aee

Wind Power 2010

Spanish Wind Energy Association
The Sector's Reference

Sponsored by:

acciona

The Spanish Wind Energy Association—Asociación Empresarial Eólica (AEE)—would like to thank its associated members information provided for updating its database. For their cooperation with this report, It also extends its gratitude to electricity regulator, Comisión Nacional de la Energía (CNE), the national TSO, Red Eléctrica de España (REE), the European Wind Energy Association (EWEA), the Global Wind Energy Council (GWEC) and the Spanish side of the Iberian Energy Market Operator (Operador del Mercado Ibérico de Energía – Polo Español, S.A).

With the collaboration of

Alberto Ceña
Ángeles Mora
Emilien Simonot
Ángel Budia
Mar Morante
Sheila Carbajal
Paz Mesa
María Isabel Núñez

Editorial coordination

Sergio de Otto
Alejandro Pérez

Translation

Michael McGovern
Toby Price

Design

Estudio Jorge Gil

Layout and printing

Impression Artes Gráficas

Photos

All attributed photos are from finalists for the Eolo Prize 2009. The cover photo is the First Prize winner: "Lighting the Future", by Fernando Pastor. The back cover photo is "After the Fog", by Antonio Soler.

aee

Wind Power 2010

Spanish Wind Energy Association
The Sector's Reference

aee
Spanish Wind Energy Association

Sponsored by:

acciona

Index

aee
Spanish Wind Energy Association

aee
Spanish Wind Energy Association

President's Address

Rosa de los vientos
Emilio Muñoz

President's Address

The Right Path

The publication of a yearbook always requires us to take stock of the previous year. In this review of 2009, we cannot fail to be struck by the differences between the first and second halves of the year.

The sudden enforcement of **Royal Decree 06/2009** has marked a before and after for the sector. It has also brought about a hiatus that can only be resolved by the introduction of a new regulatory framework that reintroduces visibility and removes the image of us as a risk sector caused by last year's political and administrative tampering.

We cannot stress enough that our sector has complied with all that has been asked of it, and more. We not only produce clean power but we have also done it in line with established planning. At the same time, we have generated a world-class domestic industry that possesses all the characteristics currently demanded of future 'ideal' sectors within the Spanish economy, most importantly home-grown technology, R&D and internationalisation.

We hope that, in making their final decisions, the regulators will take all those factors into account and renew their commitment to a sector that **guarantees the future competitiveness** of Spanish industry.

Despite the current hiatus, we at the **Spanish Wind Energy Association**, are convinced we are on the right path. Wind is a technology of the future that has already demonstrated its efficacy and efficiency. It is a sector that is growing worldwide, especially in countries we are close to. We work with an energy source that, according to recent International Energy Agency's reports, will undergo the biggest growth of all electricity generation technologies from here to 2030, both in terms of absolute volume and percentage growth.

As the following pages of this yearbook will show, we remain a **dynamic sector** that invests more in R&D than the energy sector average. We are preparing for the future with our REOLTEC technology platform, which coordinates technological advancement. We are preparing for the leap towards new areas of development, such as offshore wind power and repowering. We are a sector that has made a huge effort in grid integration to become a global reference in this aspect. Indeed, in 2009, the Spanish sector reached a series of milestones that debunked all the grid barrier myths so often brandished against wind power. For a start, we have reached peaks of electricity demand coverage in excess of 50%; an achievement inconceivable just five years ago. We have covered over 40% of demand on average of a two-day period. In the final months of the year, we were the second biggest generator in the entire electricity system.

The year 2010 is going to be another difficult year, not due so much to the general economic climate—which, of course, will also take its toll—but more to regulatory uncertainties, which are the worst enemy of a sector needy of stable frameworks and clear horizons. We hope European energy policy will help dispel those uncertainties and that, in the next edition of our yearbook, we will be able to offer a brighter scenario in which all the positive aspects of wind power are recognised and valued, not just its clean and indigenous contribution to the energy supply but also all the other socioeconomic returns it has brought to our country.

Wind has done a lot for our country; lets let it to do even more.

José Donoso
President
Spanish Wind Energy Association

Molinos
Luis del Río

Chapter I
2009, a difficult year for an industry of the future

A contradictory balance

On weighing up 2009, it might seem a striking paradox that a year in which wind power registered its second largest growth in absolute terms, with 2,459 MW of new capacity, was also one of the sector's most difficult. Up to last year, and at least once every four years, the sector had already passed through moments of tension due to various regulatory modifications. But at no time had those changes threatened what had hither to been a solid, ordered and coherent history of development until the appearance in the Official State Bulletin, on May 7, 2009, of Royal Decree Law 6/2009 (RDL 6/2009). Among other aspects—such as tackling the electricity sector deficit or the creation of a social tariff*—that regulation also created the **Pre-allocation Register**, applicable to projects within the electricity sector's Special Regime (which embraces renewables and combined heat and power).

For the first time in almost fifteen years, a regulation came into force without prior sector knowledge. As detailed in **Chapter III**, the sector suddenly found itself with a surprise legislation changing the game rules from those in place when it undertook its development initiatives.

Two further aspects compounded the industry ministry's error of demanding paperwork where before it required the reality of a constructed wind plant. Firstly, the Ministry took eight months to resolve the avalanche of projects presented for pre-allocation. Secondly, it failed to provide an alternative future regulation for those projects that did not make it onto the Register. The long wait had an extremely negative impact on the sector, especially on manufacturers who, as well as experiencing the suspension of many existing orders suffered a dry period of no new orders until the ministry made its decision. Some ten thousand jobs directly and indirectly linked with wind were lost in an industry which, until the appearance of the Pre-allocation Register, was an example of job creation, despite the financial crisis.

Since September 2009, the **Spanish Wind Energy Association**, convinced of the sector's long future potential, has demanded government energy policy makers rectify in order to avoid the complete closure and migration to other markets of the national wind industry. Nevertheless, at the time this yearbook was completed, we had not received a clear and positive response to our demands.

I.1 The year of milestones

On the bright side, Spain's installed capacity base grew by 2,459 MW and wind became the electricity system's third largest technology, with a **penetration of 14.4%**. On the way, wind passed other milestones, such as covering **54.47%** of demand in the small hours of December 30 or covering 44.9% of demand during one whole day. Those are just two examples among a series of positive wind power facts and figures last year. Wind generation penetration within the electricity system last year was more than considerable and the technology, finishing the year behind combined cycle gas and nuclear generation only. Wind even beat nuclear generation in the last two months of the year.

Appearing on the horizon are new challenges, such as how to avoid curtailment

All those achievements imply the debunking of many myths regarding the grid integration restrictions to **wind penetration**. Beyond the mere figures, the important thing is that wind has proven it can resolve grid integration restrictions and has flown in the face of both generalised scepticism as well as the barriers which, just six years ago, the heads of the System Operator firmly held to be insurmountable.

Nocturno atemporal. Roberto Milán.

In the interim, the work carried out jointly by the System Operator and the sector itself—channelled through **AEE**—has brought down many of those barriers, as detailed in **Chapter IV**. Following a huge effort by both parties, most wind turbines have undergone grid adaptation, dispatch control centres have been put in place and prediction has improved, among other aspects. New challenges appear on the horizon, however, such as how to avoid wind production curtailment in trough demand periods due to the inflexibility of other technologies and the TSO need for a minimum amount of thermal reserve power. Work is being carried out to solve this problem, such as electric vehicle initiatives, increase water pump storage and improved interconnection with France. **AEE** is leading a project called Wind Power Regulation with Electric Vehicles (Regulación Eólica con Vehículo Eléctrico, or REVE). Other areas of work include increased demand management in order to improve the daily consumption curve.

I.2 The commitment to wind is global

Wind power growth in the rest of the world has been no less important than that experienced by Spain, proving that the commitment to that technology is becoming increasingly a global one. According to data from the Global Wind Energy Council (**GWEC**), and despite the financial crisis, **the global installed figure grew last year by 31%**, with over 37,000 MW of new wind capacity. China and USA led this leap, installing 13,000 MW and 10,000 MW of new capacity, respectively, with China in third place, relegating Spain to fourth position in the national cumulative capacity ranking. Furthermore, key neighbouring countries to Spain, like Germany, France and Italy, all installed over 1,000 MW in 2009. All those figures show

Spain is not alone in its commitment to wind, as is flippantly claimed from certain quarters. But perhaps the most striking figure comes from the **European Wind Energy Association (EWEA)**, which highlights wind power as the electricity generation source with the biggest growth on the Old Continent, with 10,163 MW of new capacity. That surpasses the achievements of gas, with 6,630 MW of new capacity. Nuclear power actually lost 1,393 of capacity. Furthermore, two Spanish operators take first and third place in terms of global wind capacity ownership, according to the annual report by consultancy firm BTM. Specifically, BTM places **Iberdrola Renovables** in first place, with 10,350 MW of cumulative capacity to end 2009. **Acciona** comes third, with 6,230 MW. US utility FLP Energy is second, with 7,544 MW. Regarding turbine manufacturers, Spain's **Gamesa** ranks in sixth position, with 19,225 MW, in a table where the presence of three Chinese manufacturers stands out, ranking third, fifth and seventh. The market remains dominated by Vestas, with 39,705 MW under its belt worldwide. **Vestas** has facilities in different parts of Spain.

I.3 New pay scheme pending

In 2010, Spain must either renew its leadership or watch the efforts of the past 20 years slip down the drain. The government agenda includes approval of both a new **Renewable Energy Plan 2011-2020** and a new regulatory framework, which must facilitate compliance with the European objective of meeting 20% of final energy consumption with renewables. As all figures indicate, wind power has been the most effective and efficient of the renewables technologies and it holds all the qualities to consolidate as a key pillar of the new sustainable energy model. For that reason, the sector itself proposes a target of 40,000 MW onshore and 5,000 offshore. For **AEE**, the first step should be to rectify the Pre-allocation Register's quotas, which cap new installed capacity together with the solving of the small problems that spurred this new and unexpected regulation in the first place. As far as the Renewable Energy Plan is concerned, **AEE** maintains its proposal but also understands—as it declared at the time—that the "Zurbano scenario", which reduced the target to 35,000 MW, may be reasonable given the fall in electricity consumption registered last year. Regarding the new regulatory framework, as has been the case with previous modifications, **AEE** maintains that the government indeed holds competences in setting incentives but that it is obligated to guarantee the reasonable profit criteria that will enable compliance with the European objectives. On finalising this yearbook, the Government was considering a retroactive reduction of the production incentives, which, in **AEE's** view, would irreparably damage sector credibility in the eyes of international financing and investment institutions.

In all last year's events, such as this press conference on December 21, AEE insisted on the need to pass the new regulation as soon as possible.

Photo EFE.

The government is responsible for setting incentives and should seek to maintain reasonable profits enabling compliance with European objectives

I.4 Renewables advance

Spain needs wind power. The 2009 edition of the Spanish Energy Balance report—compiled by the Club de la Energía (Energy Club) with contribution from various bodies—shows how renewables reached an all time maximum covering 12.4% of final energy consumption in Spain. That was thanks, in part, to falling fossil fuel consumption. But it was mainly due to wind

power development. The State's commitment to renewables entered the statute books in 1997 with the Electricity Sector Law, which set the objective of covering 12% of final energy consumption using renewable sources by 2010. In terms of power, renewables was to cover 29.4% of electricity consumption. On the way to those goals, renewables have reduced external energy dependence together with greenhouse gases. Nevertheless, there is still a long way to go. Last year, for instance, was a very good one for hydroelectricity. A year closer to average rainfall would once again reduce the renewables as a proportion of final energy consumption energy mix.

