is similar to the one registered in 2002 with 37.4 €/MWh and clearly higher than the ones for 2003 (28.96 €/MWh) and 2004 (27.94 €/MWh).

Figure IV.04

Yearly evolution of the daily market price and variation rate 1998-2007

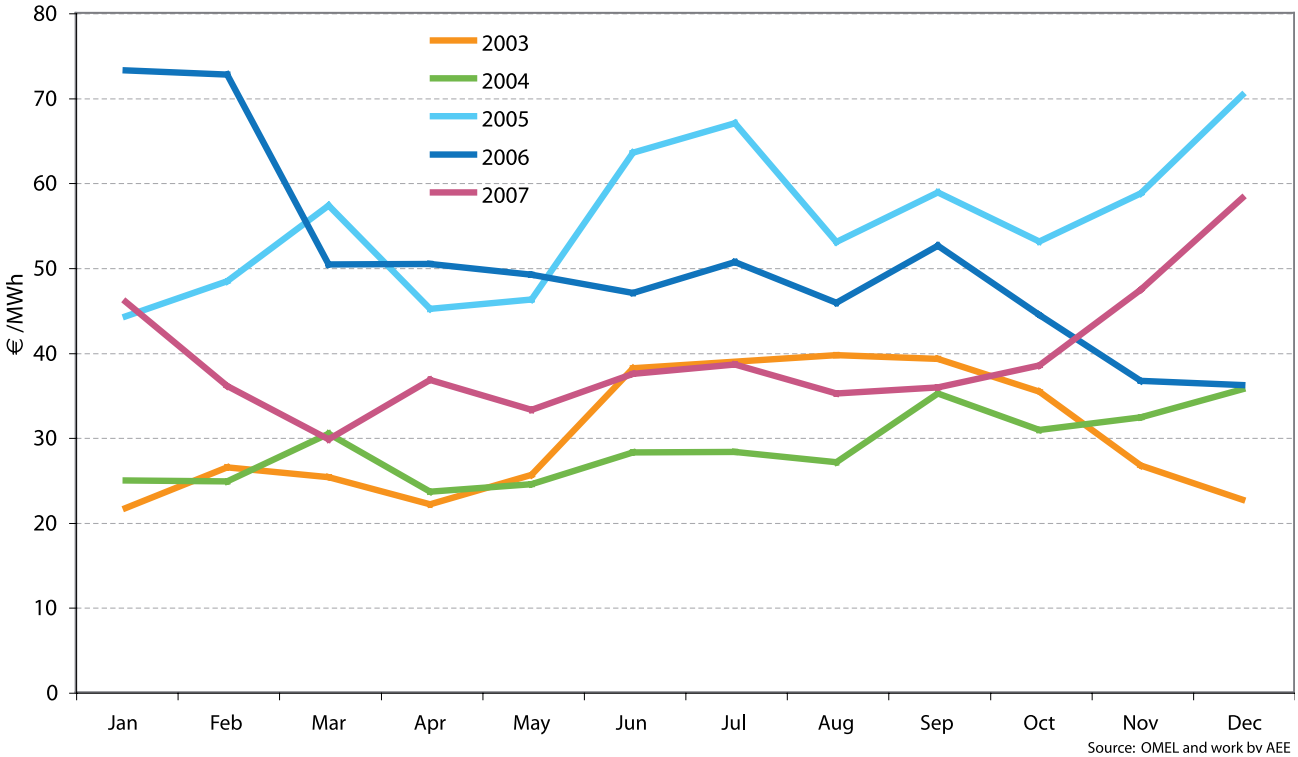


Source: OMEL and work by AEE

During the first months of the year, the prices where close to 2003-2004 levels (see figure IV.05) but as in other years, the average daily market price increased both in November and December reaching values of 47.3 €/MWh and 58.11 €/MWh respectively.

Figure IV.05

Monthly evolution of the daily market price. 2003-2007



Source: OMEL and work by AEE

The causes behind the price increments in the last two months of 2007 may be due to several factors: high demand due to low temperatures caused by anticyclones, low wind power generation and drought during the last quarter and partially due to strategic stocks of hydraulic reserves to be used in the coming winter.

The prices in the Spanish market were for the most part of 2007 similar to the main European markets (see figure IV.06).

On the other side, the total energy acquired in the daily market in 2007 (see figure IV.07) has been 195,183 GWh, a 66% increase over 2006 (117,811 GWh). This increment is due to the removal of the energy assimilation mechanism between buy/sell offers in the daily market belonging to the same business group, established in the Royal Decree Law 3/2006.

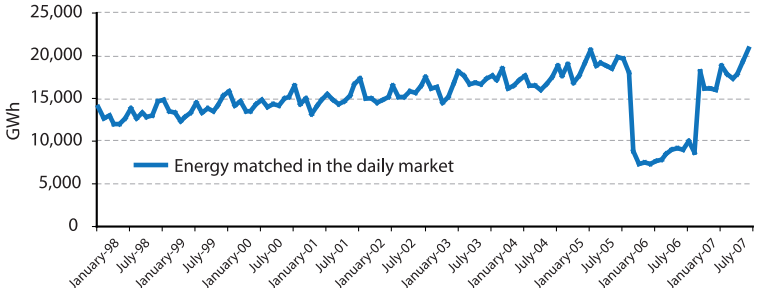
Other markets

CESUR BIDS. Order ITC 400/2004 regulates bilateral agreements signed by the distributing companies for the supply to tariff in the peninsular region (CESUR bids).

They are quarterly bids in which distributing companies acquire part of the energy they need for the next three months. They are arranged by the National Energy Commission.

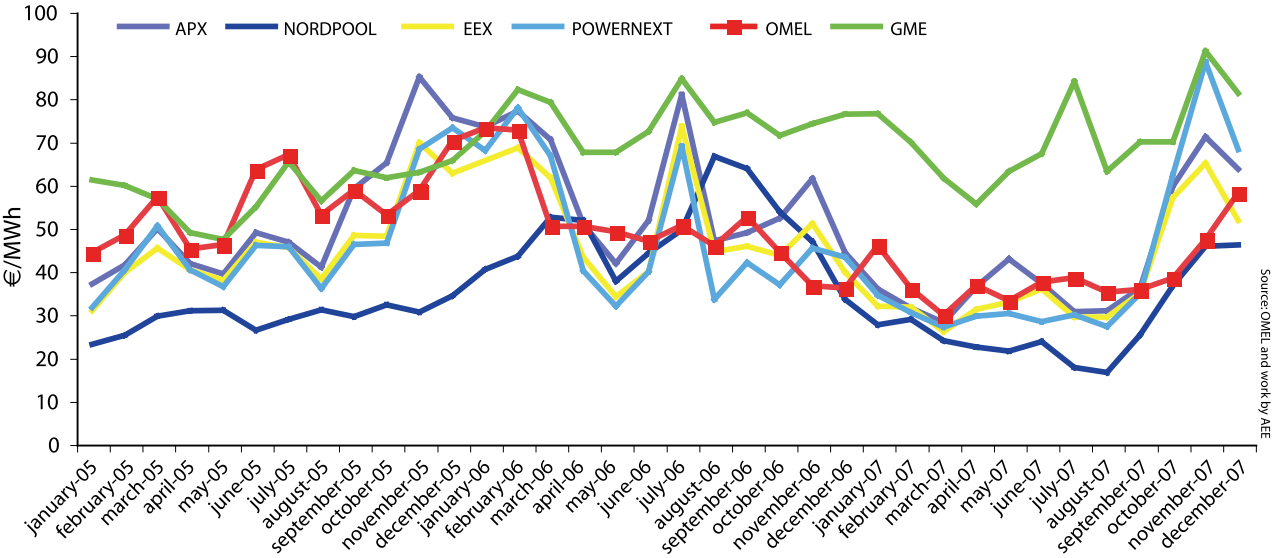
The Energy managed through the daily market has not been reduced due to the bidding system, since the second transitory disposition of Order ITC 400/2007 requires the sellers to make acquisition offers in the daily market for a total energy like the one committed in the bids at a price showing the opportunity costs for each seller.

Figure IV.07
Energy matched in the daily market. 1998-2007



Source: OMEL and work by AEE

Figure IV.06 Comparative of monthly average prices on the main international markets. 2005-2007



Source: OMEL and work by AEE

Table IV.03 Summary of the results of the CESUR bids

	1st Bid	2nd Bid	3rd Bid	4th Bid	
Delivery time	3rd quarter 2007	4th quarter 2007	1st quarter 2008	2nd quarter 2008	April-September 2008
Opening price	70 €/MWh	60 €/MWh	85 €/MWh	85 €/MWh	85 €/MWh
Closing price	46.27 €/MWh	38.45 €/MWh	64.65 €/MWh	63.36 €/MWh	63.73 €/MWh
Energy bid	6,500 MW	6,500 MW	6,500 MW	3,500 MW	3,500 MW

The fourth CESUR distribution bid for long term purchase by the distribution companies was celebrated on Thursday May 13, 2008 and from this bid, two products were simultaneously bid: quarterly base load and half year base load.

Table IV.03 shows a summary of the bids.

VIRTUAL POWER PLANT CAPACITY. VPP capacity is represented by a set of hourly call options giving the buyer the right to nominate energy for delivery at a pre-defined strike price.

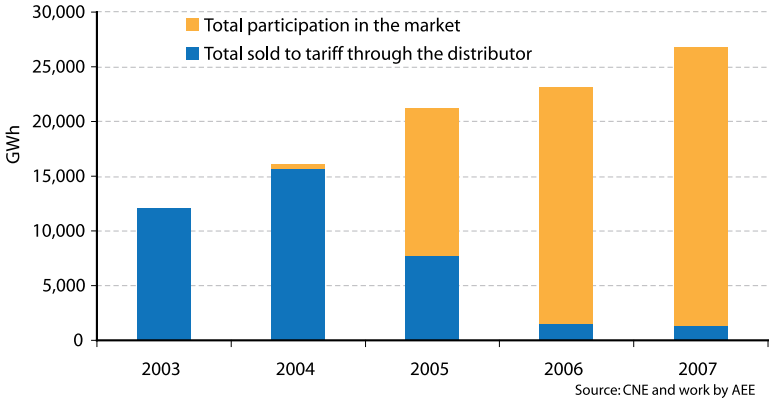
Endesa and Iberdrola celebrate quarterly bids in several rounds where they put up for sale part of their total generation capacity. The offered products are base and peak options, with settlement at delivery. The calendar, volume and reserve prices are decided by the Ministry of Industry, Tourism and Commerce. Subsidiaries of Endesa, Iberdrola and Unión Fenosa are not allowed to participate as buyers.

Wind power retribution

Wind power participation in the daily electricity production market has been kept during 2007, reaching a 95% of the total wind power production at the end of the year (see figure IV.08).

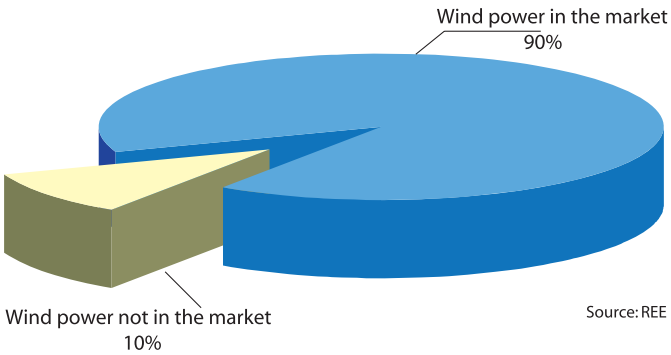
At the end of the year, there was a decrease of the participation in terms of total installed capacity has been observed (down to 90%), according to data by REE (see figure IV.09). This might be caused by the amount of wind farms in testing and start-up phases.

Figure IV.08
Participation of wind power in market and regulated tariff. 2003-2007



Source: CNE and work by AEE

Figure IV.09
Participation of wind power in the electricity market. End 2007



Source: REE

Also, another well known effect is that wind power sees lower prices than the whole of the system, since wind power production is higher at times when the price is low, precisely because of wind power production leaves out more expensive technologies. During 2007, the **average price** perceived by wind power was a 3.54% lower than the

arithmetic average price of the system (see figure IV.10). This is an average value, since certain wind farms might be better adapted to the load curve than others.

The **average retribution** in the market option in 2007 according to the RD 436/2004 has been a 12.6% higher than the retribution in the regulated tariff (90% MRT for 2006) as shown in figure IV.11.

On the other side, the **average premium** in 2007 according to the RD 661/2007 (see figure IV.12), has been 34.8 of €/MWh. The average retribution during the year was therefore of 74.14 €/MWh, a 5% lower than the average retribution in the market option of the RD 436/2004. As for regulated tariff, with the new RD it is a 4.3 €/MWh higher.

We must point out, **that the cap and floor adopted in the RD 661/2007 is applied hourly**, so if we compare the calculation of the hourly premium against a hypothetical monthly calculation, we can see that for low prices, the premium calculated hourly is higher than the one calculated monthly. Results are shown in table IV.04. If the retribution differences are studied monthly, the conclusion is as expected, for higher market prices, the differences are also higher, as shown in table IV.05 for November and December.

Since the enforcement of the RD 661/2007, the premium with this new regulation has been lower throughout the period than the one set in the RD 436/2004 (38.295 €/MWh), as shown in figure IV.13.