The most important renewables contribution was from wind power, which will comply with its 20.155 MW target to 2010, as set in the **Renewable Energy Plan 2005-2010** (PER, 2005-2010). During the PER period, wind's contribution has increased by 76%, covering 13.4% of total Spanish power consumption—14.46% on the mainland—against 7.4% at the outset. During that time, wind has generated 138 TWh of power, receiving incentives totalling €5.2 billion. If that 138 TWh of power had been produced with by gas fired turbines, gas imports would have cost €5.0-5.3 billion, according to **AEE** estimates.

Over the same period, wind has offset over 70 million tons of CO_2 emissions (against the same volume of production in gas fired generation). That would have cost Spain more than €500 million in CO_2 emission credits. The accounting is clear: that is €5.5 billion that would have gone to fossil fuel exporting countries against €5.2 that have stayed in Spain. That domestic expenditure has contributed to the development of an **important industrial base** with international reach, creating tens of thousands of jobs and spurring sector investments in R&D. The balance is clear and tangible for the Spanish economy. Instead of importing gas and coal, we have exported wind turbines, knowhow and a modern image of Spain, something that not many of our economic sectors can claim to have done. All those aspects are laid down in the **Macroeconomic Study of the Impact of the Wind Power Sector in Spain**, authored by Deloitte and presented to **AEE** last November.

Nuevos caminos. Francisco Carrasco.

Instead of importing gas and coal, we have exported wind turbines, knowhow and a modern and innovative image of Spain

I.5 Grid integration achievements

Standing out among the various lines of work in grid integration—mentioned in point I.1 and exposed in detail in **Chapter IV**—is the Working Group coordinated by **AEE** since 2006 now denominated the Technical Verification Committee (CTV in its Spanish acronym). The CTV has created and approved a procedure for verifying wind turbine compliance with voltage dip ride through requirements. The Committee has validated turbine models and wind plants. It has also certified compliance with the Verification, Validation and Certification Procedure (PVVC in its Spanish acronym) of the grid code P.O 12.3. The tremendous efforts made to adapt wind plants to that grid code, which states how to respond to specifically defined voltage dips, is paying off with excellent results. Indeed, of the 19,149 MW installed in Spain by end 2009, **16,625 MW, or 84.7%, had been certified** (the percentage increases if the 865 MW excluded from the process are deducted).

I.6 Considerable falling returns

Both 2009 and 2008 pose clear examples of the volatility of electricity market prices. Two years ago, the average price of the daily electricity market was 63.7% higher than that of 2007. Then, in 2009, the average price fell by 42.6% to €36.96 MWh; the lowest price registered since 2004. The drop—as detailed in **Chapter V**—was mainly due to a fall in demand (an effect rectified in what has gone of 2010), brought about both by the economic crisis and the considerable drop in fossil fuel prices. Logically, the connection of new wind capacity also contributed by pushing off the market increasing amounts of more expensive technologies, which mark the price. The average price attained by wind power in 2009 was also considerably lower. For wind generation governed by the RD 661/2007 regulation, the average price was **€77.05 MWh**. For older capacity governed by that regulations Transitional Disposition 1ª - extending the incentive established under RD 436/2004 - the price was **€74.07 MWh.** Those prices contrast starkly with the €85.94 MWh and 102.73 MWh achieved under the two regulations, respectively, in 2008.

I.7 Technological leadership

As mentioned, a chief characteristic of the Spanish wind sector is its global technological leadership, with **REOLTEC** as its showcase. In 2009, the **REOLTEC** platform projected the image of the Spanish wind sector through different international gatherings with counterpart from Estonia, Korea, Finland and Sweden, all interested in understanding the Spanish set up. **REOLTEC** also presents an opportunity to participate in the creation of a Sino-Spanish R&D project financing programme with the aim of extending co-operation among business from both countries and to create market openings for cutting-edge Spanish subsectors. Since last year, **REOLTEC** has taken on a new dimension with initiatives such as a clear openness towards Europe, an improved coordination with platforms from other countries and the launching of a diagnostic study regarding the positioning of Spanish wind sector technology.

Roberto Liberal.

Conviviendo con el futuro
Guillermo Quintanilla

Chapter II
The figures

Sector dynamism

In a review of the state of play of wind power in Spain and the world, the figures and statistics say more than anything else about sector dynamism, both in terms of installed capacity growth and of the amount of clean, indigenous generation produced. Such dynamism is not exclusive to Spain, as wind power is gaining an increasingly important role worldwide. Standing out among the many facts and figures in this chapter, several deserve special emphasis. For a start, new installed capacity came in at **2,459 MW** online, the biggest leap since the all time record in 2007. Having covered 14.39% of mainland electricity consumption, wind power became the electricity system's third biggest contributor. It also attained a spot peak, when it covered 54.1% of demand, and a daily record, covering 44.9%.

In 2009, **37,466 MW** on new capacity was installed, marking a 31% growth rate and underlining the global commitment to wind. Also significant are figures supplied by the European Wind Energy Association (EWEA) showing wind as the generation technology with most growth in Europe, with 10,163 MW of new capacity, ahead of combined cycle gas, which installed 6,630 MW, while nuclear actually lost 1,393 MW.

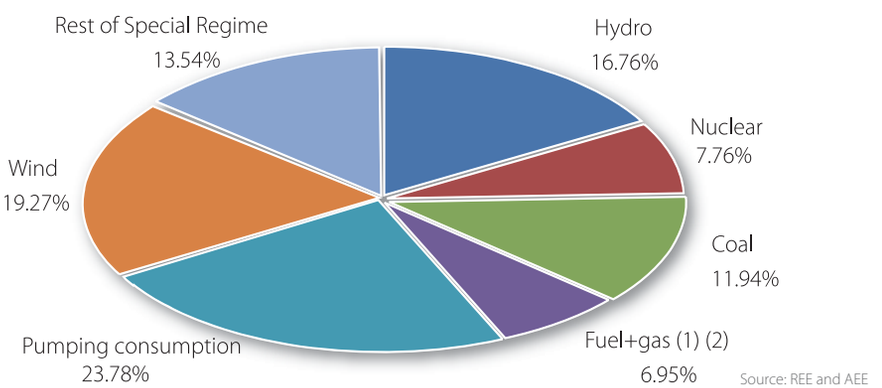
II.1 Installed capacity in Spain

II.1.1 Electricity mix

Wind power consolidated its position in 2009 as Spain's second largest generation base in terms of installed capacity, making up nearly 20% of the whole, as shown in **Graph II.01.** Only combined cycle gas is ahead (23.78%). Behind sit hydro (16.76%), the rest of Spain's Special Regime -grouping all renewables plus combined heat and power- (13.54%), coal (11,94%), nuclear (7,76%) and fuel/gas (6,95%).

Yet a true grasp of wind growth is best represented in **Graph II.02.**, showing each generation technology's new installed capacity in 2009. As illustrated, the 2,459.8 MW of new wind capacity installed last year was five times higher than new combined cycle gas capacity, in second place with 568 MW. At the same time, hydro, nuclear and coal failed to install any new capacity at all. Furthermore, both fuel/gas and the rest of the Special Regime decommissioned capacity, bringing down the cumulative capacity figure.

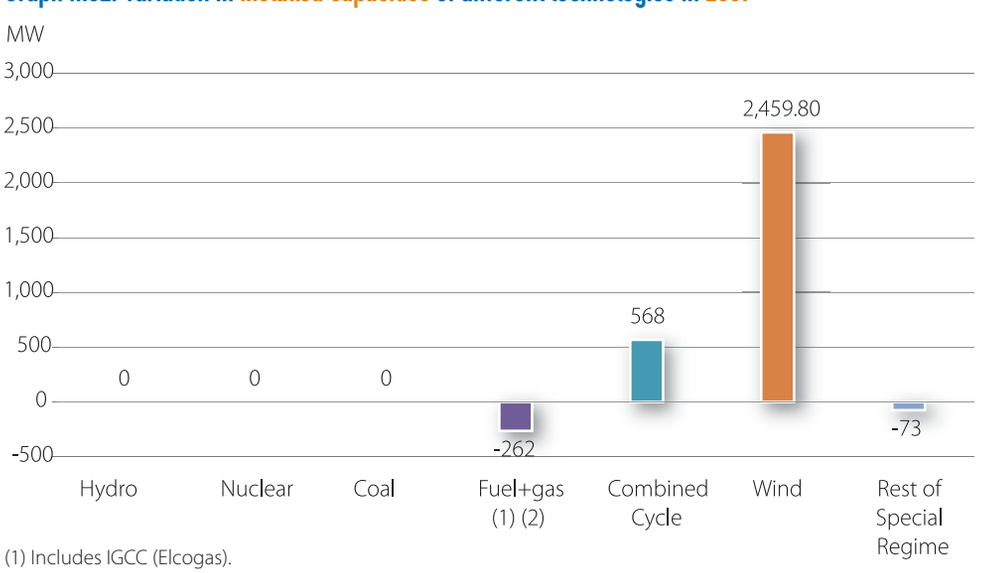
Graph II.01. Breakdown of installed capacity by generation technology in the Spanish electricity system to 31/12/2009



(1) Includes IGCC (Elcogas).

(2) For the Canary electricity system, ancillary generators are included

Graph II.02. Variation in installed capacities of different technologies in 2009



(1) Includes IGCC (Elcogas).

(2) For the Canary electricity system, ancillary generators are included.

Source: REE and AEE

Table II.01. Installed capacity of different technologies to end 2009

Installed power to 31/12/2009	2009			
	Mainland electricity sistem (MW)	Island electricity sistem(MW)	National total (MW)	% share of total
Hydro	16,657	1	16,658	16.76%
Nuclear	7,716	0	7,716	7.76%
Coal	11,359	510	11,869	11.94%
Fuel+Gas (1) (2)	3,927	2,980	6,907	6.95%
Combined Cycle	22,243	1,392	23,635	23.78%
Total of Ordinary Regime	61,902	4,883	66,785	67.20%
Wind	19,007	142	19,149	19.27%
Rest of Special Regime	13,194	260	13,454	13.54%
Total of Special Regime	32,201	402	32,603	32.80%
Grand Total	**94,103**	**5,285**	**99,388**	**100%**

(1) It includes IGCC

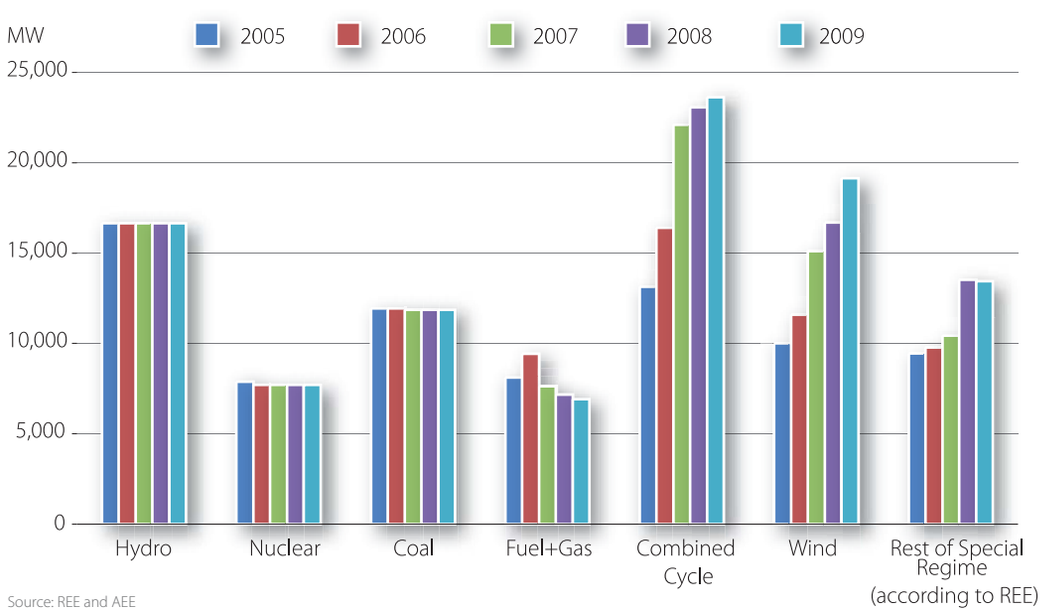
(2) For the Canary electricity system, ancillary generators are included.

Source: REE and AEE

Table II.01. shows in detail the installed capacities of different technologies, indicating existing capacity (MW) in the mainland and island systems, both separately and combined. Each technology's capacity as a proportion of the whole is also shown. The Special Regime, headed by wind power, makes up nearly a third of the whole. One striking aspect is the low presence of Special Regime capacity in the islands, making up less than 10% of the total.

Graph 11.03. illustrates how wind power growth over the past five years has been constant and controlled, as AEE has always argued. Thus, while strong growth was experienced by combined cycle gas in 2007 and the rest of the Special Regime in 2008, wind has grown at a stable pace. Regarding the other technologies, hydro, nuclear and coal have remained mainly unaltered, while fuel/gas has been in decline since 2006.

Graph II.03. Annual installed capacity of different technologies. 2005-2009



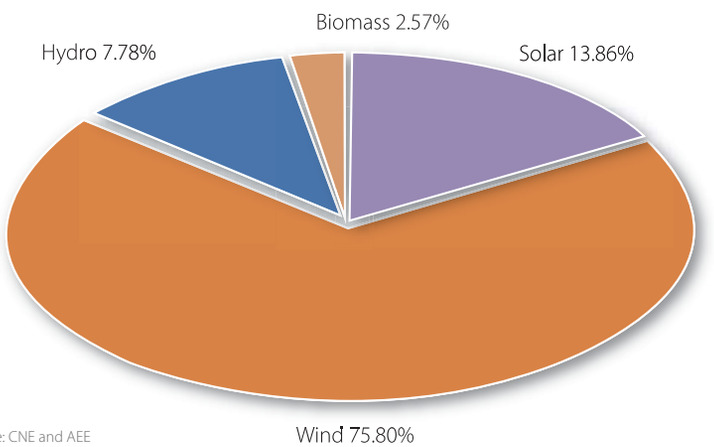
Source: REE and AEE

El abrazo. Manuel Navarro.

II.1.2 Renewables technologies

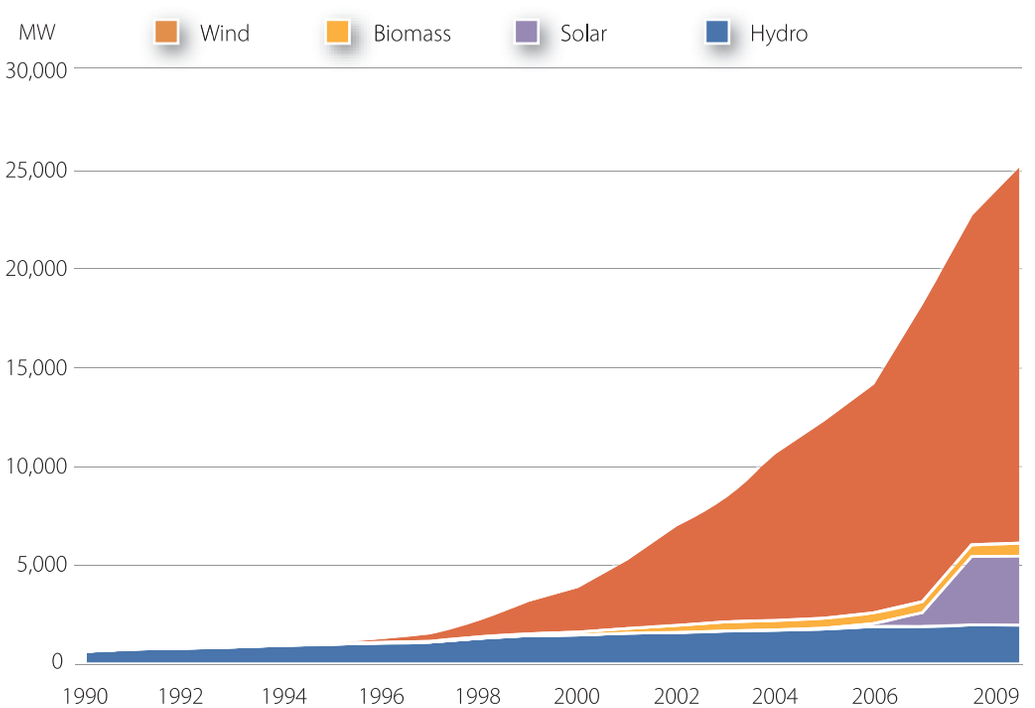
Wind power's steady growth keeps it at the head of renewables development, now making up 75.80% of all installed renewables capacity, followed by solar power, with 13.86%, and then small hydro, with 7,78%. Regulator CNE's statitistics do not yet distinguish between solar photovoltaic and thermoelectric power.

Graph II.04. Renewables technologies' installed capacity breakdown. 2009



Source: CNE and AEE

Graph II.05. Renewables annual installed capacity. 1998-2009



Source: CNE and AEE

II.1.3 Wind capacity

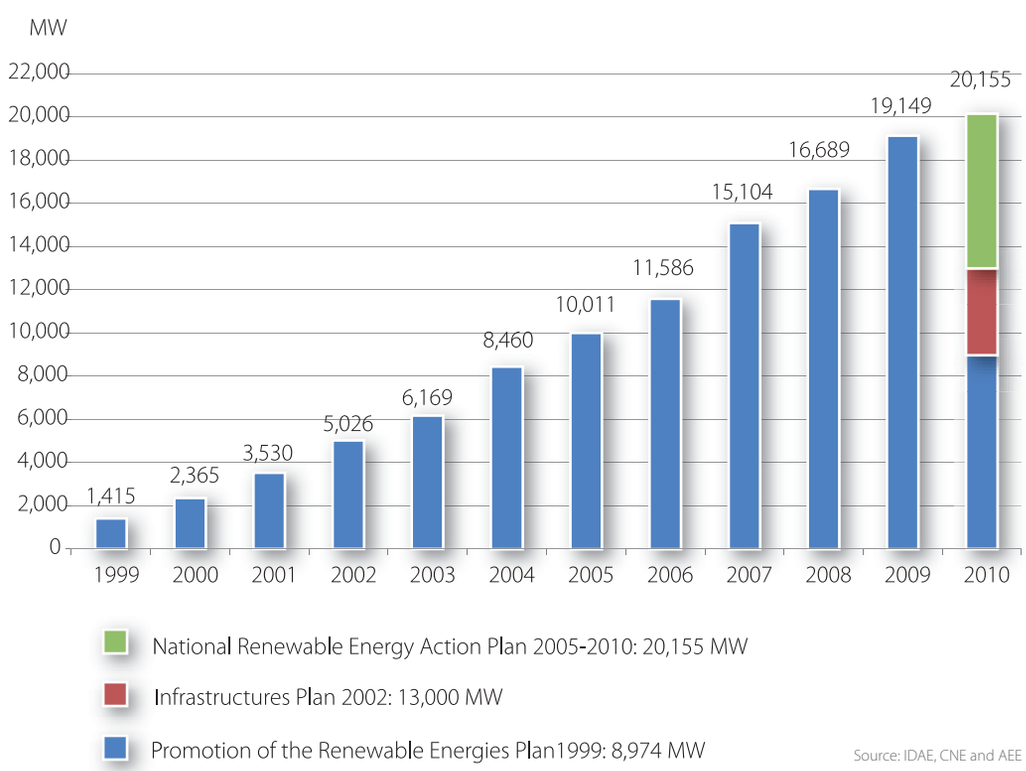
The past decade has been one of takeoff and maturity for Spanish wind power, with installed capacity leaping from 1,415 MW end-1999 to 19,149 MW end-2009. While such growth may be striking, the truth is that wind power technology has developed closely in line with state renewable energies' planning.

Neverthless, **Graph II.06.** shows that while growth has been regular, there have been certain years with especially high levels: 2004, 2007 and 2009. Those cases coincide with the regulatory changes affecting the sector (Royal Decree 436/2004, RD 661/2007 and RD-Law 6/2009). Indeed, last year's strong growth was due to the regulatory instability following the government's publishing of RD Law 6/2009, which created the Pre-allocation Register, determining how much capacity could be installed 2009-2012.

The sector perplexity arising from this sudden and unexpected change of rules spurred a development rush with new installed capacity reaching 2,459 MW, according to figures compiled by **AEE's Wind Power Observatory**.

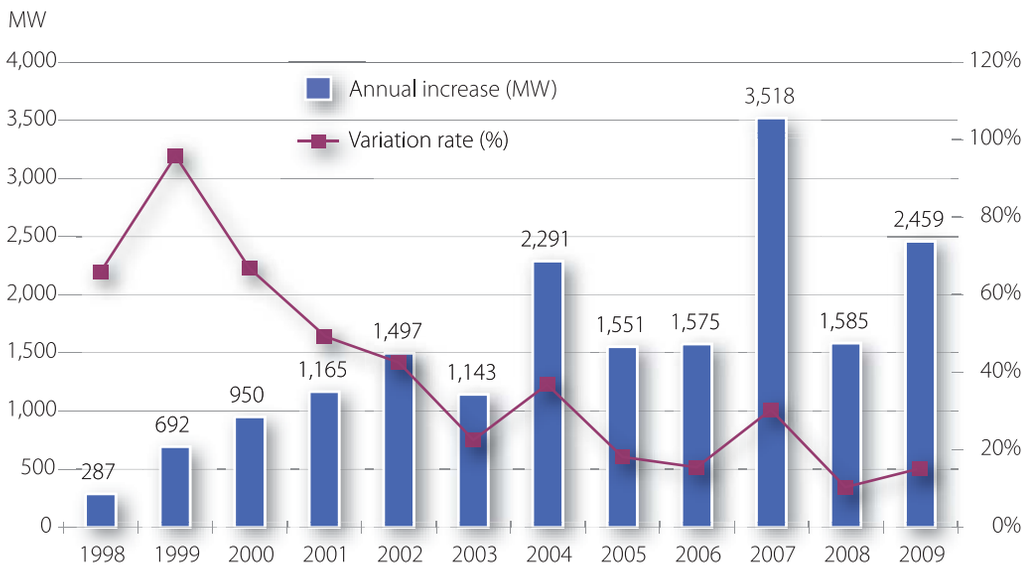
The figure represents a 14.7% increase in cumulative capacity as it stood at the beginning of 2009. Nevertheless, while those figures might be healthy ones, **AEE** forecasts 2010 will be the year when the negative effects of the Pre-allocation Register impact the sector and new installed capacity figures, which will not tally more than 1,000 MW throughout the twelve months.