Retribution for 2008

With the updated data for the upper and lower limits, premium and regulated tariff, the evolution of pool+premium and regulated tariff, according to the RD 661/2007 and the RD 436/2004 is the following:

Wind farms with definitive certificate for setting up installation prior to December 31, 2007

Figure IV.10
Comparative between average price seen by wind power and arithmetic average price of the daily market. 2007

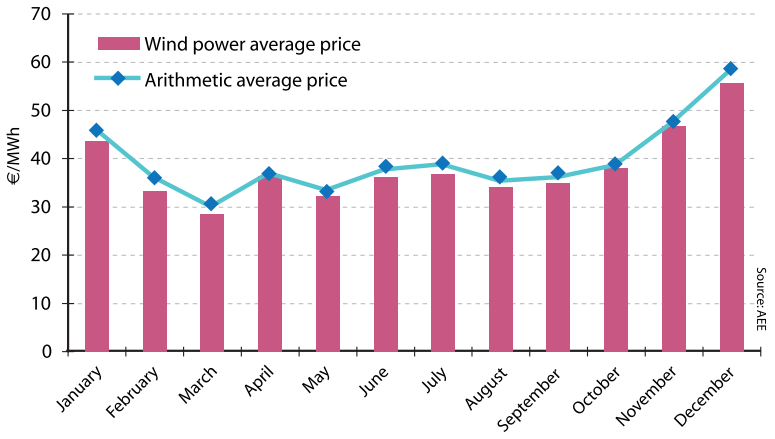
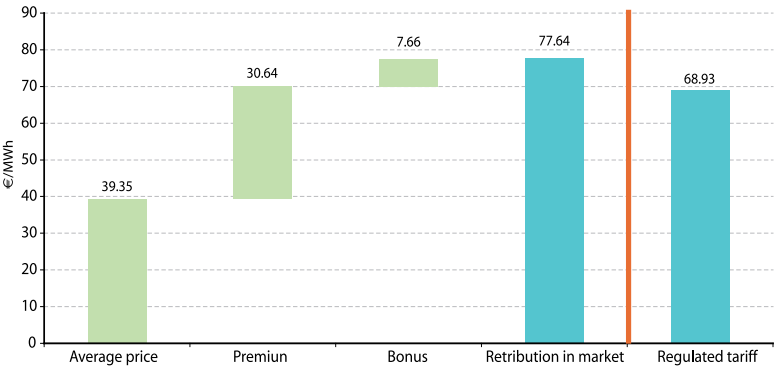


Figure IV.11
Retribution according to RD 436/2004. 2007



Source AEE

Figure IV.12
Retribution according to RD 661/2007. 2007

Source AEE

Table IV.04
Comparative between hourly calculation and monthly calculation of RD 661/2007. 2007

	Monthly average price	Average premium with RD 661 (MONTHLY CALCULATION)	Average premium with RD 661 (HOURLY CALCULATION)	Difference (Hourly Calc - Monthly Calc)
January	45.86	29.29	31.18	1.89
February	35.96	35.32	37.50	2.19
March	29.68	41.60	41.94	0.35
April	36.66	34.62	35.90	1.29
May	33.13	38.15	38.47	0.32
June	37.40	33.88	36.42	2.54
July	38.48	32.80	35.15	2.36
August	35.05	36.23	37.34	1.11
September	35.80	35.47	36.52	1.05
October	38.38	32.90	34.87	1.97
November	47.30	29.29	29.98	0.69
December	58.11	26.84	22.31	-4.52
PERIOD YEAR 2007	**39.35**	**33.86**	**34.80**	**0.94**

* Premium + bonus RD 436 = 50% TMR 2006

Source: AEE

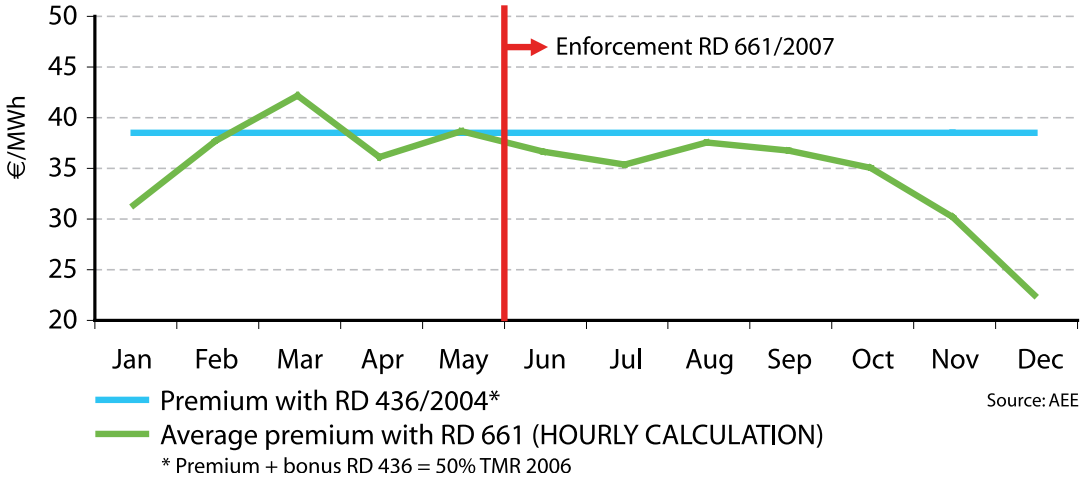
Table IV.05
Monthly analysis of the retribution according to RD 661/2007 and RD 436/2004. 2007

	Monthly average price	Average premium with RD 661 (HOURLY CALCULATION)	POOL + PREMIUM RD 661 (HOURLY CALCULATION)	Premium with RD 436/2004*	POOL + PREMIUM RD 436/2004	Difference (Premium 661 hourly calculation Premium 436)
January	45.86	31.18	77.04	38.30	84.16	-7.11
February	35.96	37.50	73.46	38.30	74.26	-0.79
March	29.68	41.94	71.62	38.30	67.98	3.65
April	36.66	35.90	72.56	38.30	74.96	-2.39
May	33.13	38.47	71.60	38.30	71.43	0.17
June	37.40	36.42	73.82	38.30	75.70	-1.88
July	38.48	35.15	73.63	38.30	76.78	-3.14
August	35.05	37.34	72.39	38.30	73.35	-0.96
September	35.80	36.52	72.32	38.30	74.10	-1.78
October	38.38	34.87	73.24	38.30	76.67	-3.43
November	47.30	29.98	77.28	38.30	85.60	-8.31
December	58.11	22.31	80.42	38.30	96.40	-15.98
PERIOD YEAR 2007	**39.35**	**34.80**	**74.14**	**38.30**	**77.64**	**-3.50**

* Premium+ bonus RD 436 = 50% TMR 2006

Source: AEE

Figure IV.13
Monthly evolution of the premium according to RD 436/2004 and RD 661/2007. 2007



Source: AEE

* Premium + bonus RD 436 = 50% TMR 2006

Table IV.06

Number of hours in each retribution section. 2007

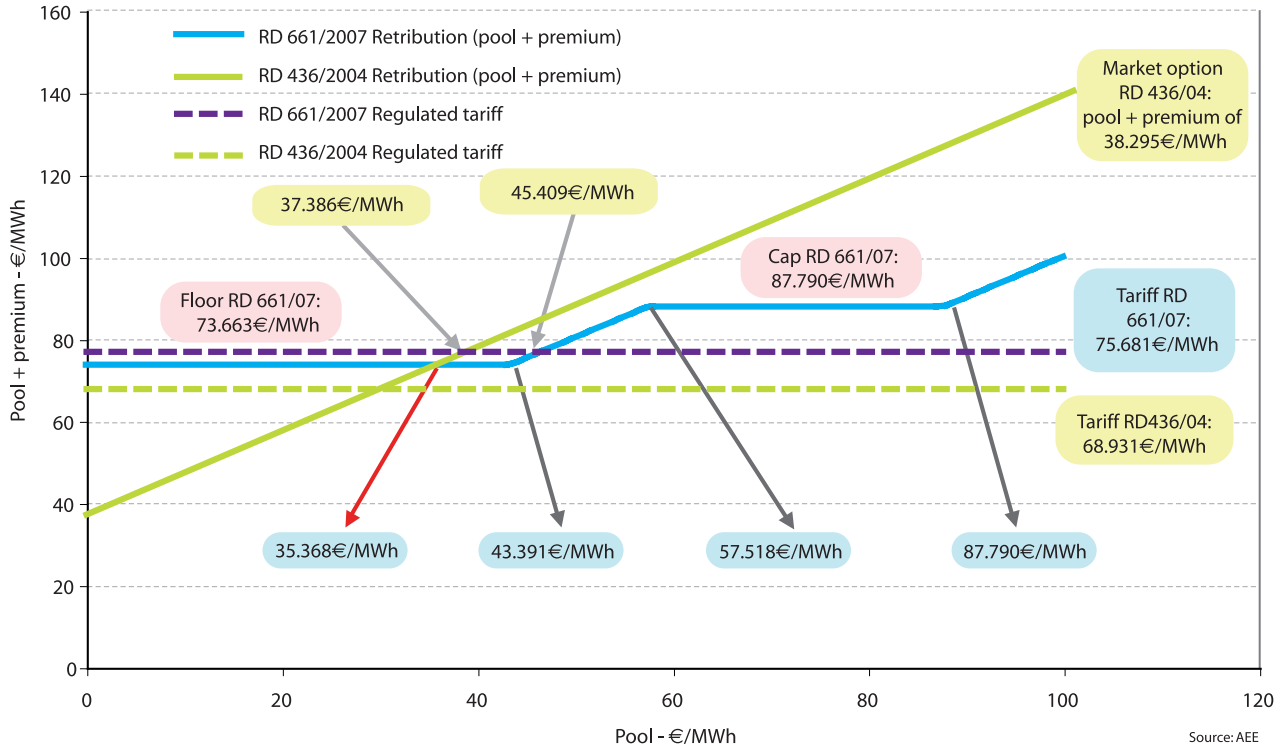
	Section Premium 661> Premium 436		Floor		2nd section (constant premium)		Cap		Premium = 0		
	Nr hours	% of total	Nr hours	% of total	Nr hours	% of total	Nr hours	% of total	Nr hours	% sobre total	Total Nr of hours
January	163	21.9%	145	19.5%	266	35.8%	170	22.8%	0	0.0%	744
February	307	45.7%	176	26.2%	134	19.9%	55	8.2%	0	0.0%	672
March	545	73.4%	150	20.2%	44	5.9%	4	0.5%	0	0.0%	743
April	288	40.0%	239	33.2%	181	25.1%	12	1.7%	0	0.0%	720
May	387	52,0%	265	35.6%	92	12.4%	0	0.0%	0	0.0%	744
June	302	41.9%	162	22.5%	218	30.3%	38	5.3%	0	0.0%	720
July	277	37.2%	189	25.4%	233	31.3%	45	6.0%	0	0.0%	744
August	344	46.2%	221	29.7%	173	23.3%	6	0.8%	0	0.0%	744
September	296	41.1%	194	26.9%	230	31.9%	0	0.0%	0	0.0%	720
October	250	33.6%	190	25.5%	287	38.5%	18	2.4%	0	0.0%	745
November	116	16.1%	155	21.5%	278	38.6%	171	23.8%	0	0.0%	720
December	16	2.2%	155	20.8%	177	23.8%	368	49.5%	28	3.8%	744
PERIOD YEAR 2007	**3,291**	**37.57%**	**2,241**	**25.58%**	**2,313**	**26.40%**	**887**	**10.13%**	**28**	**0.32%**	**8,760**

* Premium + bonus RD 436 = 50% TMR 2006

Source: AEE

Figure IV.14

Evolution of Pool + Premium depending in daily market price



Source: AEE

Table IV.07
Forecast of monthly prices and retribution in market option according to RD 436/2004 and RD 661/2007 for 2008

	SCENARIO - MEDIUM PRICE FORECAST AEE	Premium with RD 436/2004	Pool + Premium with RD 436/2004	Premium with RD 661/2007	Pool + Premium with RD 661/2007	Section	Difference (RD 436/04 - RD 661/07)
Jan-08	68.15	38.30	106.44	19.64	87.79	Floor	18.65
Feb-08	66.26	38.30	104.55	21.53	87.79	Floor	16.76
Mar-08	61.04	38.30	99.33	26.75	87.79	Floor	11.54
Apr-08	56.25	38.30	94.54	30.27	86.52	Ctnt Premium	8.02
May-08	52.30	38.30	90.60	30.27	82.57	Ctnt Premium	8.02
Jun-08	55.04	38.30	93.33	30.27	85.31	Ctnt Premium	8.02
Jul-08	61.20	38.30	99.49	26.59	87.79	Cap	11.70
Aug-08	58.72	38.30	97.02	29.07	87.79	Cap	9.23
Sep-08	61.87	38.30	100.16	25.92	87.79	Cap	12.37
Oct-08	60.10	38.30	98.40	27.69	87.79	Cap	10.61
Nov-08	55.87	38.30	94.16	30.27	86.14	Ctnt Premium	8.02
Dec-08	53.43	38.30	91.73	30.27	83.70	Ctnt Premium	8.02

Source: AEE

may choose between the transient regime established in the RD 436/2004 (1st TD of RD 661/2007) and that of the RD 661/2007.

The regulated tariff option of the 1st TD is lower than the regulated tariff set in the new RD. On the other side, for prices higher than 35.368 €/MWh it is more profitable the market option of the 1st TD of RD 661/2007, that is, to choose the market option of the RD 436/2004.

If the regulated tariff option of the RD 661/2007 is compared to the market option of the 1st TD of the RD 661/2007, the latter one is better for market prices higher than 37.386 €/MWh.

Wind farms with definitive certificate for setting up installation later than December 31, 2007 may choose between the regulated tariff option and the market option of the RD 661/2007. If both options are compared, for prices lower than 45.409 €/MWh, the regulated tariff option is better.

Table IV.07 shows the retribution forecast for the market option (pool+premium) depending on the evolution of the prices predicted by AEE for the period from January to December 2008 for a wind farm using the RD 436/2004 and another one using the RD 661/2007.

According to this forecast of the market prices for 2008, and calculating the retribution on the

forecasted monthly prices, **the retribution for a wind farm with the market option of the RD 436/2004** (1st TD RD 661/2007) **is higher than the retribution for a wind farm with the RD 661/2007.** The average difference throughout the year is of 10.92 €/MWh.

Figure IV.15
Evolution of avoided CO_2 emissions by wind power

Source: AEE estimate

IV.2 Returns

Environmental benefits

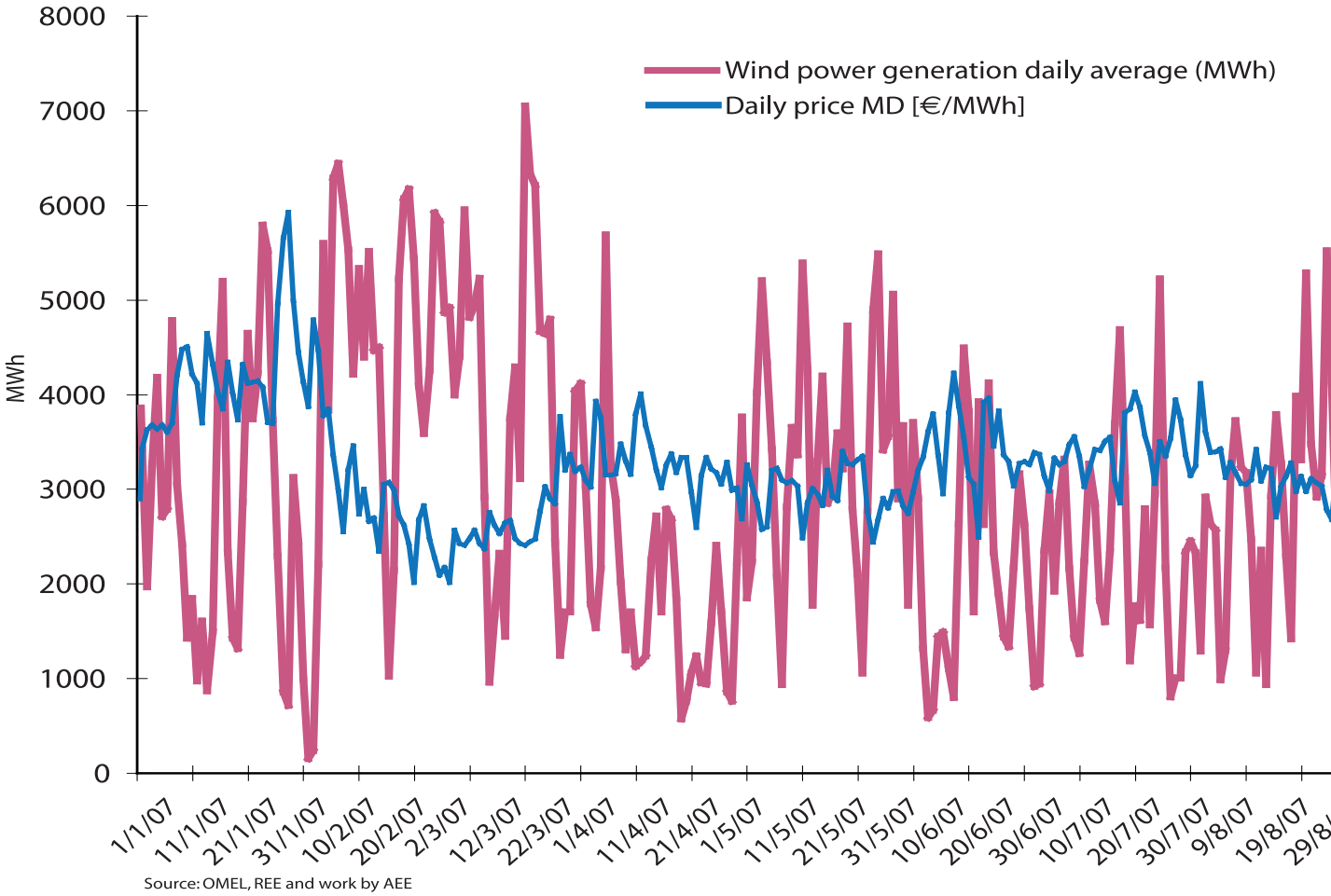
Wind power has shown a clear effect on **reducing CO_2 emissions** with over **18 million tonnes** avoided just in 2007.