Graph II.06. Cumulative annual wind capacity growth (1999-2009) and PER 2005-2010 planning



Source: IDAE, CNE and AEE

Graph II.07. Annual installed wind capacity increase and variation rate. 1998-2009



Source: AEE

Table II.02. Regional breakdown of installed wind capacity. 2008-2009

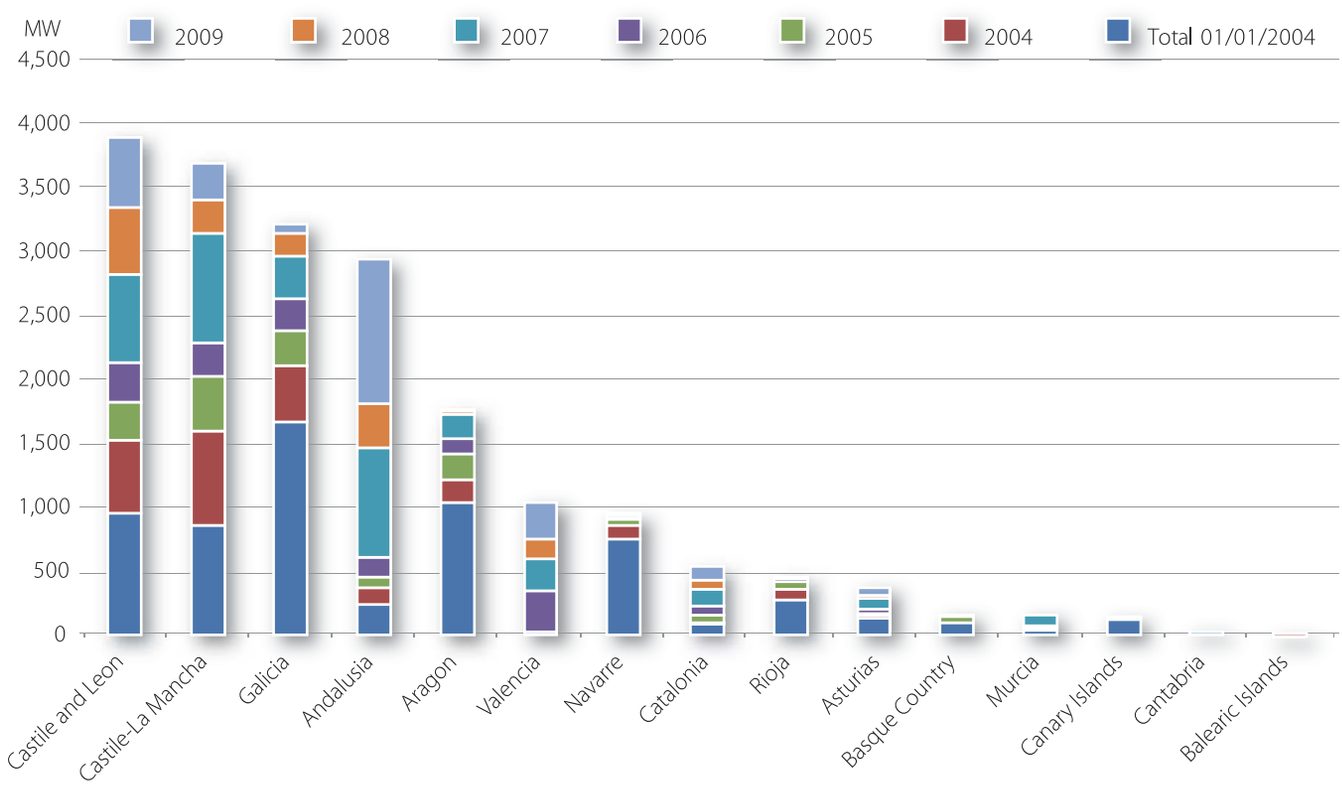
Region	Wind power to 31/12/2008 (MW)	New capacity in 2009 (MW)	Total wind power to 31/12/2009 (MW)	Variation rate(%)	Share of total %	Number of wind farms
Castile and Leon	3,334.04	548.68	3,882.72	16.5%	20.3%	171
Castile-La Mancha	3,415.61	284	3,699.61	8.3%	19.3%	120
Galicia	3,140.76	91.05	3,231.81	2.9%	16.9%	148
Andalusia	1,762.61	1,077.46	2,840.07	61.1%	14.8%	127
Aragon	1,749.31	4.50	1,753.81	0.3%	9.2%	75
Valencia	697.24	289.75	986.99	41.6%	5.2%	30
Navarre	958.77	3	961.77	0.3%	5%	44
Catalonia	419.44	105.10	524.54	25.1%	2.7%	22
La Rioja	446.62	0	446.62	0%	2.3%	14
Asturias	304.30	51.65	355.95	17%	1.9%	15
Basque Country	152.77	0	152.77	0%	0.8%	7
Murcia	152.31	0	152.31	0%	0.8%	10
Canary Islands	134.09	4.25	138.34	3.2%	0.7%	47
Cantabria	17.85	0	17.85	0%	0.1%	1
Balearic Islands	3.65	0	3.65	0%	0%	3
Total	**16,689.36**	**2,459.44**	**19,148.80**	**14.74%**	**100%**	**834**

Source: AEE

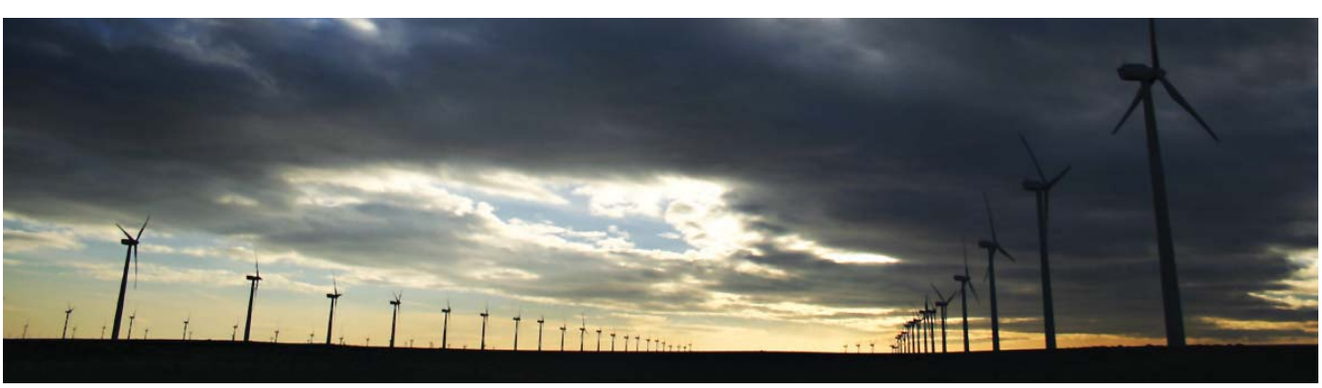
Andalusia and **Castile and León** stand out among the autonomous regions in 2009. Specifically, Andalusia installed the most new capacity, 1,077 MW in all—almost twice that of runner up, Castile and León, which installed 548 MW. In third place comes **Valencia**, with 289.75 MW of new wind capacity, closely followed by **Castile-La Mancha** with 284 MW.

In terms of cumulative capacity, Castile and León, with 3,882 MW by end-2009 took over first place from Castile-La Mancha, which finished the year with 3,699 MW. **Galicia** maintained its third position—though it only managed 90 MW of new capacity throughout 2009—while strong growth in Andalusia consolidated that region's ranking in forth place. Indeed, Andalusia experienced the biggest growth rate, at 61.1%. Arriving sixth, Valencia overtook **Navarre**, whose wind capacity has barely altered in recent years.

Graph II.08. Regional installed capacity growth. 2004-2009



Source: AEE



Carlos Cazurro.

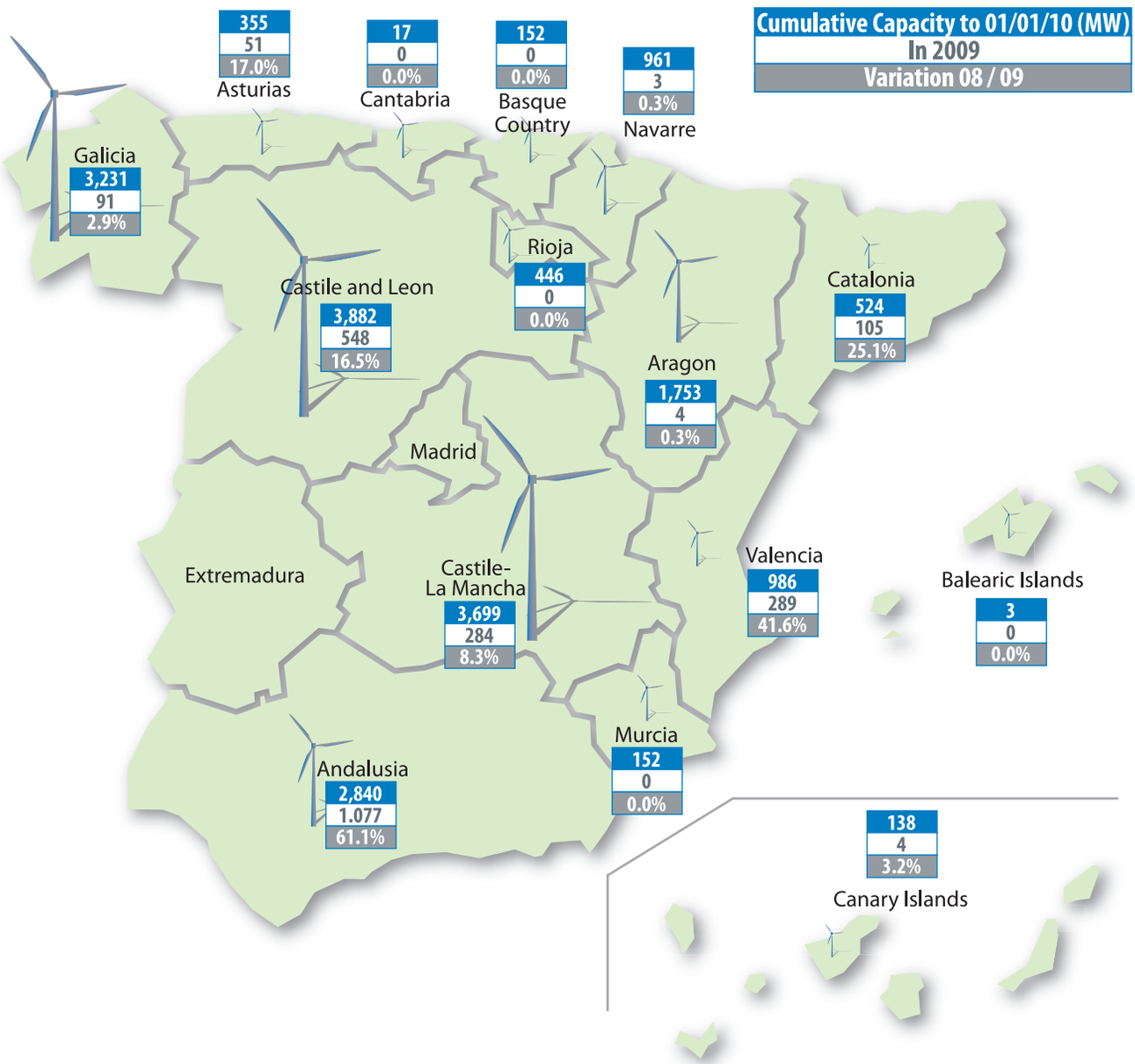
Table II.03. Installed capacity and number of wind plants in province to end-2009

Region	Province	Cumulative capacity to end 2009 (MW)	Total number of wind farms
	Almeria	467.75	17
	Cadiz	1,230.54	62
	Granada	349.30	15
Andalusia	Huelva	287.80	10
	Jaen	15.18	1
	Malaga	412.00	16
	Seville	32.50	3
	Seville and Malaga	45.00	1
Total Andalusia	**Andalusia**	**2,840.07**	**125**
	Huesca	279.15	8
Aragon	Teruel	177.95	7
	Saragossa	1,296.71	60
Total Aragon	**Aragon**	**1,753.81**	**75**
Asturias	Asturias	355.95	15
Total Asturias	**Asturias**	**355.95**	**15**
Balearic Islands	Balearic Islands	3.65	3
Total Balearic Islands	**Balearic Islands**	**3.65**	**3**
	Fuerteventura	13.31	4
	Gran Canaria	73.99	28
Canary Islands	La Gomera	0.36	1
	La Palma	9.93	5
	Lanzarote	8.78	2
	Tenerife	31.98	7
Total Canary Islands	**Canary Islands**	**138.34**	**47**
Cantabria	Cantabria	17.85	1
Total Cantabria	**Cantabria**	**17.85**	**1**
	Albacete	1,989.61	64
	Ciudad Real	202.00	5
Castile-La Mancha	Cuenca	794.10	20
	Guadalajara	630.40	24
	Toledo	83.50	7
Total Castile-La Mancha	**Castile-La Mancha**	**3,699.61**	**120**
	Avila	132.13	9
	Burgos	1,232.72	56
	Burgos - Palencia	8.80	1
	Leon	299.75	14
	Palencia	504.35	24
Castile and Leon	Salamanca	43.14	2
	Segovia	48.52	2
	Segovia - Soria	27.20	1
	Soria	987.07	35
	Valladolid	88.13	2
	Zamora	510.91	26
Total Castile and Leon	**Castile and León**	**3,882.72**	**172**
	Barcelona	75.00	2
Catalonia	Lerida	40.50	1
	Lerida y Tarragona	44.00	2
	Tarragona	365.04	17
Total Catalonia	**Catalonia**	**524.54**	**22**
Valencia	Castellon	554.55	15
	Valencia	432.44	15
Total Valencia	**Valencia**	**986.99**	**30**
	Corunna	1,020.59	58
	Corunna - Lugo	163.62	6
	Lugo	1,222.25	48
Galicia	Lugo - Pontevedra	43.83	2
	Ourense	222.02	12
	Ourense - Pontevedra	176.20	5
	Pontevedra	383.30	18
Total Galicia	**Galicia**	**3,231.81**	**149**
La Rioja	Logroño	446.62	14
Total La Rioja	**La Rioja**	**446.62**	**14**
Murcia	Murcia	152.31	10
Total Murcia	**Murcia**	**152.31**	**10**
Navarre	Navarre	961.77	44
Total Navarre	**Navarra**	**961.77**	**44**
	Alava	81.80	2
Basque country	Guipúzkoa	26.97	2
	Vizcaya	44.00	3
Total Basque Country	**Basque Country**	**152.77**	**7**
Grand Total		**19,148.80**	**834**

Note: The number of plants includes plant extensions and experimental plants

Source: AEE

Map II.01. Regional capacity breakdown (MW)

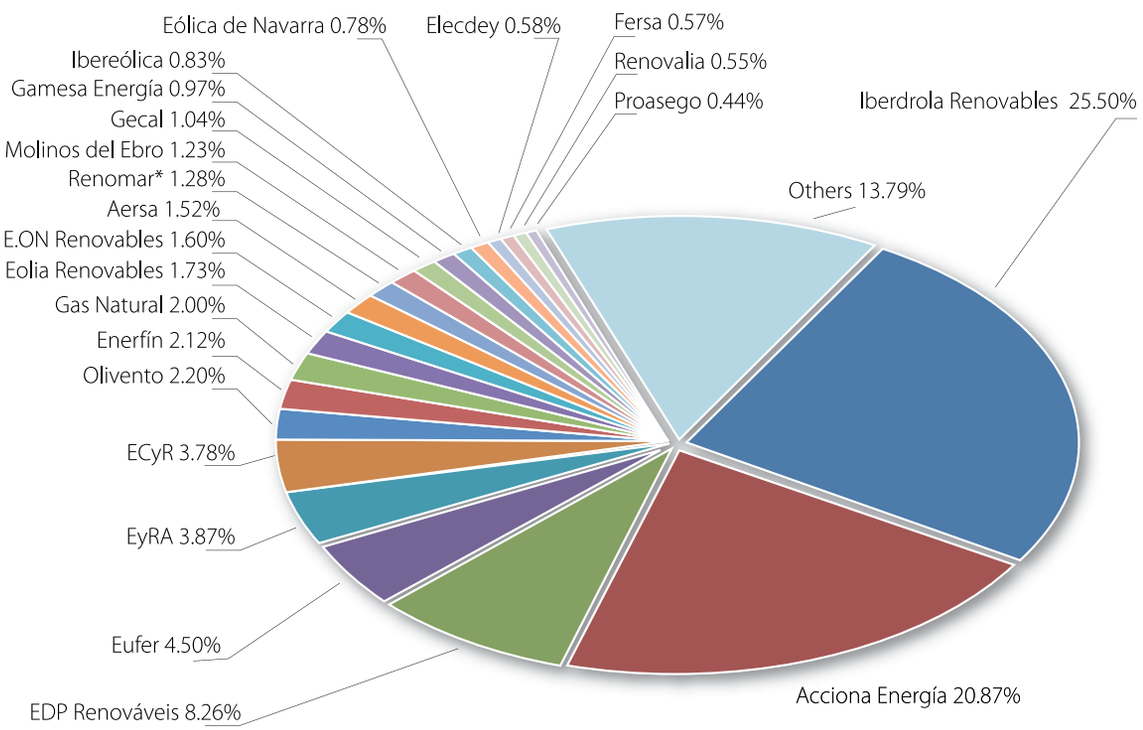


Source: AEE

Undoubtedly, as mentioned, Andalusia was last year's star, with cumulative capacity growing 61.1% over the year. But sharing some of the limelight were Valencia, with a 41.6% growth after installing 289 MW, Catalonia, which grew 25% and Asturias, with 17% more capacity. The Basque Country, Cantabria, the Balearic Islands, Murcia and Rioja did not put a single wind turbine up in 2009.

II.1.3.1 Wind capacity installed by companies

Graph II.09. Breakdown of company ownership of cumulative installed wind capacity to end-2009



* Renomar has a total of 490.5% but, as Acciona owns 50% of that company, only the 50% owned by Medwind is reflected here.

Source: AEE

Iberdrola Renovables and **Acciona** maintain their leadership in wind plant development, owning 25.5% and 20.87% of cumulative capacity, respectively, to end 2009. The rest of the market is spread thinly among companies whose market share varies from 8.26% in the case of **EDP Renováveis**, and 0.44% in that of **Proasego**. Numerous companies with a lower share figure in **Graph II.09.** as "others", making up a combined 13.79%.

Furthermore, putting to one side the top ten wind plant owners of cumulative capacity to end 2009, the percentage of combined ownership by the remainder is 25.2%, against 23% the previous year, illustrating how, bit by bit, the smaller companies are scratching market share from the big corporations.

Regarding new capacity installed throughout 2009, while Acciona (359.70 MW) and Iberdrola Renovables (341.45 MW) once again came top, EDP Renováveis (291 MW), **Eufer** (247.20 MW) and **EyRA** (246.25 MW), followed closely behind. Indeed, the annual market share of new capacity last year among the top five companies varies just 10-14%. Those top five were also behind 60% of new capacity, leaving 40% for the rest of the field.

Table II.04. Company ownership of wind capacity new wind capacity 2008, 2009 and cumulative

Developer	Cumulative wind capacity to end 2008 (MW)	Wind capacity installed in 2009 (MW)	Share of total installed wind power in 2009 %	Cumulative wind capacity installed to end 2009 (MW)	Share of total to end 2009 (%)	Variation rate (%)
Iberdrola Renovables	4,540.55	341.45	13.88%	4,882	25.50%	7.52%
Acciona Energía	3,637.12	359.70	14.63%	3,996.82	20.87%	9.89%
EDP Renováveis	1,290.87	291.03	11.83%	1,581.91	8.26%	22.55%
Eufer	614.31	247.20	10.05%	861.51	4.50%	40.24%
EyRA	494.11	246.25	10.01%	740.36	3.87%	49.84%
ECyR (1)	671.94	52.33	2.13%	724.27	3.78%	7.79%
Olivento	421.79	0	0.00%	421.79	2.20%	0%
Enerfín	335.39	69.72	2.83%	405.11	2.12%	20.79%
Gas Natural	382.77	0	0.00%	382.77	2%	0%
Eolia Renovables	232.80	98.94	4.02%	331.74	1.73%	42.50%
E.ON Renovables	214.54	92.21	3.75%	306.75	1.60%	42.98%
Aersa	291.42	0	0.00%	291.42	1.52%	0%
Renomar (2)	197.25	48	1.95%	245.25	1.28%	24.33%
Molinos del Ebro	235.16	0	0.00%	235.16	1.23%	0%
Gecal	95.75	104	4.23%	199.75	1.04%	108.62%
Gamesa Energía (3)	144.45	40.50	1.65%	184.95	0.97%	28.04%
Ibereólica	140.90	18	0.73%	158.90	0.83%	12.78%
Eólica de Navarra	149.11	0	0.00%	149.11	0.78%	0%
Elecdey	69.59	40.80	1.66%	110.39	0.58%	58.63%
Fersa	95.98	12.60	0.51%	108.58	0.57%	13.13%
Renovalia	105	0	0.00%	105	0.55%	0%
Proasego	62.65	22	0.89%	84.65	0.44%	35.12%
Others	2,265.93	374.70	15.24%	2,640.63	13.79%	16.54%
Total (MW)	**16,689.36**	**2,459.44**	**100.00%**	**19,148.80**	**100%**	**14.74%**

Source: AEE

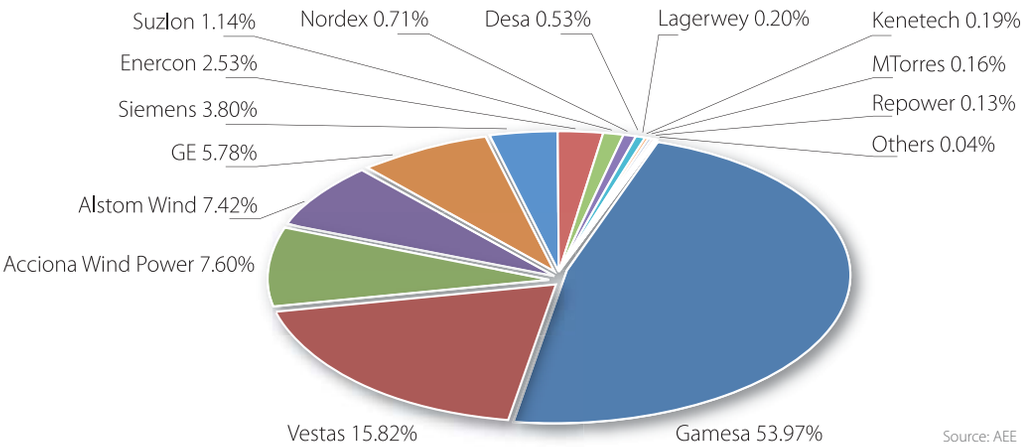
(1) Ecyr developed a total power of 214.6 MW but subsequently sold four farms to Acciona Energía.