For the period 2005-2010 (see figure IV.15), estimations are that the emission of over 127 million tons CO_2 will be avoided.

With the stating of the new period of the National Allocation Plan 2008-2012, wind energy production will spare over 1,500 million € for 2008-2010, for a price of emission rights of 20 €/ton.

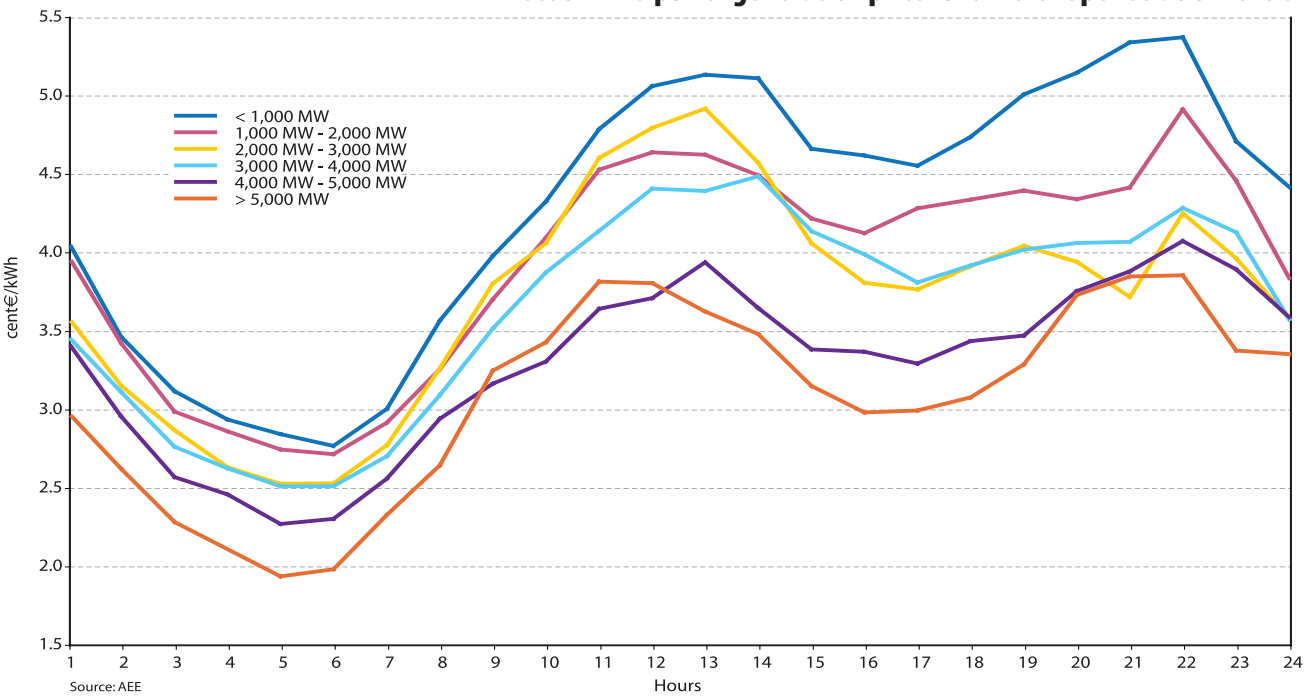
Daily market price reduction

As said before, **wind power lowers the price in the daily market**, since it moves the offer curve which translates into a decrease in prices, meaning a benefit for the whole of the system. Figure IV.16



Source: OMEL, REE and work by AEE

Figure IV.17
Effect of wind power generation price for different penetration levels



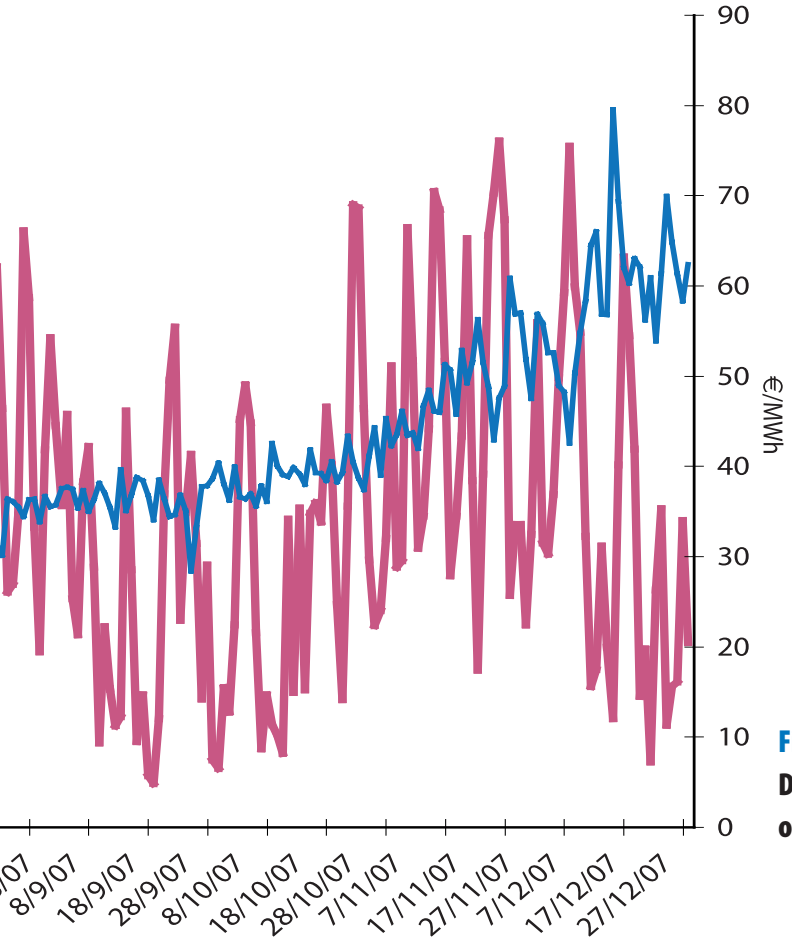
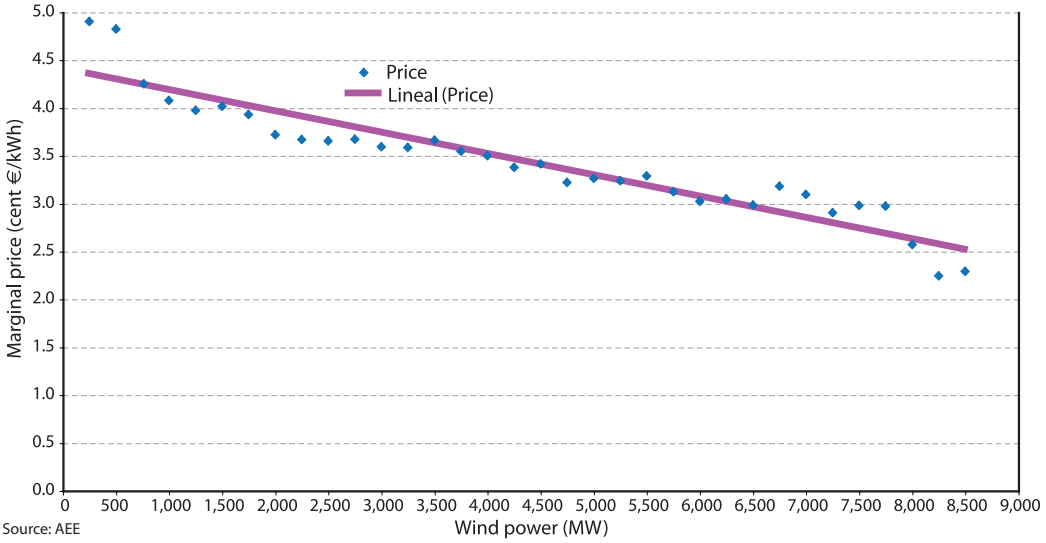


Figure IV.16
Daily wind power generation and average price of the daily market. 2007



Source: AEE

Figure IV.18
Relationship between wind power production and daily market price

shows the evolution of daily wind power generation (in MWh) and the average daily market price (in €/MWh) for 2007.

For different levels of wind power production the average price for each hour has been calculated and as shown in figure IV.17, as wind power generation increases, the price decreases and the difference is higher for the hours with greater demand.

It is estimated that for 2007 the price reduction was of 2 €/MWh for each additional 1,000 MW of wind power (see figure IV.18).

Reduction of fossil fuel imports

The total energy consumption in Spain in 2006, including final consumption of renewable energies reached 105,753 tonnes of oil equivalent (toe), a 1.2% lower than the previous year. This trend of changing reduction is due to a softening of the climatic conditions compared to the previous year, together with a higher global efficiency of the industry.

On the other side, in 2006, according to the report published by the Ministry of Industry, Tourism and Commerce, the auto supply increased by a 1% from 2005 (which can be seen in table IV.08). This is due to a decrease in the demand and an increase of the internal production, which expressed in toe, reaches a 22.1%.

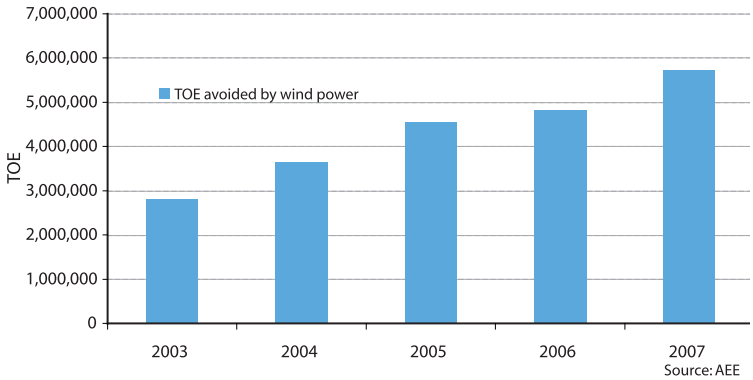
Table IV.08
Degree of supply (1). 2005-2006

	2005	2006
COAL	31.3	33.8
OIL	0.2	0.2
NATURAL GAS	0.5	0.2
NUCLEAR	100	100
HYDROWER	100	100
RENEWABLE ENERGIES	100	100
TOTAL	**21.1**	**22.1**

(1): Rate of internal production over total consumption
Methodology: AIE
Source: SGE

Electricity production through wind power, because of its renewable and local character does not require the use of fossil fuels, thus avoiding the costs of coal, fuel-oil and natural gas **while helping reduce foreign dependence from fossil fuel imports.**

Figure IV.19
Tonnes of oil equivalent avoided by wind power. 2003-2007



Source: AEE

Wind energy production has avoided in primary energy consumption for 2007, about the equivalent of 6 million tonnes of oil (see figure IV.19), which means savings in fossil fuel imports of about 1,014 million euros considering the coal price at 89 $/ton, 73 $/ton the fuel-oil one and 7 $/MMBTU .

Households supplied with wind power

The 27,000 GWh produced by wind farms in 2007 mean **the supply for over 9 million households** (see figure IV.20), with an average year consumption of 3,000 kWh.

Job creation: 45,000 jobs

Wind power is also a source for new jobs (see figure IV.21). Direct job creation for wind farm operation and maintenance, manufacturing, assembly, research and development is estimated in over 17,700 jobs, while indirect job creation, linked mainly with component supply for electrical equipment for the electricity draining systems and transport is estimated in over 27,000 jobs.

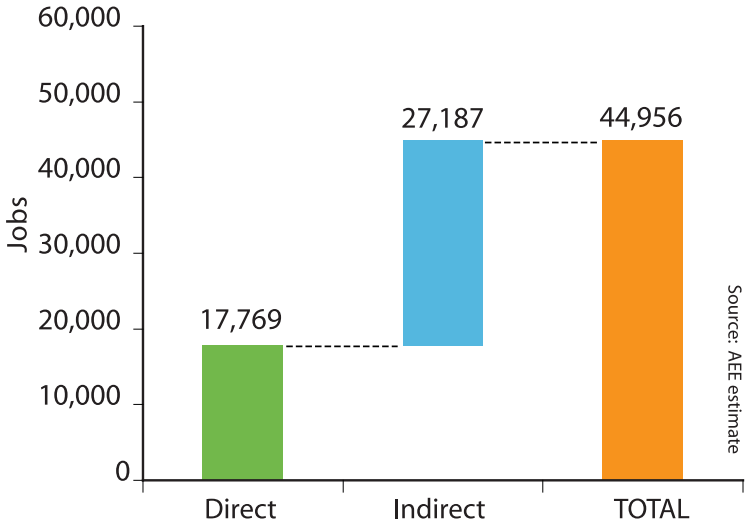
Industrial development

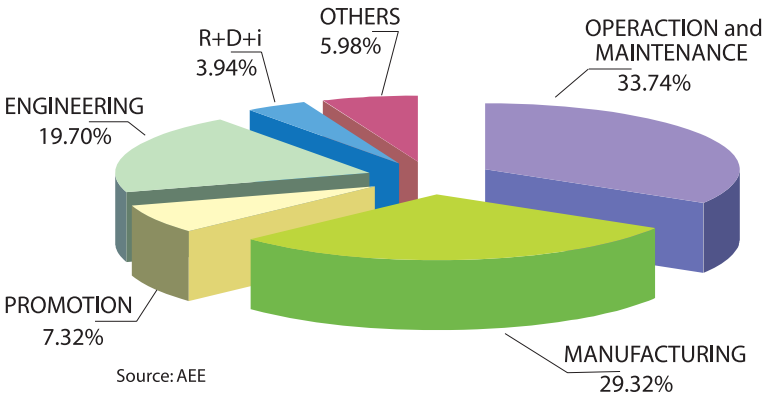
Besides the environmental benefits and the reduction of foreign dependency in energy, **wind power** is an important **motor for industrial development**. It is not just that wind power total investment in Spain is higher than 5,000 million euros; wind power is also increasing its exporting capacity with about 50% of the production in a global market that is continually growing.