(2) Renomar has a total of 490.5 MW but as Acciona owns 50% of this company here it is only reflected Medwind's 50%.

(3) Gamesa developed a total capacity of 370.1 MW but subsequently sold nine farms to Iberdrola Renovables.

Abanicos Blancos. Álvaro Corripio.

Graph II.10. Manufacturer share of cumulative installed wind capacity to end-2009



Source: AEE

As is the case with developers, the manufacturers are also seeing how competition from market newcomers is gaining ground. Putting aside the top four manufacturers, the capacity installed by the remaining competitors combined is 15.2%, against 13.4% the previous year; that is, nearly two percentage points higher.

In any case, **Gamesa's** leadership is solid, having manufactured practically 54% of Spain's cumulative installed capacity. **Vestas**, with 16%, doubles the market share from the third-ranked manufacturer, **Acciona**, which has around 8% of the market.

Gamesa, Vestas and Acciona—in that order—also top the tables for new capacity installed in 2009. Nevertheless, other companies are making inroads, as is the case of **Enercon**, which, in 2009, installed 210 MW, against a cumulative capacity to end-2008 of 274.5 MW.

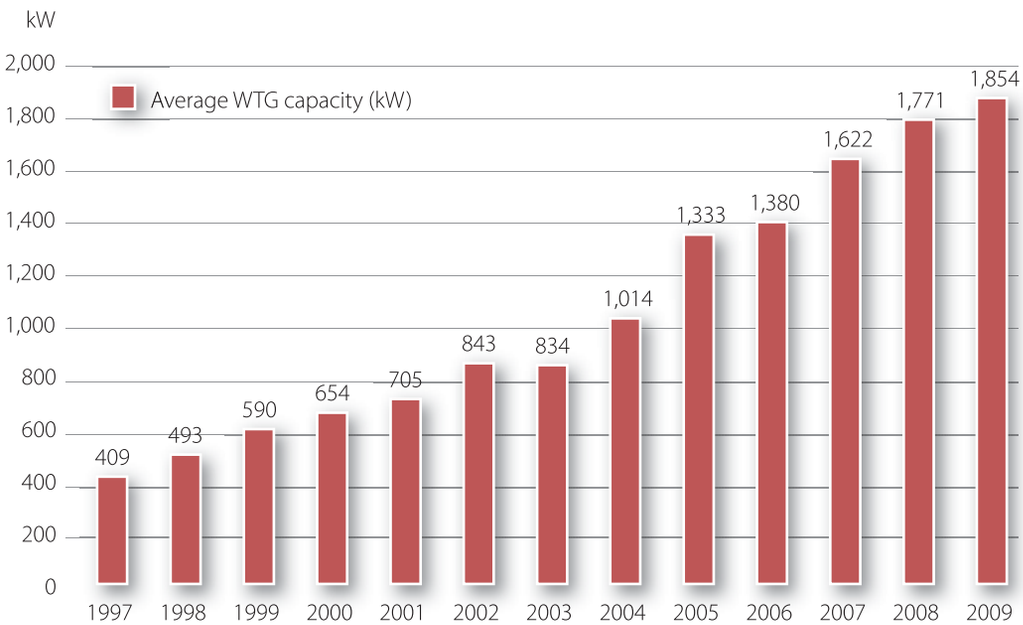
Table II.05. Manufacturer share of wind capacity installed in 2008, 2009 and cumulative

Manufacturer	Cumulative wind capacity to end 2008 (MW)	Share of total to end 2008 (%)	Wind capacity installed in 2009 (MW)	Share of total installed wind power in 2009 (%)	Cumulative wind capacity to end 2009 (MW)	Share of total to end 2009 (%)	Variation rate (%)
Gamesa	9,489.52	56.86%	845.15	34.36%	10,334.67	53.97%	10.28%
Vestas	2,455.36	14.71%	573.61	23.32%	3,028.97	15.82%	23.36%
Acciona Wind Power	1,229.10	7.36%	226.05	9.19%	1,455.15	7.60%	18.39%
Alstom Wind	1,296.60	7.77%	124.09	5.05%	1,420.69	7.42%	9.57%
GE	1,034.20	6.20%	72.5	2.95%	1,106.70	5.78%	7.01%
Siemens	612.40	3.67%	115	4.68%	727.40	3.80%	18.78%
Enercon	274.50	1.64%	210.1	8.54%	484.6	2.53%	76.54%
Suzlon	0	0%	218	8.86%	218	1.14%	0%
Nordex	85.24	0.51%	49.94	2.03%	135.18	0.71%	58.59%
Desa	101.02	0.61%	0	0%	101.02	0.53%	0%
Lagerwey	37.50	0.22%	0	0%	37.50	0.20%	0%
Kenetech	36.90	0.22%	0	0%	36.90	0.19%	0%
MTorres	30.30	0.18%	0	0%	30.30	0.16%	0%
Repower	0	0%	25	1.02%	25	0.13%	0%
Others	6.73	0.04%	0	0%	6.73	0.04%	0%
Total	**16,689.36**	**100%**	**2,459.44**	**100%**	**19,148.80**	**100%**	**14.74%**

Source: AEE

II.1.4 Wind turbines

Graph II.11. Annual change in average turbine size. 1997-2009

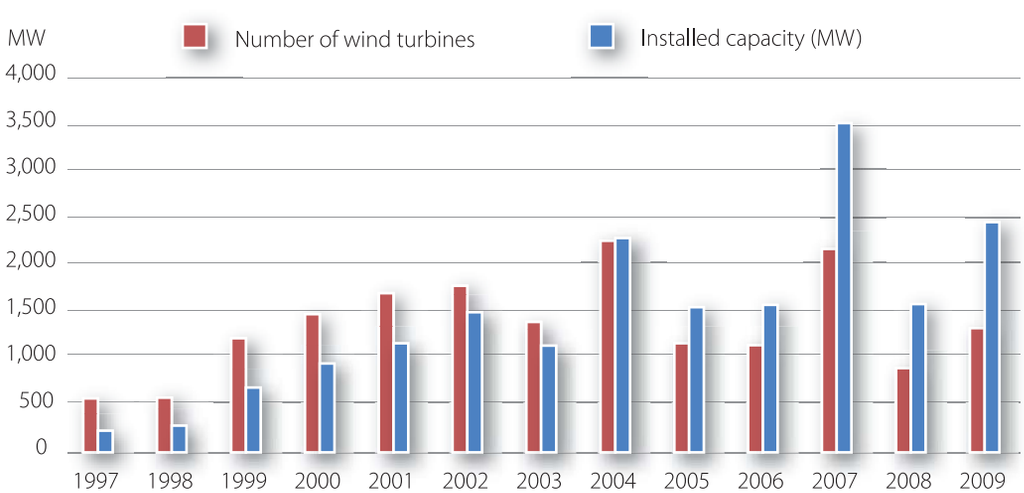


Source: AEE

In 2009, 1,329 wind turbines were installed in Spain, with unit size averaging 1,854 kW, as shown in **Graph II.11.** The graph also illustrates the speed with which turbine sizes are growing, the average being 1,000 kW (1 MW) in 2004, reaching around 1,900 kW (1.9 MW) by end-2009. Furthermore, according to **AEE** figures, over 70% of turbines installed in 2009 were above 2 MW in unit capacity. Gamesa installed a 4.5 MW prototype.

Accordingly, as illustrated in **Graph II.12.**, since 2004 (when average turbine size was little more than 1 MW), the number of turbines needed has been slightly reduced due to increase capacity and efficiency.

Graph II.12. Number of wind turbines against capacity installed annually. 1997-2009



Source: AEE

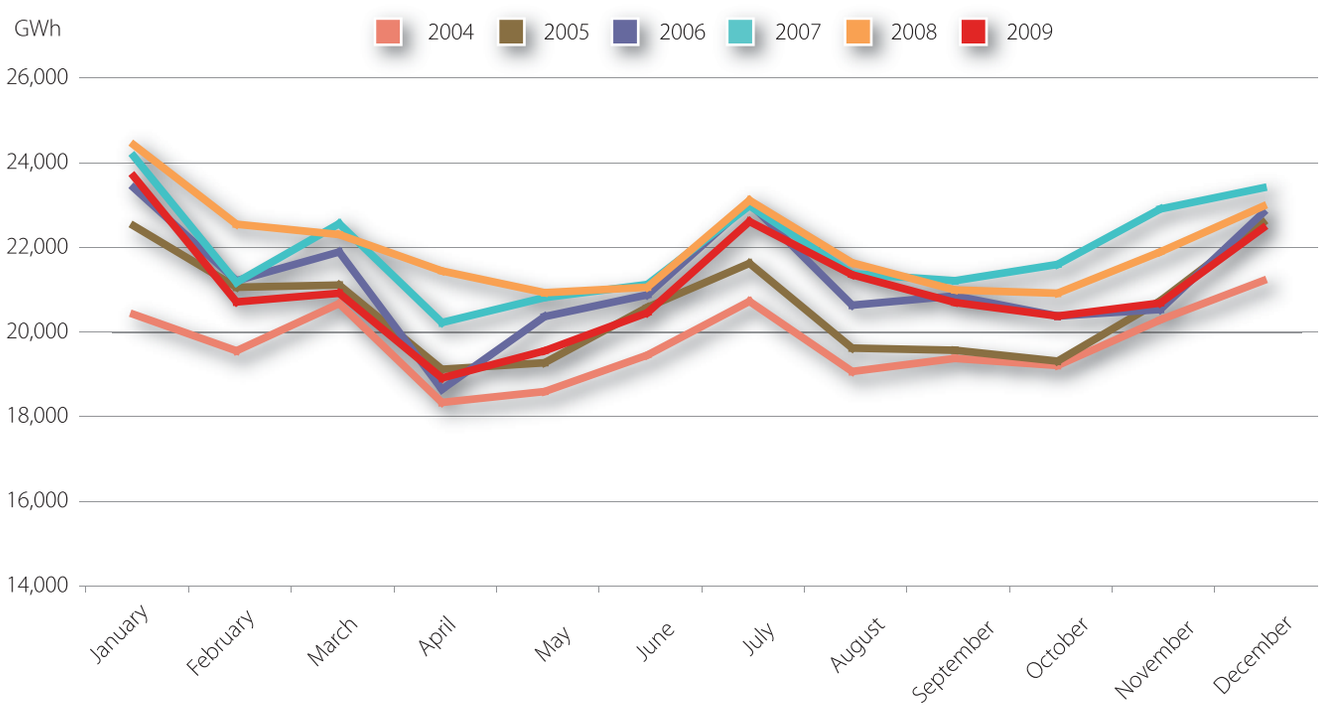
II.2 Generation in Spain

II.2.1 Electricity mix

Spain has not been immune to the effects of the global economic crisis, which has had its impact on electricity demand in 2009. As factories and industrial centres have closed down, demand has fallen and, as **Graph II.13.** illustrates, consumption in 2009 has fallen below the levels of 2007 and 2008.