Figure IV.20
Number of households supplied with wind power. 2004-2007

Source: AEE

Figure IV.21
Jobs created by the wind power industry in Spain (2007)





Source: AEE

Figure IV.22
Distribution of direct employment by activity. 2007

	FIRM NAME	ACTIVITY	CLASSIFICATION	LOCATION	PROVINCE	REGION
1	ACCIONA WIND POWER	WTG MANUFACTURE	WTG ASSEMBLY	BARASOAÍN	NAVARRA	NAVARRA
2	ACCIONA WIND POWER	WTG MANUFACTURE	WTG ASSEMBLY	LA VALL D'UIXÓ	CASTELLÓN	COMUNIDAD VALENCIANA
3	CORUÑESA DE COMPOSITES, S.L.	NACELLES	WTG ASSEMBLY	ARTEIXO	LA CORUÑA	GALICIA
4	ECOTÈCNIA GALICIA, S.L.	WTG ASSEMBLY	WTG ASSEMBLY	AS SOMOZAS	LA CORUÑA	GALICIA
5	ECOTÈCNIA NAVARRA, S.A.	WTG ASSEMBLY	WTG ASSEMBLY	BUÑUEL	NAVARRA	NAVARRA
6	ENFLO WINTEC IBÉRICA	WTG MANUFACTURE	WTG ASSEMBLY	ORCOYEN	NAVARRA	NAVARRA
7	EOZEN	WTG MANUFACTURE	WTG ASSEMBLY	FERREIRA	GRANADA	ANDALUCÍA
8	GAMESA	NACELLE ASSEMBLY	WTG ASSEMBLY	ÁGREDA	SORIA	CASTILLA Y LEÓN
9	GAMESA	NACELLE ASSEMBLY	WTG ASSEMBLY	SIGÜEIRO	LA CORUÑA	GALICIA
10	GAMESA	PROTOTYPE ASSEMBLY	WTG ASSEMBLY	IMARCOAIN	NAVARA	NAVARRA
11	GAMESA	NACELLE ASSEMBLY	WTG ASSEMBLY	TAUSTE	ZARAGOZA	ARAGÓN
12	GAMESA	NACELLE ASSEMBLY	WTG ASSEMBLY	MEDINA DEL CAMPO	VALLADOLID	CASTILLA Y LEÓN
13	GE WIND ENERGY S.L.	WTG ASSEMBLY	WTG ASSEMBLY	NOBLEJAS	TOLEDO	CASTILLA-LA MANCHA
14	GRUPO EYMOSA-VENTOGAL	NACELLES	WTG ASSEMBLY	NARÓN	LA CORUÑA	GALICIA
15	M-TORRES	WTG ASSEMBLY AND MANUFACTURE	WTG ASSEMBLY	ÓLVEGA	SORIA	CASTILLA Y LEÓN
16	NAVANTIA	FINISHING AND ASSEMBLING	WTG ASSEMBLY	FERROL	LA CORUÑA	GALICIA
17	VESTAS NACELLES	WTG ASSEMBLY	WTG ASSEMBLY	VILLADANGOS DEL PÁRAMO	LEÓN	CASTILLA Y LEÓN
18	VESTAS NACELLES	WTG ASSEMBLY	WTG ASSEMBLY	VIVEIRO	LUGO	GALICIA
19	3M ESPAÑA, S.A.	COMPONENT MANUFACTURER	GENERATORS AND ELECTRICAL COMPONENTS	MADRID	MADRID	MADRID
20	ALSTOM POWER SERVICE, S.A.	COMPONENT MANUFACTURER	GENERATORS AND ELECTRICAL COMPONENTS	MADRID	MADRID	MADRID
21	AREVA T&D IBÉRICA, S.A.	COMPONENT MANUFACTURER	GENERATORS AND ELECTRICAL COMPONENTS	SAN FERNANDO DE HENARES	MADRID	MADRID
22	ASEA BROWN BOVERI, S.A.	COMPONENT MANUFACTURER	GENERATORS AND ELECTRICAL COMPONENTS	MADRID	MADRID	MADRID
23	ECOTÈCNIA GALICIA, S.L.	CONTROL SYSTEMS	GENERATORS AND ELECTRICAL COMPONENTS	CASTRO (NARÓN)	LA CORUÑA	GALICIA
24	ENERGEA	WIND FARM CONTROL AND MAINTENANCE	GENERATORS AND ELECTRICAL COMPONENTS	FERREIRA DO VALADOURO	LUGO	GALICIA
25	ENERGEA	WIND FARM CONTROL AND MAINTENANCE	GENERATORS AND ELECTRICAL COMPONENTS	A CAÑIZA	PONTEVEDRA	GALICIA
26	ENERGEA	WIND FARM CONTROL AND MAINTENANCE	GENERATORS AND ELECTRICAL COMPONENTS	MAZARICOS	LA CORUÑA	GALICIA
27	GAMESA	ELECTRICAL EQUIPMENT MANUFACTURING	GENERATORS AND ELECTRICAL COMPONENTS	REINOSA	CANTABRIA	CANTABRIA
28	GAMESA	ELECTRICAL EQUIPMENT MANUFACTURING	GENERATORS AND ELECTRICAL COMPONENTS	COSLADA	MADRID	MADRID
29	GAMESA	ELECTRICAL EQUIPMENT MANUFACTURING	GENERATORS AND ELECTRICAL COMPONENTS	BENISANÓ	VALENCIA	VALENCIA
30	KINTECH INGENIERIA, S.L.	DATA LOGGERS	GENERATORS AND ELECTRICAL COMPONENTS	ZARAGOZA	ZARAGOZA	ARAGÓN
31	SANTOS MAQUINARIA ELÉCTRICA, S.L.	COMPONENT MANUFACTURER	GENERATORS AND ELECTRICAL COMPONENTS	GETAFE	MADRID	MADRID
32	VESTAS CONTROL SYSTEMS	CONTROL SYSTEMS	GENERATORS AND ELECTRICAL COMPONENTS	ÓLVEGA	SORIA	CASTILLA Y LEÓN
33	GAMESA	GEARBOX MANUFACTURE	GEARBOXES	ASTEASU	GUIPÚZCOA	PAÍS VASCO
34	GAMESA	GEARBOX MANUFACTURE	GEARBOXES	MUNGIA	VIZCAYA	PAÍS VASCO
35	GAMESA	GEARBOX MANUFACTURE	GEARBOXES	BERGONDO	LA CORUÑA	GALICIA
36	GAMESA	GEARBOX MANUFACTURE	GEARBOXES	BURGOS	BURGOS	CASTILLA Y LEÓN
37	ACCIONA WIND POWER	HUB AND OTHER COMPONENTS	BLADES	TOLEDO	TOLEDO	CASTILLA-LA MANCHA
38	AEROBLADE	ROTOR MANUFACTURE	BLADES	VITORIA	ÁLAVA	PAÍS VASCO
39	COASA	AERONAUTICAL COMPONENTS	BLADES	SAN CIBRAO DAS VIÑAS	OURENSE	GALICIA
40	DANIGAL	BLADES	BLADES	AS PONTES	LA CORUÑA	GALICIA
41	EOZEN	ROTOR MANUFACTURE	BLADES	FERREIRA	GRANADA	ANDALUCÍA
42	GAMESA	BLADES	BLADES	ALSASUA	NAVARRA	NAVARRA
43	GAMESA	BLADES	BLADES	MIRANDA DEL EBRO	BURGOS	CASTILLA Y LEÓN
44	GAMESA	BLADES	BLADES	SOMOZAS	LA CORUÑA	GALICIA
45	GAMESA	BLADES	BLADES	TUDELA	NAVARRA	NAVARRA
46	GAMESA	BLADES	BLADES	ALBACETE	ALBACETE	CASTILLA-LA MANCHA
47	GAMESA	BLADE BASES	BLADES	CUENCA	CUENCA	CASTILLA-LA MANCHA
48	GAMESA	BLADE MOULDS	BLADES	IMARCOAIN	NAVARRA	NAVARRA
49	LM COMPOSITES GALICIA, S.A.	ROTOR MANUFACTURE	BLADES	AS PONTES DE GARCIA RODRIGUEZ	LA CORUÑA	GALICIA
50	LM GLASFIBER EÓLICA, S.A.	ROTOR MANUFACTURE	BLADES	LES COVES DE VINROMÁ	CASTELLÓN	VALENCIA
51	LM GLASFIBER ESPAÑOLA, S.A.	ROTOR MANUFACTURE	BLADES	PONFERRADA	LEÓN	CASTILLA Y LEÓN
52	VESTAS BLADES	ROTOR MANUFACTURE	BLADES	DAIMIEL	CIUDAD REAL	CASTILLA-LA MANCHA
53	AVANTI WIND SYSTEMS, S.L.	STAIRS AND ELEVATORS MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	LA MUELA	ZARAGOZA	ARAGÓN
54	C.C. JENSEN IBÉRICA, S.L.	COMPONENT MANUFACTURER	TOWERS AND MECHANICAL COMPONENTS	BARCELONA	BARCELONA	CATALUÑA
55	CALDERERIA TORRES ALTAMIRA, S.A.	WTG TOWER MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	CORESES	ZAMORA	CASTILLA Y LEÓN
56	COIPER	WTG TOWER MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	PONFERRADA	LEÓN	CASTILLA Y LEÓN
57	DANOBAT S. COOP.	COMPONENT MANUFACTURER	TOWERS AND MECHANICAL COMPONENTS	ELGOIBAR	GUIPÚZCOA	PAÍS VASCO
58	DIMECO	BOLT MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	ALCALÁ DE HENARES	MADRID	MADRID
59	ELEVADORES GOIAN	ELEVATORS MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	LAZKAO	GUIPÚZCOA	PAÍS VASCO
60	EMESA	WTG TOWER MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	COIROS	LA CORUÑA	GALICIA
61	FIBERBLADE NORTE II	WTG TOWER MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	AS SOMOZAS	LA CORUÑA	GALICIA
62	FLUITECNIK	COMPONENT MANUFACTURER	TOWERS AND MECHANICAL COMPONENTS	ORCOYEN	NAVARRA	NAVARRA
63	GAMESA	WTG TOWER MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	OLAZAGUTIA	NAVARRA	NAVARRA
64	GAMESA	WTG TOWER MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	CADRETE	ZARAGOZA	ARAGÓN
65	GAMESA	WTG TOWER MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	LINARES	JAÉN	ANDALUCÍA
66	GAMESA	WTG TOWER MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	AVILÉS	ASTURIAS	ASTURIAS
67	HORTA COSLADA	TOWERS	TOWERS AND MECHANICAL COMPONENTS	ARCOS DE JALÓN	SORIA	CASTILLA Y LEÓN
68	INNEO TORRES	CONCRETE PREFAB TOWERS	TOWERS AND MECHANICAL COMPONENTS	TALAVERA DE LA REINA	TOLEDO	CASTILLA-LA MANCHA
69	MATZ-ERREKA S. COOP.	BOLT MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	ANTZUOLA	GUIPÚZCOA	PAÍS VASCO
70	MONTAJES DEL ATLÁNTICO	WTG TOWER MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	FERROL	LA CORUÑA	GALICIA
71	MONTAJES DEL ATLÁNTICO	WTG TOWER MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	MUGARDOS	LA CORUÑA	GALICIA
72	TRACTEL IBÉRICA, S.A.	ELEVATORS MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	HOSPITALET DE LLOBREGAT	BARCELONA	CATALUÑA
73	TRACTEL IBÉRICA, S.A.	ELEVATORS MANUFACTURE	TOWERS AND MECHANICAL COMPONENTS	HUESCA	HUESCA	ARAGÓN
74	VOITH TURBO, S.A.	PUMPS	TOWERS AND MECHANICAL COMPONENTS	COSLADA	MADRID	MADRID

Source: AEE

Map IV.01 Industrial factories in the wind power sector in Spain

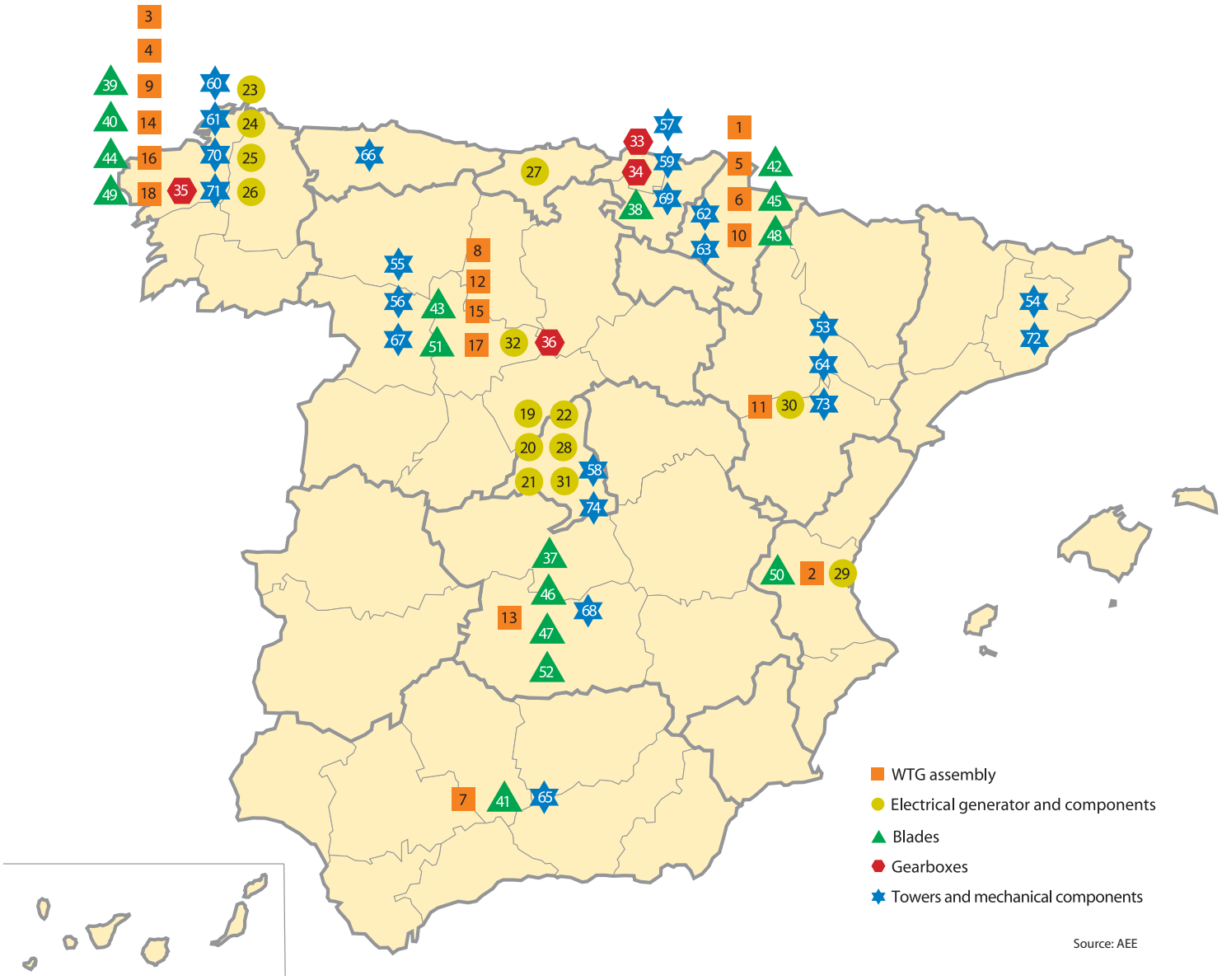


Table IV.09
(to the left)
Industrial factories in the wind power sector in Spain

Factories and companies

Besides the big centres for production and assembly of WTGs, blade manufacturing, towers, gearboxes and electrical generators and components, **there are an estimated number of 630 companies whose entire or part of the billing comes from wind power** (see maps IV.01 and IV.02).

Table IV.09 show the industrial centres.

The new blade fabric of VESTAS in Daimiel (Ciudad Real) is already working.

The blade manufacturing plant of Acciona in Lumbier (Navarra) is currently under construction.

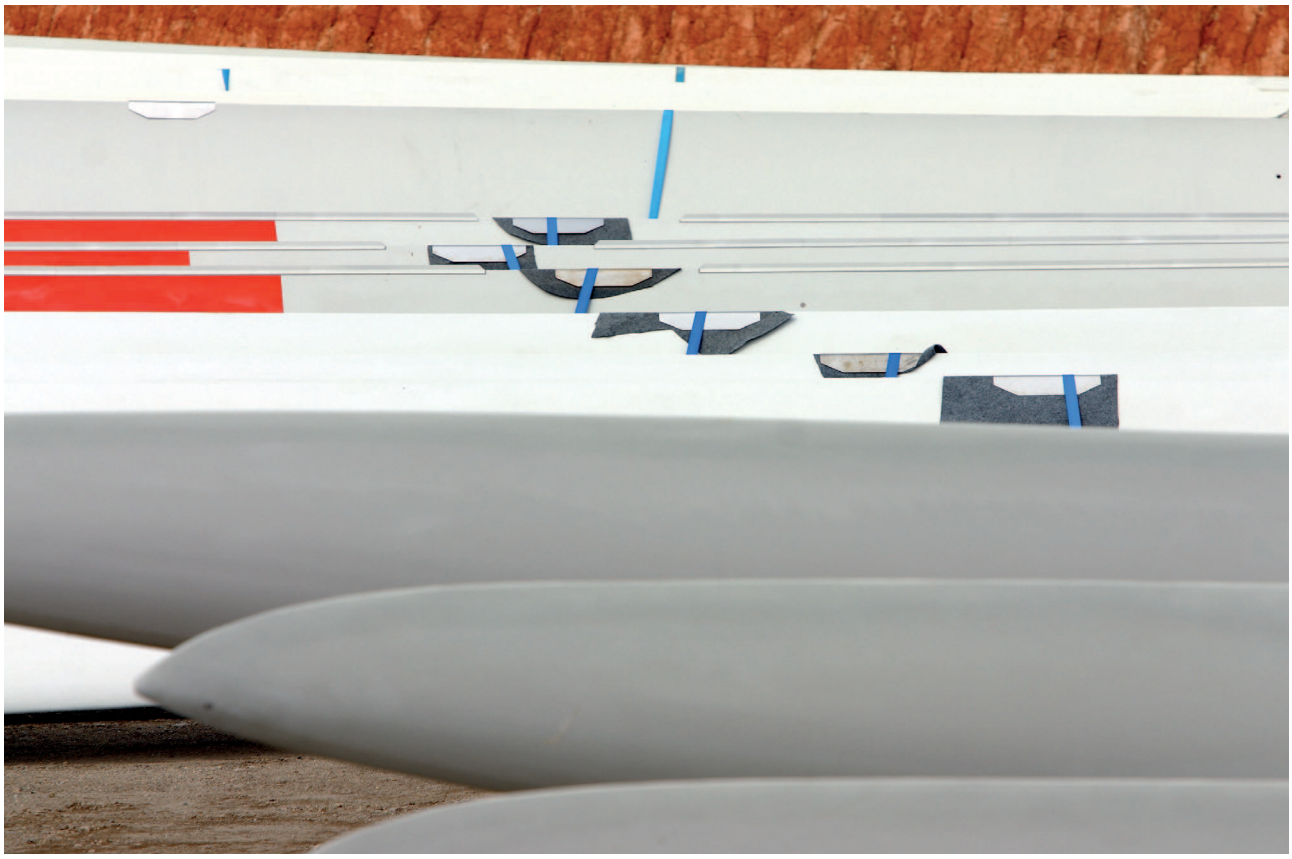
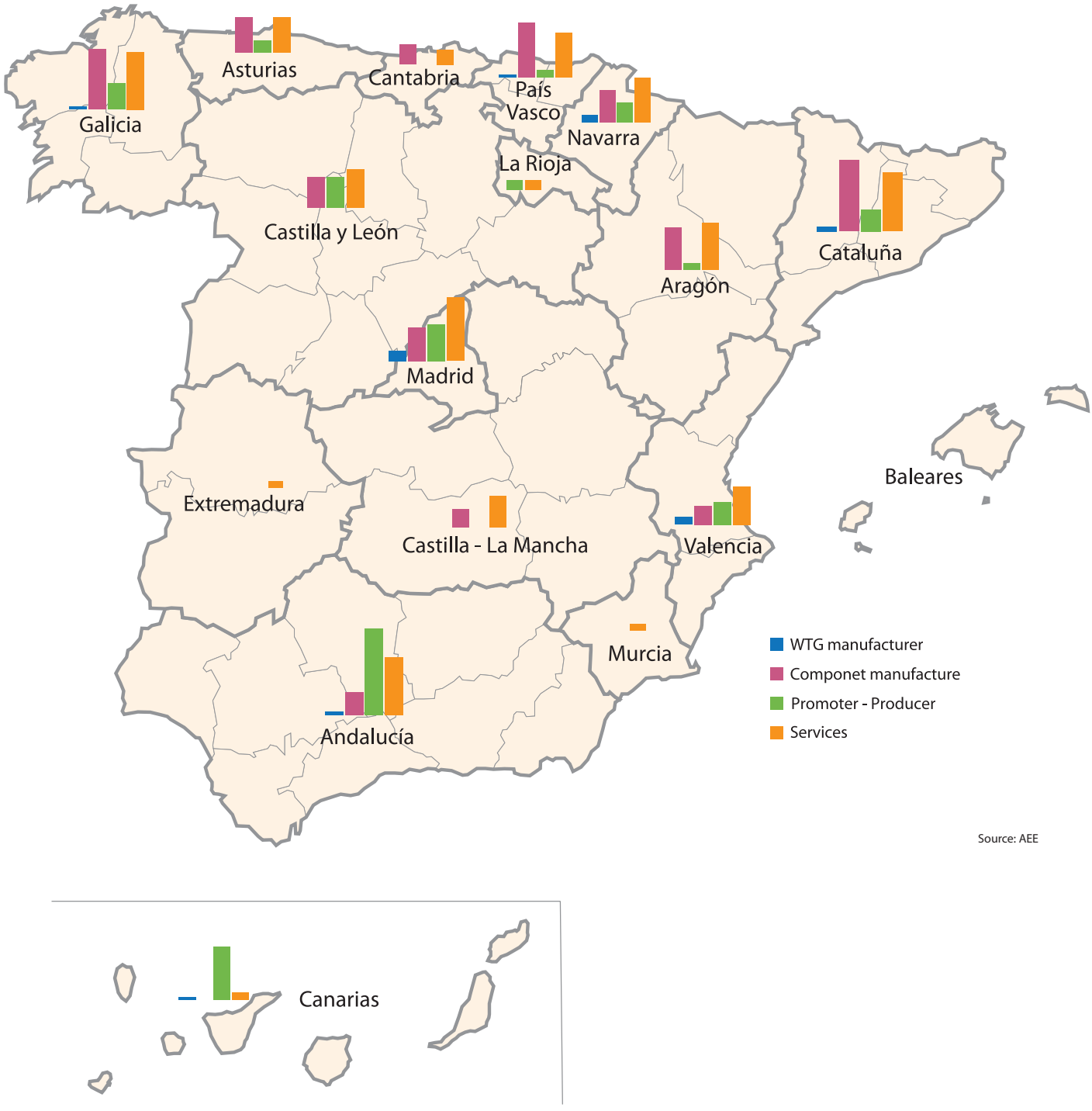


Table IV. 10 Number of companies in the wind power sector by region

	WTG manufacturers	Component manufacturers	Promoter - Producer	Service	TOTAL
Andalucía	1	7	27	18	53
Asturias	0	9	3	9	21
Baleares	0	0	0	0	0
Canarias	1	0	7	1	9
Cantabria	0	4	0	3	7
Castilla-La Mancha	0	4	0	7	11
Castilla y León	0	8	8	10	26
Cataluña	2	52	16	43	113
Extremadura	0	0	0	1	1
Galicia	1	21	9	20	51
La Rioja	0	0	3	3	6
Madrid	10	33	36	62	141
Murcia	0	0	0	2	2
Navarra	3	13	8	18	42
País Vasco	1	44	6	36	87
Comunidad Valenciana	2	5	6	10	23
Aragón	0	19	3	21	43
TOTAL	**21**	**219**	**132**	**264**	**636**

Source: AEE

Map IV.2 Companies in the wind power sector by region



Source: AEE


Navantia

Chapter V
TECHNOLOGY AND FUTURE

V.1 The importance of research and technological development

Technological Platform REOLTEC

REOLTEC is the technological platform of the wind energy sector in Spain that began its work in July 2005, its main objective is to integrate and coordinate the scientific and technological development of the Spanish Wind Energy sector, through the proposal of specific actions financed by public programmes and carrying out concrete initiatives. REOLTEC is formed by 64 participants among component manufacturers, promoters, engineering companies, consultants, scientific and technological agents (public R&D institutions, universities, tech centers) with whom the system Science-Technology-Business is in constant contact.

During 2007, a progressive consolidation of REOLTEC took place through the meetings held by the different work groups and the information exchange that has allowed the definition of the lines, objectives and strategies to integrate them all and specify the Strategic Plan of R&D&Innovation of the wind energy sector.

The meetings of the work groups focus in analyzing the fundamental aspects derived from the new capacities of the sector and including those aspects in the Strategic Plan.

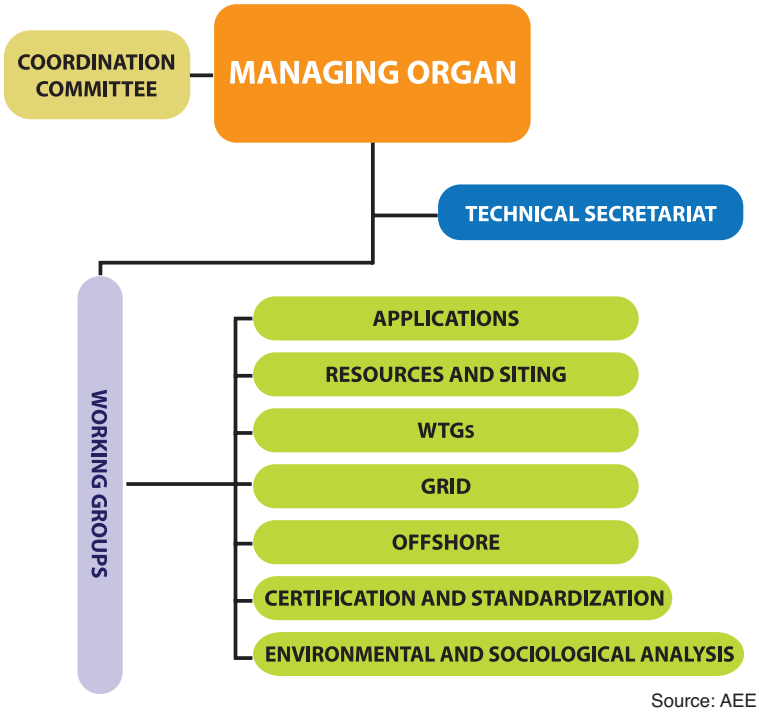
Within the **Applications Work Group**, a specific line of action is designed for small wind power, in order to study its particular needs.

In that same Group, and provided that hydrogen generation is also the job of the Hydrogen Platform, coordination is being considered towards the development of joint initiatives. Some projects have been proposed following the lines of research.

The **Certification Work Group** tackled new lines proposed in the draft of the National Plan of R&D& Innovation, the current regulation with its possible lacks or limitations, the current requirements for certification and the future possibilities. A major participation in the activities of AENOR and other certification organisms is considered.

The **Grid Work Group** analyzed the research lines proposed by the National Plan of R&D&Innovation, its coincidences or divergences, and the coherence of the projects financed with the research lines proposed in the later years. Some pro-

Diagram V.01 Structure of REOLTEC



Source: AEE

jects were also proposed that could be completed in a joint manner, according to the lines defined by the Platform

Inside this working group it is important the follow-up of the Wind on the Grid project, financed by the EC in the Sixth Framework Programme and coordinated by Red Eléctrica de España.

The **Offshore Working Group** studied the new Royal Decree 1028/2007 of July 20, in which the administrative procedure for processing the authorization requests for the installation of electrical facilities in territorial waters is established.

The draft of the National R&D&Innovation was also studied, and it was decided, that it fails to include the priority guidelines given by REOLTEC.

The **WTG Working Group** studied the investigation line of the National Plan and its adjustment to the ones defined by the Platform.

II Members' Assembly

On September 25, the **II REOLTEC General Assembly** took place at the Eurobuilding Hotel, in Madrid, which counted with the assistance of the Secretary General of Energy, **Ignasi Nieto**, and the Deputy General Director of Programmes for the promotion of the sector´s Technical Research, **Manuel Montes**, as well as representatives from companies of the sector, from the CDTI, the IDAE and the European Wind Energy Platform.

In the Assembly, the future of research in wind energy was discussed, as well as, its current needs and the situation compared to leading countries. In this event the achieved advances were discussed, as well as the future perspectives in both national and global technology.

The support shown to the sector by the Ministry of Industry, Education and Science was important, highlighting the growth expectations and the industry and jobs creation.

The goal is for the national industry to be technological leader in an avant-garde sector

According to the Ministry, the platforms´ duties are to promote projects, to support big initiatives, to revise investigation priorities, to act as a lobby and to orientate formation. The high number of national-edited publications was mentioned, as well as the lack of patents with Spanish technology.

In the presentations, the work made by the Platform was analyzed, as well as its impact, the activities of the European Platform, the financing levels, the state of the national infrastructures for investigation, and the need of coordination between them. It was pointed out, as well, the needed measures to make the national technology a leader in the world, in an avant-garde sector. A great participation was registered from the sector.