Within that complex context, wind power covered 14.39% of demand, sitting behind only nuclear (20,9%) and combined cycle gas (31%). Furthermore, those two technologies have experienced a drop in penetration compared to the previous year. The difference between wind and nuclear generation volumes last year was 6.5 percentage points, against 10 percentage points the previous year. Coal dropped from covering 17% of demand in 2008 to 13.46% in 2009. Penetration by hydro and the rest of the Special Regime rose 1.6 and 4.23 percentage points, respectively.

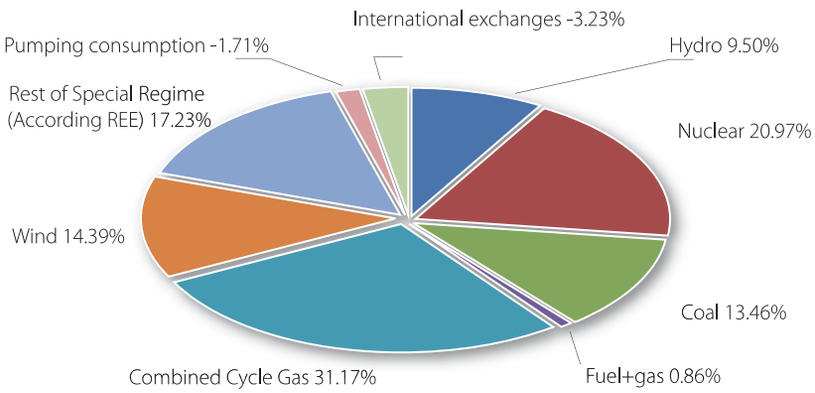
Graph II.13. Monthly demand for electricity transmission at power station busbars. 2004-2009



Source: REE

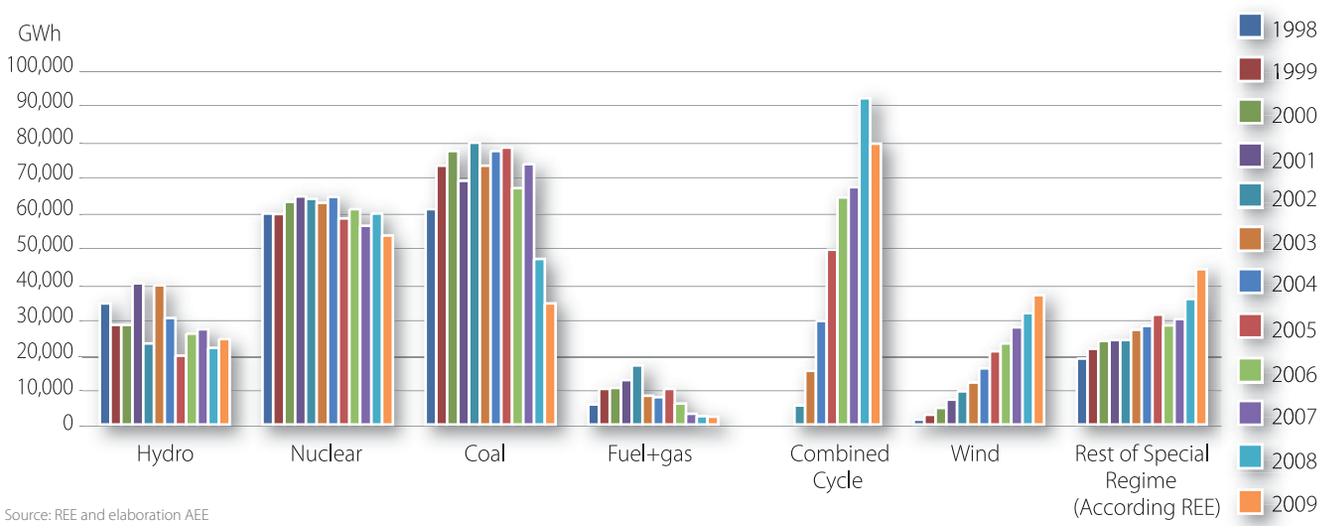
Compatible. José Ramón Moreno.

Graph II.14. Coverage of mainland demand by different technologies in 2009



Source: REE and AEE

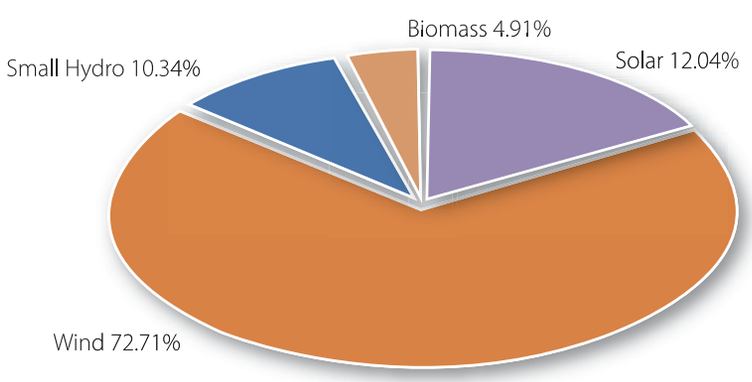
Graph II.15. Annual generation by different technologies. 1998-2009



Source: REE and elaboration AEE

Graph II.15. is a medium-term review (1998-2009) of the changing generation set up in Spain. While penetration by the four technologies on the left has dropped (especially in the case of coal, which has halved in the period 2007-2009), combined cycle gas, wind and the rest of the Special Regime have grown considerably over the past decade. And while combined cycle penetration dropped last year, wind and Special Regime generation maintain an upward trend. Finally, wind power is noticeable for its steady growth, without excessive peaks.

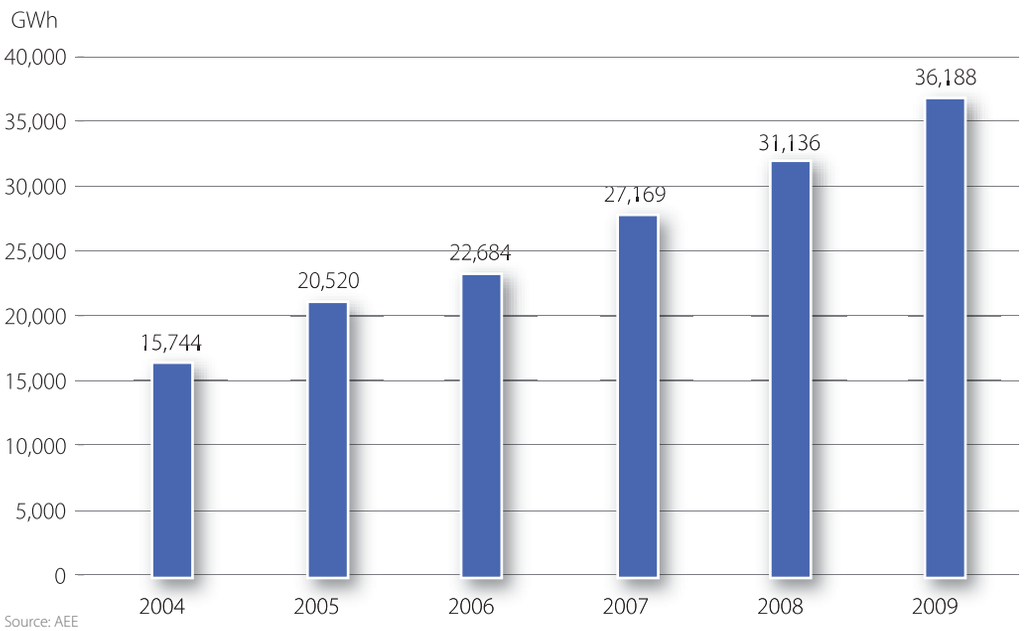
Graph II.16. Renewables generation 2009



Source: CNE and REE

II.2.2 Wind generation

Graph II.17. Annual wind generation. 2004-2009

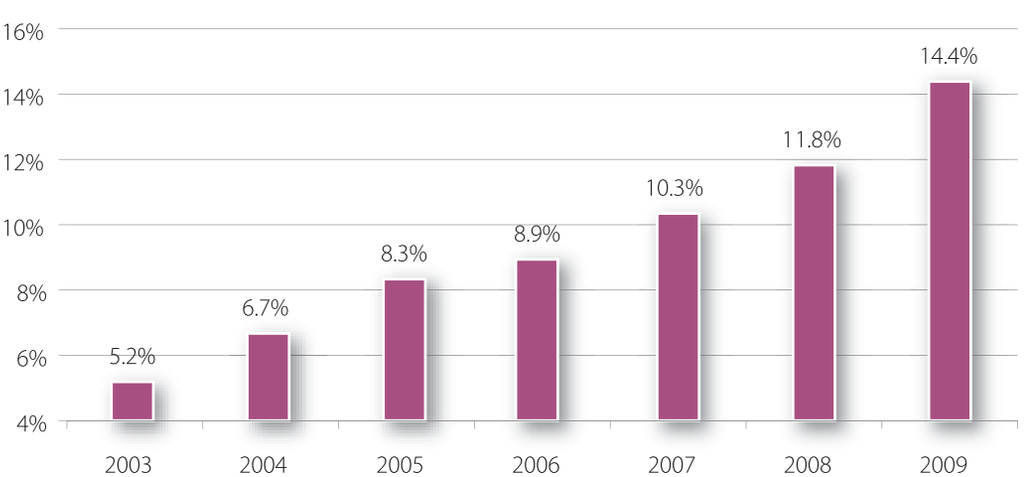


Source: AEE

This graph clearly illustrates the steady growth of wind power's contribution to covering demand over the past six years. Since 2004, wind generation has grown on average 4,088 GWh. Years like 2006 when its contribution only increased by 2,164 GWh compared to the previous year were compensated with other years, like 2009, when it increased by 5,000 GWh against 2008, reaching **36,188 GWh.**