European Platform (TPWIND)

The objective of **TPWind** is to identify areas with innovation potential, as well as new research and development tasks. The main objective is to cut costs in social, environmental and technological terms. This will help to achieve EU objectives in terms of renewable electricity production. The platform will develop coherent recommendations,

detailing specific tasks, approaches, participants and the necessary infrastructure.

The big difference between the Spanish platform and the European one is the final objective.

REOLTEC is purely technological; its task is to identify the technological needs of the sector and to create working groups to coordinate the different actions of research, development and innovation that would increase wind power productivity.

TPWIND has technological and political interests. Its objective is to increase wind energy competitiveness reducing costs. The technological efforts of the European Platform are designated to components' price lowering and installation, operation and maintenance tasks.

Both platforms work to achieve grid integration in the safest and most efficient way. They have as common goals to raise WTGs availability and research to develop infrastructures and offshore platforms for offshore wind farms, and both platforms seek to reduce, as much as possible, the environmental impact.

Other wind power platforms

Denmark:

Megawind: This platform is the result of a government initiative to encourage the technological development of wind energy.

Germany:

CE Wind: This research platform was founded in 2005 to board connection and grid integration, the design of new rotor models, turbines and towers, maintenance and operation, and the environmental impact of wind energy.

ForWind: Was founded in 2003 and its research programme includes the offshore wind power analysis in connection issues, prediction, and structures.

Netherlands:

We@Sea: The Dutch government created it to focus on research about offshore wind power, to meet the objective of installing 6 GW of capacity by 2020.

Undergoing projects: Windlider 2015 (CÉNIT PROGRAMME)

The industrial research project **Windlider 2015**, is led by Gamesa and Ecotècnia, with the goal of keeping Spain in the technological leadership in wind power. It shall receive a subvention of non-recoverable 13 million euros.

The Windlider 2015 project has been one of the 16 initiatives worth of support from the National Strategic Consortiums of Technological investigations (CENIT).

The objectives of the projects are as follows:

- To master the design of future turbines, reducing the "time to market" and increasing the maturity of the first series, which is considered vital to lead this market after 2012.
- To dispose of enabling Technologies of Spanish property.
- To dispose of a holistic model of simulations that reproduces as faithfully as possible the behaviour of future turbines and experiment the effect in performance of new configurations, new enabling technologies, etc.
- To concentrate on the deployment of various mid-sized scientific and technological infrastructures in Spain that allow to experiment in scales up to 5 MW, with complete WTG prototypes and its critical components (generator, multiplier, converters, frames, yaw, etc.)

Windlider 2015 will obtain the first model in its class for integral simulation of a WTG, and will reenact its behaviour in conjunction with wind, terrain and grid.

Platforms work to achieve safe and efficient grid integration

Table V.01 5th Framework Programme and 6th Framework Programme (approved projects)

TECHNOLOGICAL AREA	5th Framework Programme			6th Framework Programme		
	Number of proyects	Cost in M Euros	Financing in M Euros	Number of proyects	Cost in M Euros	Financing in M Euros
Larger WTGs	10	27,68	14,98	4	37,95	19,46
Grid Integration	7	12,99	7,15	4	7,75	4,43
Developmen management for wind farms	3	4,02	2,23	2	34,03	7,70
TOTAL	**20**	**44,69**	**24,36**	**10**	**79,73**	**31,59**

Source: CE

European Commission's Framework Programmes

The **Framework Programme of research, Technological Development and Demonstration** is the main instrument for European financing of R&D and sets itself in the context of the Lisbon strategy and the European Space of Research.

The European Commission presents a proposal for a Framework Programme that has to be approved later by the Council and the European Parliament in a joint decission procedure.

Programmes cover a 5 year period, superposing the last year of a programme with the first of the following, and they have been implemented ever since 1984.

The Seventh Framework Programme

The **7th Framework Programme** covers the 2007-2013 period, **and has as a main objective the raise of competitiveness**, mainly between financing activities of research, technological development, demonstration and innovation carried out in a transnational collaboration regime, between businesses and research institutions, belonging to the EU and to associated states and third-party countries.

The 7th Framework Programme has as a main objective the raise of competitiveness

The 7th FP structures itself in 4 grand programmes: Cooperation, ideas, people, capacities.

It has a total budget of 50,521 billion Euros for a 7 year period, as well as 2,700 additional billion for the **EURATOM Programme** that lasts 5 years.

Participation in the Framework Programme is through between calls that take place once or twice a year. Participants receive generally 50% of their activity costs in the projects and in the case of mid-sized and small firms, and researchers, including technological centres, a 75% in addition to an anticipation paid at the signing of the contract.

The programme of cooperation is divided in ten priority areas. The small businesses can participate in such programme by presenting projects in cooperation with other firms and European research entities, and obtain up to 75% of the project's budget. In the Information Service of CORDIS, a search service has been enabled for the search of partners for projects.

The 7th Framework Programme has the following objectives:

- Creation of European Excellence centres through collaboration of laboratories.
- Launching of European technological initiatives.
- Stimulation of creativity in research through competence between teams on a European scale.
- To raise the attraction of Europe for the best researchers.
- To develop research infrastructures of European interest
- To improve the coordination between national programmes.

V.2 Offshore wind power in Spain

With the approval of Royal Decree 1028/2007 on July 20, the administrative procedure for requests of authorization for the installation of offshore wind power generation in our territorial sea is established. This means a great advance as to administrative classification, needed for the final impulse in the growth of wind power in Spain.

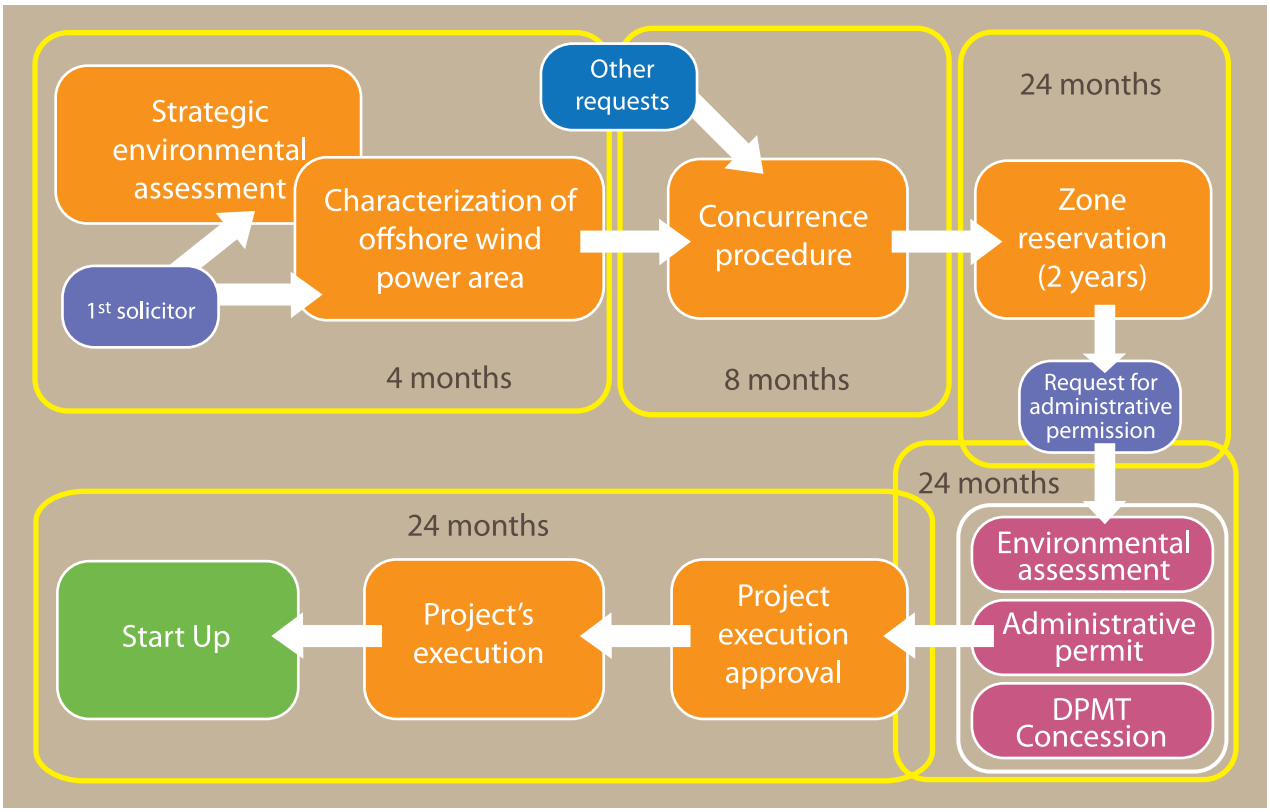
The approval of RD 1028/2007 means an impulse to the growth of the sector

Table V.02 Projects financed by the 7th Framework Programme

7th Framework Programme					
PROJECT	COORDINATOR	COUNTRY	COST (€)	SPANISH PARTICIPATION	FINANCING (€)
7MW-WEC-by-11	WIP Wirtschaft und Infrastruktur GmbH & Co Planungs-KG	DE	3,270,286		
NORSEWIND	Oldbaum Services Limited	UK	3,955,214		
PROTEST	Energy research Centre of the Netherlands	NL	1,981,791		
RELIAWIND	Gamesa Innovation And Technology, S.L.U.	ES	5,181,758	Gamesa Innovation and Technology S.L:	1,207,280
				Ecotècnia, S.C.C.L.	597,336
SAFEWIND	Association pour la Recherche et le Développement des Méthodes et Processus Industriels	FR	3,992,400	Universidad Complutense de Madrid	90,061
				Fundacion Cener-Ciemat	287,226
				Universidad Carlos III de Madrid	76,115

Source: CE

Diagram V.02 Legal Procedure



Source: MITyC

It is estimated that about 6 years pass between the strategic study, the zone reservation and the start of the project. That is why the first wind farm in Spain is awaited for 2014, with the goal of 4 GW installed in 2020.

It is important to indicate that only wind farms with capacity over 50 MW are allowed to be installed, although installations of 10 MW will be permitted as experimental ones.

The third Additional Disposition of Royal Decree 1029/2007 requires performing a strategic environmental assessment of offshore wind farms. This study was presented for public information on December 11, 2007 and is currently pending approval.

The objective of the study is to determine the zones of public space that, to environmental effects, gather favorable conditions towards the installation of offshore wind farms.

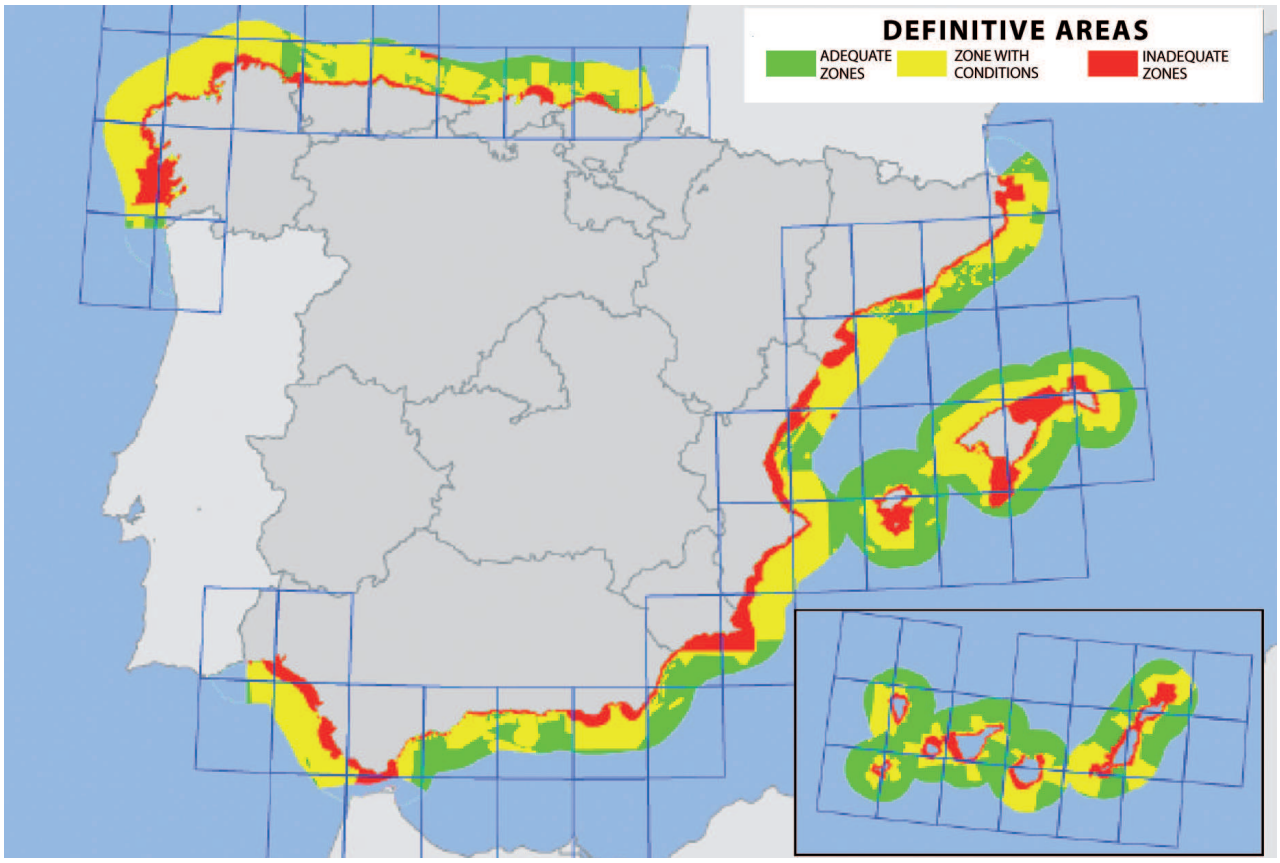
For that, there is a classification for able zones, sites with environmental conditions and exclusion zones.

In Spain there are several projects for offshore wind farms with undergoing plans.

- **Acciona** presented several years ago a study for the installation of an offshore wind farm between Conil and Barbate. The study contemplates the installation of 273 turbines of 3.6 MW of capacity per unit, sited 10 kilometers away from the coast.

- **Capital Energy** has a project portfolio of offshore wind farms in Spain close to 3,700 MW.

- **Iberdrola Renovables** has proposed the development of six projects of offshore wind power in the Spanish coast that will reach a total capacity of 3,000 MW and will be in Cadiz, Castellón and Huelva. Those installations would be working before 2015.



Source: MITyC

Map V. 01

Offshore wind power areas

Vestas Dime©

The Spanish offshore wind power potential is numbered in about 4 GW

• **Endesa Cogeneración y Renovables (ECyR) and ENERFIN**, have signed an agreement for the joint promotion of offshore wind farms in Spain. The firm will focus its efforts, in the first phase, on the development of offshore wind farms in the southern part of the Iberian Peninsula.

The offshore wind power potential in Spain is numbered in 4 GW approximately, which is the fifth part of the current power potential worldwide. The occupation solicitations are of approximately 10,000 MW.

The planning of the Electricity and Gas sectors 2008-2016 must incorporate the needed infrastructure for the evaluation of offshore wind power, as well as doing the area studies considering the existing offshore wind power potential in the different nodes.

The importance of the technological development in offshore wind power

The installation of wind farms in the sea is made with the objective of **optimizing site use and finding the best sites with the highest wind resource and lowest turbulence.** The special conditions of the sea require however important technological efforts in machine size as well as in the building needs in deep waters, without forgetting about the materials' adaptation and equipments that must work in aggressive marine environment or the costly maintenance of that equipment and installations.

The REOLTEC technological platform has the following priority lines in offshore wind power research:

- Measurement of wind resources in the sea.
- Offshore weather studies:
  - Wave modeling.
  - Wind.

The special conditions of the sea demand important technological efforts

- Building and support of offshore structures.
- Specific Technologies specialized in the adaptation of turbines to the marine environment:
  - Protection against weather.
  - Very high reliability.
  - Environmental.
- Submarine cables and offshore electrical substations.
- Logistics of offshore installations.
- Technical and scientific infrastructures (experimentation bays) in laboratory and field to deepen in the knowledge of turbine and component behaviour.

Project EOLIA (Approved by the CDTI within the CENIT Programme)

The Centre for Technological Industrial Development (CDTI) is a public entity depending from the Ministry of Industry, Tourism and Commerce that promotes innovation and technological development of Spanish businesses. Its objective is to contribute to the upgrading of their

technological levels.

The CENIT programme is a project of the Spanish government to increase investing in R&D both public as private. Among the approved projects by CDTI, within the CENIT programme is the **EOLIA project**.

EOLIA aims to develop the adequate technologies that allow the implant of offshore wind farms in deep waters (deeper than 40 meters)

The activities of research in this project integrate energy technologies (wind power and electrical) aquaculture, desalinization, construction and naval technology.

EOLIA is a 16-firms-based consortium, led by Acciona Energía and with an approved budget of 33.9 million Euros, with CDTI subventions of 16.7 million Euros.

Furthermore, EOLIA involves the inclusion of 25 research centres and 7 businesses as sub-contracted entities by the consortium's associates.

The Project includes a total of 10 research activities, with 50 tasks and 189 sub-tasks. Altogether, 29 patents are previewed.

V.3 Risks prevention

The **occupational safety and health** (OSH) is growingly important in our society, as the Law for Risks Prevention at Work and Industrial Security makes evident.

In July 2007, the **Working Group for Occupational Safety and Health** begun its activities within the Spanish Wind Energy Association, aiming to "lead in security and health matters in the businesses of the wind power sector", for which several activities where presented.

- To gather knowledge, at national and international levels about:
  - Death toll in the sector.
  - Applied regulation.
  - Preventive techniques in use.
- To promote technical knowledge and the exchange of information and experience, among different European firms, in the area of risks prevention at work and possible solutions in case

Table V.03 Activities within Eolia Project

Project Management
1- General specifications and objectives assignment.
2- Technologies for building offshore farms in deep waters
3- Technologies for electrical testing
4- New concepts for floating structures for OWEC
5- Marine equipments for offshore works in deep waters
6- New concepts for OWEC
7- Methodology for testing of offshore sites
8- Methodologies of operation and offshore maintenance
9- Aquiculture through offshore Farms.
10- Offshore desalination

Source: ACCIONA

of an accident.

• To diffuse studies, documents, events, etc. with the means the Groups establish, or using the resources of the AEE.

• To channel and represent before the corresponding institutions the interests in prevention matters of the wind power sector's risks.

• To know and obtain the different economic aid of international and regional programmes to finance the activities and programmes in the area of risks prevention at work.

During this year, the Work Group has set tasks to develop, therefore, sub - work groups have been created, formed by experts in different areas, that later will be presented as operative procedure.

• Temporary meetings have been scheduled with clear and realistic objectives to take place every three months, six or every year and with a definition of the content to achieve.

- Criteria unification
- Accident registry.
- Information exchange

• It has been decided to establish permanent contacts with similar Work Groups and other national, European, and international wind energy associations.

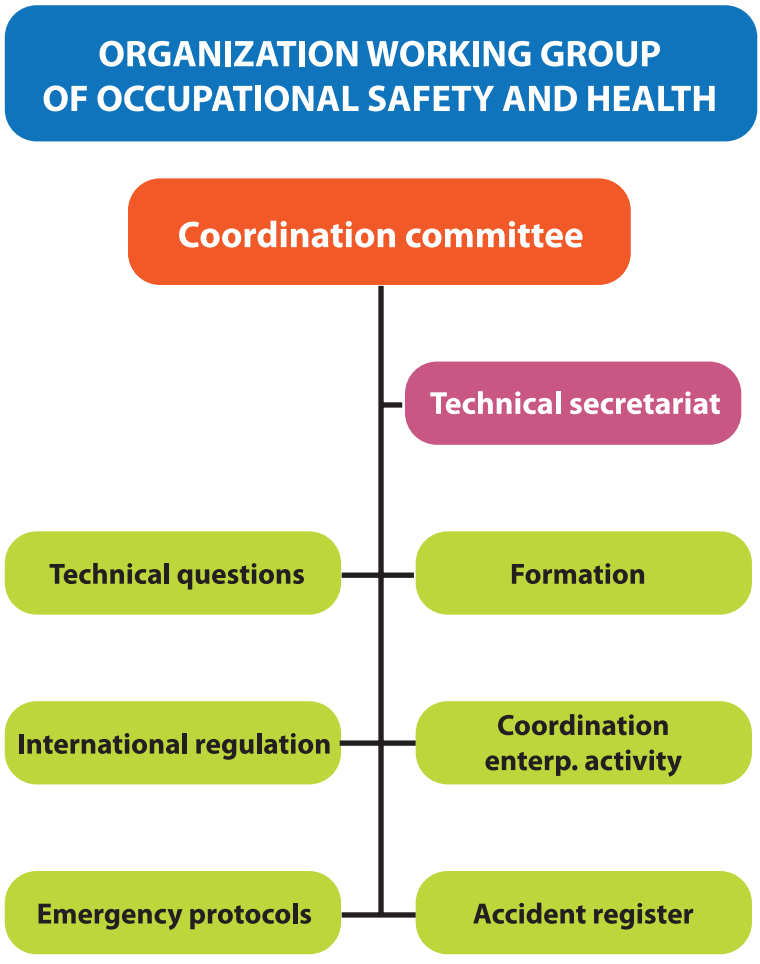
• Furthermore, the Work Group will coordinate itself with the European Agency for Safety and Health, the National Institute for Security and Hygiene at Work and Foundation for occupational safety and health.

Group structure and organization

The working group on occupational safety and health is formed by all AEE associated companies that ask for their inclusion in writing to the working group secretariat. They shall include the details of the employees representing the company.

The working group is structured according to the following chart:

The work meetings will be joint, being preset the points to attend by the Coordination Committee and the different sub-groups. AEE will act as secretary for both, bringing agility and operations needed. The secretary will write a record all of



Source: AEE

Diagram V.03
Organization of the Working Group Occupational Safety and Health

the reunions and inform all participants in the GTPRL of the achievements.

The objectives of the different sub-groups of Work are the following

A) WORK GROUP "FORMATION IN OSHs FOR THE WIND POWER SECTOR"

Objective: To elaborate an agreements´ programme of a Basic Welcoming Course in the wind power sector, index, formation contents, evaluation tests, the requirements of the speakers and the installations where the courses will take place.

B) WORK GROUP "INTERNATIONAL REGULATION OF OSH"

Objective: To get to know the documents that must be presented by Spanish businesses that execute wind farms abroad and in different situations (EU countries, other countries, permanence times, validations)

C) WORK GROUP "COORDINATION OF ENTREPRENEURIAL ACTIVITIES"

Objectives: To harmonize the coordination of the activities' procedures in the wind power sector's firms.

To analyze the national regulation in OSH and insist in the analysis of the regulation applicable to EU and non-EU workers who come to Spain to bring services and especially in the application of those rules on short-term activities.

D) WORK GROUP "EMERGENCY PROTOCOLS"

Objective: To establish emergency protocols in wind farms and its coordination with Civilians' Protection and other external ways. The development of a self-protection plan adapted to the basic regulation of self-protection.

An agreement will be reached with the Civilians' Protection of the Navarra Government, to develop such protocols. Once concluded, they will be developed in all regions.

E) WORK GROUP "TECHNICAL QUESTIONS CONSULTANT"

Objective: To dispose of a database of technical questions in OSHs matters under the AEE criteria.

F) WORK GROUP "ACCIDENT REGISTER"

Objectives: To obtain the accident statistics in the sector, as well as databases about accidents and to carry out a comparative analysis with other sectors and other international associations.

V. 4 Wind Farms exploitation

In February 2008, the Working Group for wind farms exploitation was created in the AEE, whose goal will be the exchange of information and the search for solutions to the problems regarding the to operation and maintenance of the farms.

The general objectives of exploitation management are to **maximize earnings and to optimize costs**, with the main challenge of **maintaining a high availability** for the 20-year long lifespan of a wind farm.

The maintenance labours of a wind farm are based mainly on the periodical following of the WTGs function, to detect and solve problems that their stop provokes.

The operations of maintenance are characterized by their complexity, due to the big number of variables that intervene, some of them hardly predictable. This requires careful demands of planning and control to maintain a high availability in the WTGs.

Importance of exploitation

The costs of exploitation can be set around 18€/MWh, according to the study made by Intermoney-AEE for 2007. Those costs could be during the life of the farm, a 50% of the updated value of the investment, and another 50% can be tied to the replacement of the biggest components such as blades, gearboxes or generators.

Proposals of action in the AEE Work group

- **Creation of a failure database by WTG component.**

Failures in turbines are one of the main causes of low availability and, therefore, the number of failures, their frequency, and their incidence, both in the cost of repairs and in the productive one, are important to lower costs and raise such availability.

In figure V.02 it can be seen the failure distribution by WTG components, taking as database the statistics of Germany in 2003, brought by the Institute of Renewable Energies of Kassel University (ISET)

AEE proposes in its Working Group the creation of a database that includes the number of failures, their reason, and the time of stop by the different components of the turbine.

The database would be coordinated by the AEE, which would update it periodically in function of the provided data by the wind farm operators. This information would be compared with the ISET data and would be sent to the entities that participate in that elaboration.

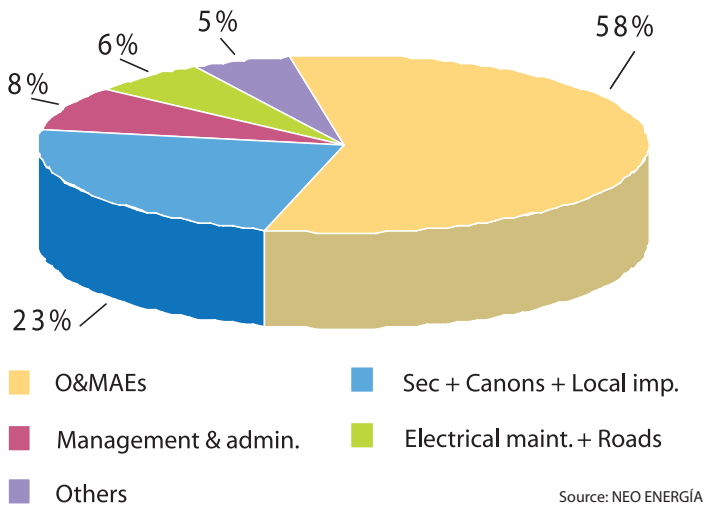
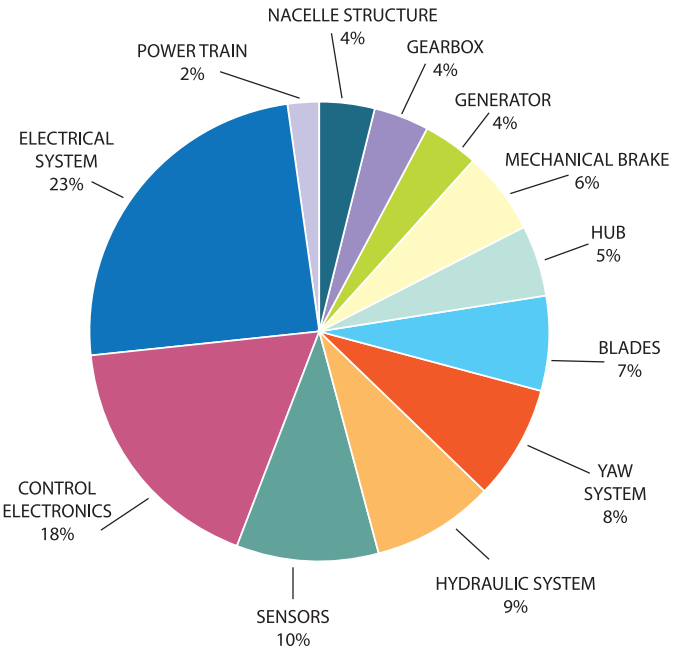


Figure V.01
Cost structure

Source: NEO ENERGÍA

Figure V.02
Failure by component



Source: ISET

Promotion of the formation in farms exploitation.

The works of operation and maintenance in wind farms are normally developed in proving conditions, due to the height at which the work is done, the reduced space of operation and the weather conditions existing at those heights.

Currently, there is a shortage of qualified personnel for these tasks, which demand a specific and well diversified training for Operation and Maintenance. Aspects like availability of local labour become important in this kind of jobs, as it ensures a **greater royalty and continuity of the professionals.**

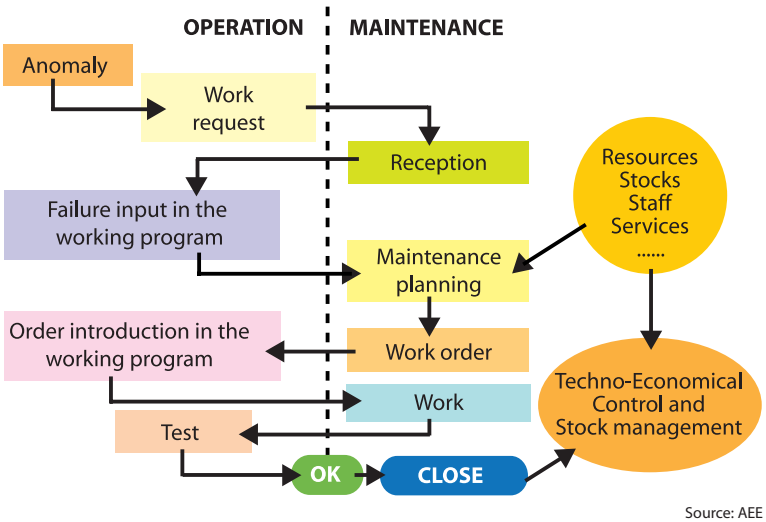
To obtain a 98-99 % availability, a strong investment in human resources is to be done, as well as maintaining a correct coordination between them.

An **adequate personnel distribution** can increase in 2 points the availability of a wind farm, avoiding the failures that may happen during night time and that, very often, are very easy to solve, but that may make the machine to stop, generating important losses, especially in high-wind periods.

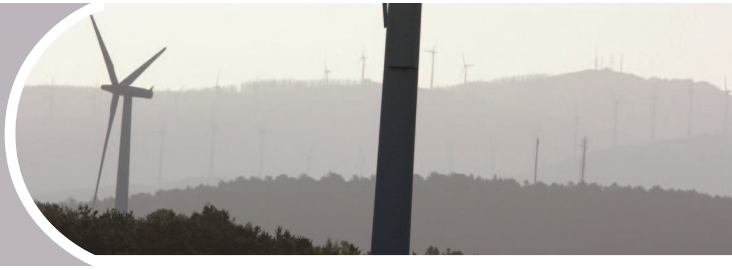
Other objectives and action lines

- Studies on the components' durability
- Precise knowledge of supported charges by the turbines
- Upgrade of the predictive maintenance systems by:
  - Sensorization of components
  - Monitoring of the state and prediction of breakdowns
- Tolerance to component failures.
- Progressive elevator add-ons in the machines.
- Construction of warehouses in the farms to store components for quick replacements that may help a machine not to be stopped unnecessarily.

Diagram V.04
Sketch of a correct maintenance management



Source: AEE



Chapter VI

AEE; OBJECTIVES, ASSOCIATES & STRUCTURE

VI.1 Objectives

The Spanish Wind Energy Association (AEE) that groups most of the economic agents in the Spanish wind energy sector has as main objective the **development and consolidation of the growth of the sector**, both in Spain and abroad. With an installed capacity over 15,200 MW in Spain, the objectives of the wind energy sector open new possibilities for national and foreign investment, generating great expectancy out of a clean and endless resources technology. Indeed, the natural and climate-related resources, together with industry, promoters and technology have allowed the Spanish wind power sector to be the 3rd power in the world by installed MW, but first in leading its firms in the main world markets, as stated in Chapter III of this yearbook.

Growth and consolidation of this sector mean a basic pillar for the accomplishing of the compromises acquired by Spain at the signing of the Kyoto protocols and to reach the goals set by the EU of being capable in 2010 of having a 12% of renewable energy of primary energy consumption, and even more so, to make that contribution reach a 20% in 2020.

Main challenges

Wind power currently assumes important challenges that require clear statements by the involved firms, integrating their technical capabilities and canalizing their entrepreneurial aspirations.

Ever since its foundation, the goals of the AEE have been:

- A long-term framework of retributive stability.
- A framework of administrative transparency.
- A forum of coordination for development and infrastructure management.

Specific goals

To achieve so, the Association has set itself the following objectives:

- To maintain and consolidate a retributive regime for wind power generated electricity that allows sustainable development for the sector.
- To be a meeting point between the main agents in the wind power market and a valid spokesperson of the sector.
- To generate opportunities and attract investors for the development of wind power.
- To overcome technical and regulation obstacles that affect growth of wind power.

Procedure

All that is possible thanks to the work of the AEE:

- Incorporating most firms of the sector: promoters, manufacturers, financing institutions, insurers, providers…
- Taking advantage of the capacities of its members and concentrating efforts.
- Mutual assistance with regional wind power associations.
- Maintaining permanent cooperation with administrations.
- Intensifying data interchange and experiences with all involved agents.

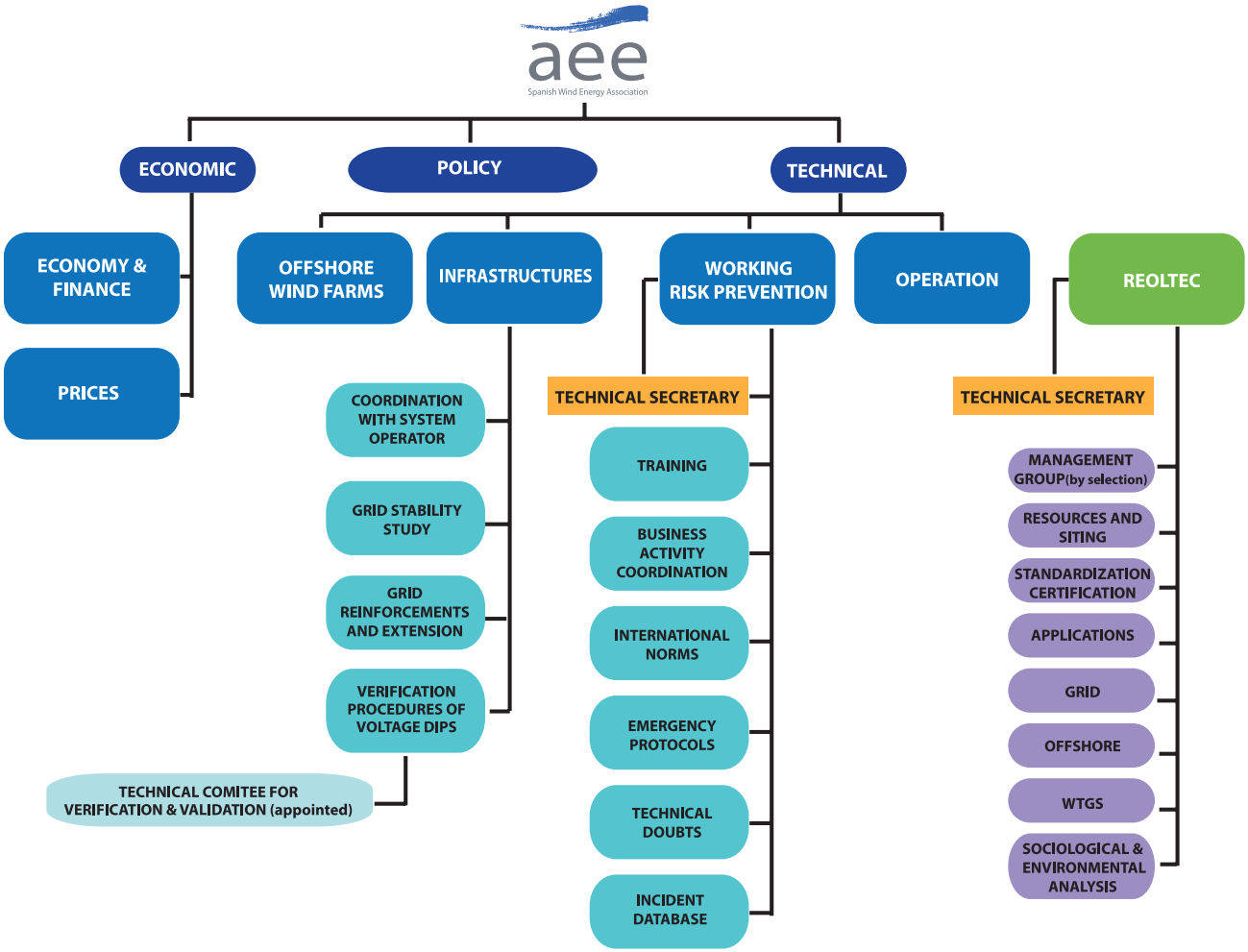
Working groups

One of the main tools to reach the association's goals are the various workgroups created by the AEE which involve almost every possible scenario of activity in the sector. In the following diagram it can be observed the structure of such working groups.

VI.2 All of the agents are represented

The Spanish Wind Energy Association (AEE) groups most of the economic agents of the Spanish wind energy sector: promoters, manufacturers, engineering firms, component providers, insurance companies, financing entities and other companies, besides several regional wind energy associations. At the closing of the yearbook, there are **139 associated companies**, among them manufacturers and promoters that account for over 85% of installed wind power.

Diagram VI.01
Working group structure



Source: AEE

VI.3 Associated firms

Associations

AEPA
(Asociación Eólica del Principado de Asturias)

APECYL
(Asociación de Promotores de Energía Eólica de Castilla y León)

APREAN RENOVABLES
(Asociación de Promotores y Productores de Energías Renovables de Andalucía)

APRECAM
(Asociación de Promotores de Energía Eólica de Castilla-La Mancha)

Manufacturers of components

3M ESPAÑA, S.A.

ALSTOM POWER SERVICE, S.A.

AREVA T&D IBÉRICA, S.A.

ASEA BROWN BOVERI, S.A.

AVANTI WIND SYSTEMS, S.L.

C.C. JENSEN IBÉRICA, S.L.

DANOBAT S. COOP.

DIMECO TÉCNICAS INDUSTRIALES, S.L.

ELEVADORES GOIAN

ENFLO WINDTEC IBÉRICA, S.L.

FLUITECNIK

INGETEAM, S.A.

INNEO TORRES, S.L.

KINTECH INGENIERIA, S.L.

LM GLASFIBER ESPAÑOLA, S.A.

MATZ-ERREKA S. COOP.

MITA-TEKNIKA/S

PRAINSA PREFABRICADOS, S.A.

SANTOS MAQUINARIA ELÉCTRICA, S.L.

SKF ESPAÑOLA, S.A.

TRACTEL IBÉRICA, S.A.

VOITH TURBO, S.A.

WINERGY (FLENDER IBÉRICA, S.A.)

WTGs manufacturers

ECOTÈCNIA RENOVABLES, S.L.

ENERCON WINDENERGY SPAIN, S.L.

EÓLICA DEL ZENETE, S.L. (EOZEN)

GAMESA EÓLICA

GE WIND ENERGY, S.L.

M TORRES OLVEGA INDUSTRIAL, S.A.

NORDEX ENERGY IBÉRICA, S.A.

REPOWER ESPAÑA, S.R.L.

SOLUCIONES FERROLANAS, S.A. SOFESA (NAVANTIA)

SUZLON WIND ENERGY ESPAÑA, S.L.U.

VESTAS EÓLICA, S.A.U.

Others organisms

CENTRO NACIONAL DE ENERGÍAS RENOVABLES (CENER)

INSTITUTO DE INVESTIGACIÓN DE ENERGÍAS RENOVABLES. UNIVERSIDAD DE CASTILLA-LA MANCHA

Promoters / Producers

ABO WIND ESPAÑA, S.A.

ACCIONA GREEN ENERGY, S.L

ALARDE SOCIEDAD DE ENERGÍA, S.A.

ALDESA ENERGÍAS ALTERNATIVAS, S.A.

BANCSABADELL INVERSIÓ I DESENVOLUPAMENT

BEAS DE INGENIERIA, S.L.,

CALIDAD ENERGÉTICA, S.A.

CAPITAL ENERGY, S.A.

CASTELLWIND-03, S.L.

COPCISA ELÉCTRICA, S.L.U.

ENDESA COGENERACIÓN Y RENOVABLES, S.A.

ENEL UNIÓN FENOSA RENOVABLES, S.A.

ENERFÍN SOCIEDAD DE ENERGÍA, S.A.

ENERGI E2 RENOVABLES IBÉRICAS, S.L.U.

ENERGÍAS RENOVABLES MEDITERRÁNEAS, S.A. (RENOMAR)

ENERGY RESOURCES, S.A.

ENERGYO RENEWABLE ENERGY, S.A.

EOLIA MISTRAL DE INVERSIONES, SCR, S.A.

EÓLICA BOSQUE ALTO, S.A. (GRUPO URVASCO)

EÓLICA DE NAVARRA, S.L

EÓLICA DEL SURESTE, S.L.

ESBI FACILITY MANAGEMENT ESPAÑA, S.L.

EVELOP SPAIN, S.L.

GAELSA ENERGIAS, S.A.

GAMESA ENERGÍA

GECAL, S.A.

GENERA AVANTE, S.L.

GRUPO GUASCOR, S.L.

GRUPO VI ENERGÍAS RENOVABLES, S.L.U.

IBERDROLA RENOVABLES, S.A.U

IBEREÓLICA, S.L.

ISOLUX CORSAN CONCESIONES, S.A.

MARTINSA-FADESA RENOVABLES

MONTAÑESA DE RECURSOS ENERGÉTICOS, S.L.

NEO ENERGÍA, S.L.

NORVENTO, S.L.

NUEVAS EMPRESAS DE MÉLIDA, S.L.

OLIVENTO, S.L. (BABCOCK BROWN)

ORISOL CORPORACIÓN ENERGÉTICA, S.A.

PALENCIA DE ENERGÍA EÓLICA, A.I.E

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SAN MARTÍN, S.A.

SHELL ESPAÑA, S.A.

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DEWI, Sucursal en España

ELDU, S.A.

ELEKTRIZITATS-GESELLSCHAFT LAUFENBRG

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ICIT, S.A. GRUPO TÜV RHEILAND

INFOPOWER (T & F Informanews Ibería, S.A.)

ISASTUR, S.A.

ISOTROL, S.A.

LA CAIXA, S.A.

MARSH, S.A.

MASTER DISTANCIA, S.A.

METEOLÓGICA, S.A.

METEOSIM TRUEWIND, S.L.

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SERVICIOS RENOVABLES DE NAVARRA, S.L.

SSB SERVICIOS EÓLICOS IBERIA, .S.L.

TESICNOR, S.L.

YNFINITI ENGINEERING SERVICES, S.L.

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WINTEST IBÉRICA, S.L.

WINDBROKERS ESPAÑA, S.L.

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Nacho Soucheiron	BANCSABADELL
José Manuel Uncio Lacasa	ENERGIAS RENOVABLES MEDITERRÁNEAS, S.A.
Rafael Zubiaur	BARLOVENTO
Enrique Álvarez Uría	AEPA
Ramón Fiestas	Secretary

The President an Vice-Presidents are part of the Permanent Commission

VI.5 Staff

Ramón Fiestas

Secretary General

Alberto Ceña

Technical Director

Sergio de Otto

Comunications Director

Ángel Budia

Administration

Ángeles Mora

Technical Department

Juan José Mostaza

Technical Department

Mar Morante

Communications Department

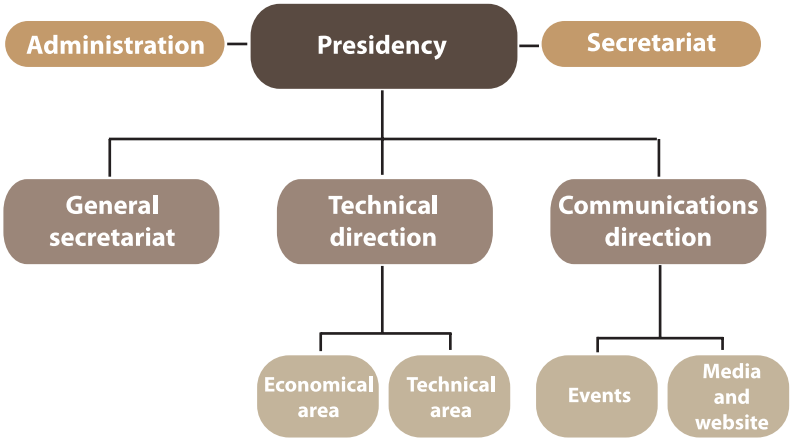
Sheila Carbajal

Communications Department

Paz Mesa

Secretary

Diagram VI.02
AEE Staff



ANNEX
LIST OF FIGURES, TABLES, MAPS AND DIAGRAMS

CHAPTER I