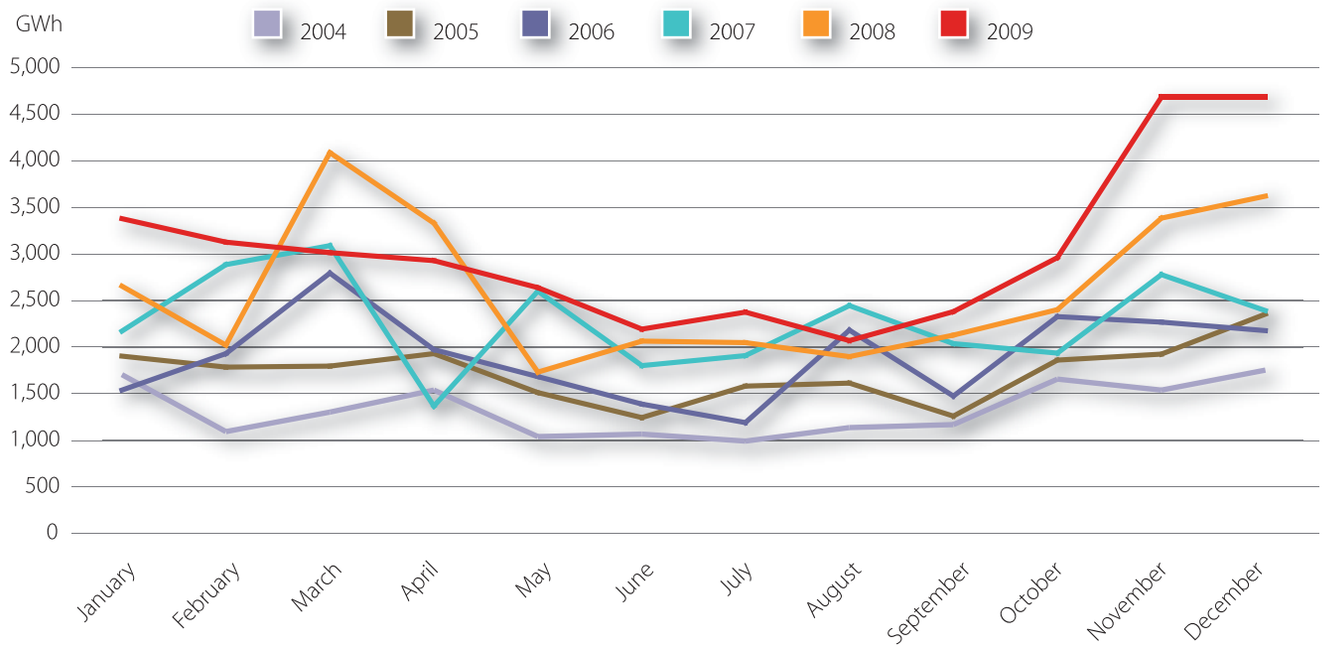
In any case, in 2009, wind's contribution to covering demand grew more than in any other year, reaching 14.4%. **Graph II.18.** shows how last year produced the biggest rise in demand coverage growth since 2003, with a 3 percentage point rise on the figure for 2008. That increase is explained both by a significant increase in installed wind capacity and the fall in electricity demand mentioned earlier.

Graph II.18. Annual coverage of electricity demand by wind power. 2003-2009



Source: Elaboration AEE

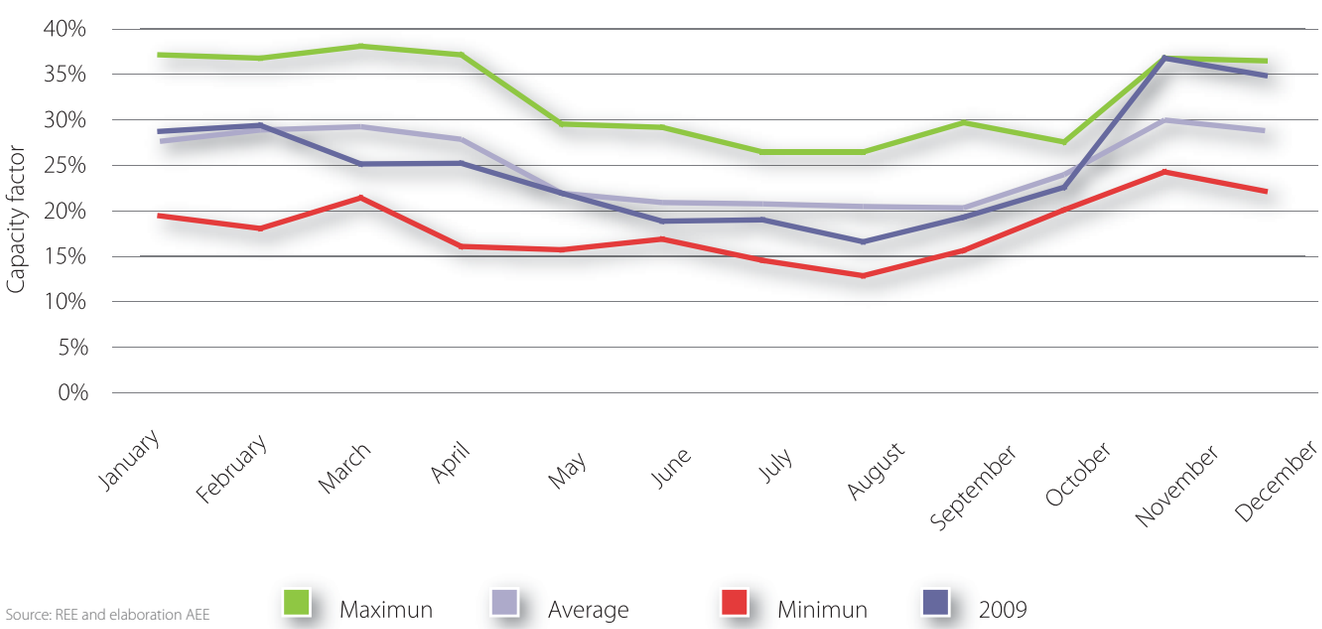
Graph II.19. Monthly wind generation. 2004-2009



Source: REE and elaboration AEE

Graph II.19. shows how 2008 and 2009 were undoubtedly atypical years in terms of monthly generation, shaking a hitherto regular pattern. While there was a stable growth in monthly wind generation 2004-2007, a series of pronounced peaks and troughs was experienced in 2008. That unstable pattern was repeated September-December 2009, reaching a record at over 1,000 GWh above the production in the same period of 2008 and around 500 GWh above 2008's monthly peak, achieved in March.

Graph II.20. Monthly capacity factor. Average, minimum and maximum points1998-2009 and the average for year 2009



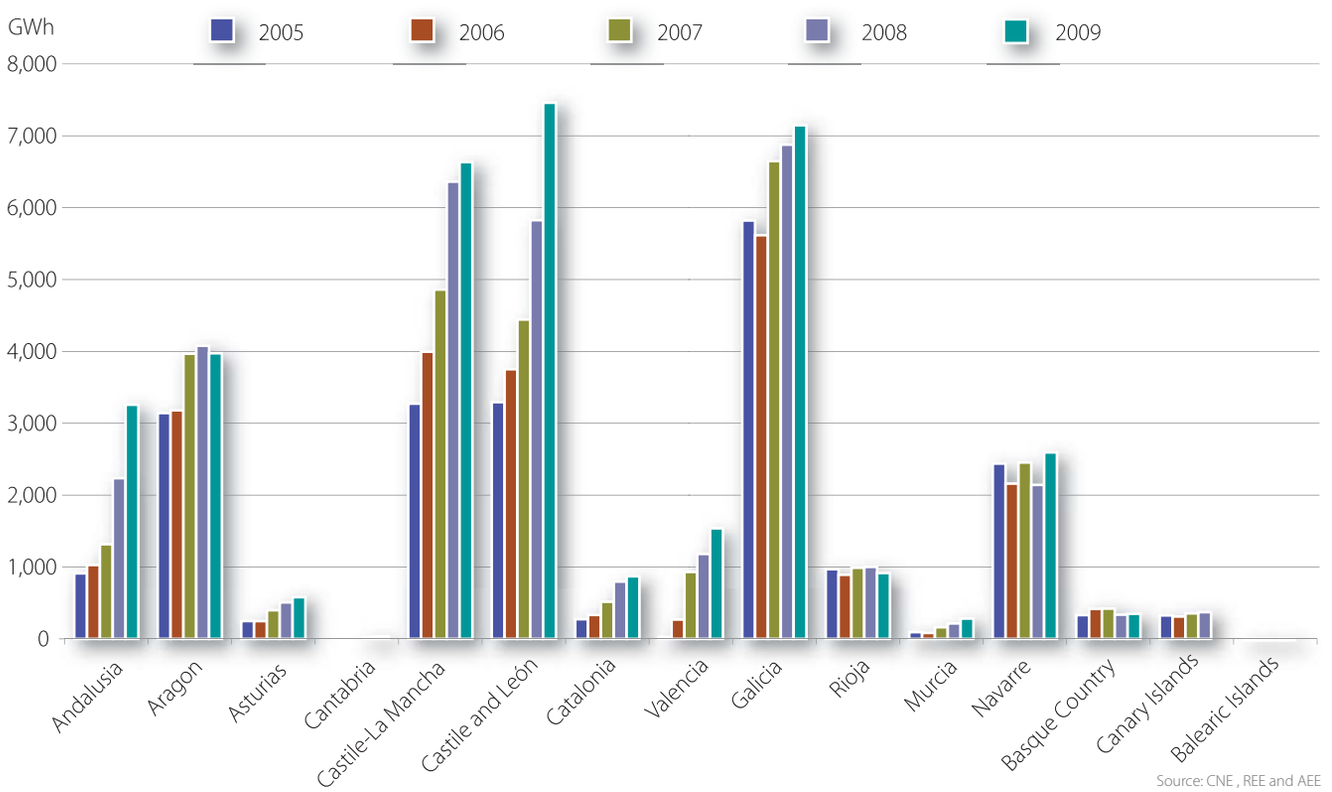
Source: REE and elaboration AEE

Graph II.20. illustrates how the capacity factor remained below average for nearly the whole of 2009, except in the last few months, when it rose well above the average of previous years.

Graph II.21. Average number of operating hours annually (equivalent to operating at nominal power) and rate of variation. 1999-2009

Source: REE and elaboration AEE

Graph II.22. Regional wind generation. 2005-2009



Source: CNE , REE and AEE

II.2.3. Wind power generation milestones

In 2009, wind power reached the following milestones regarding its contribution to covering demand:

- SPOT DEMAND COVERAGE: the most important mark, reached on December 30, when wind covered **54.1%** of demand at 3.50h, is shown in **Graph II.23.**

- MAXIMUM CAPACITY OPERATING SIMULTANEOUSLY: **11,620 MW** of wind power came to operate at the same time. November 8.

- HOURLY PRODUCTION: **11,429 MWh** of hourly wind generation. November 8.

- DAILY PRODUCTION: **251,543 MWh** of wind production over 24 hours. November 8.

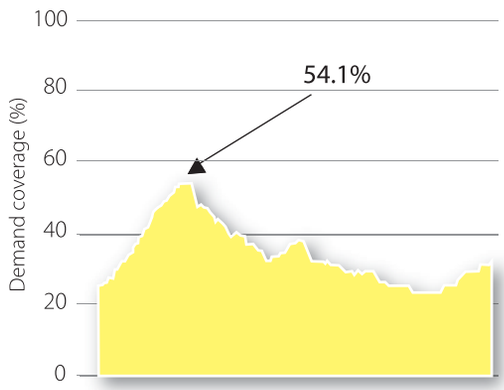
Most of these impressive figures were surpassed in the first two months of 2010, as follows:

- February 24, 2010: Record in simultaneous wind generation, reached at 11.20h, with **12,916 MW** feeding the system at the same time. At that time, wind covered **35%** of demand.

- February 24, 2010: Maximum daily production, with **270,420 MWh** generated over the 24 hours.

- February 24, 2010: Maximum hourly production with **12,843 MWh** (11.00h-12.00h).

Graph II.23. The December 30, 2009 landmark: 54.1% coverage of demand



Source: REE

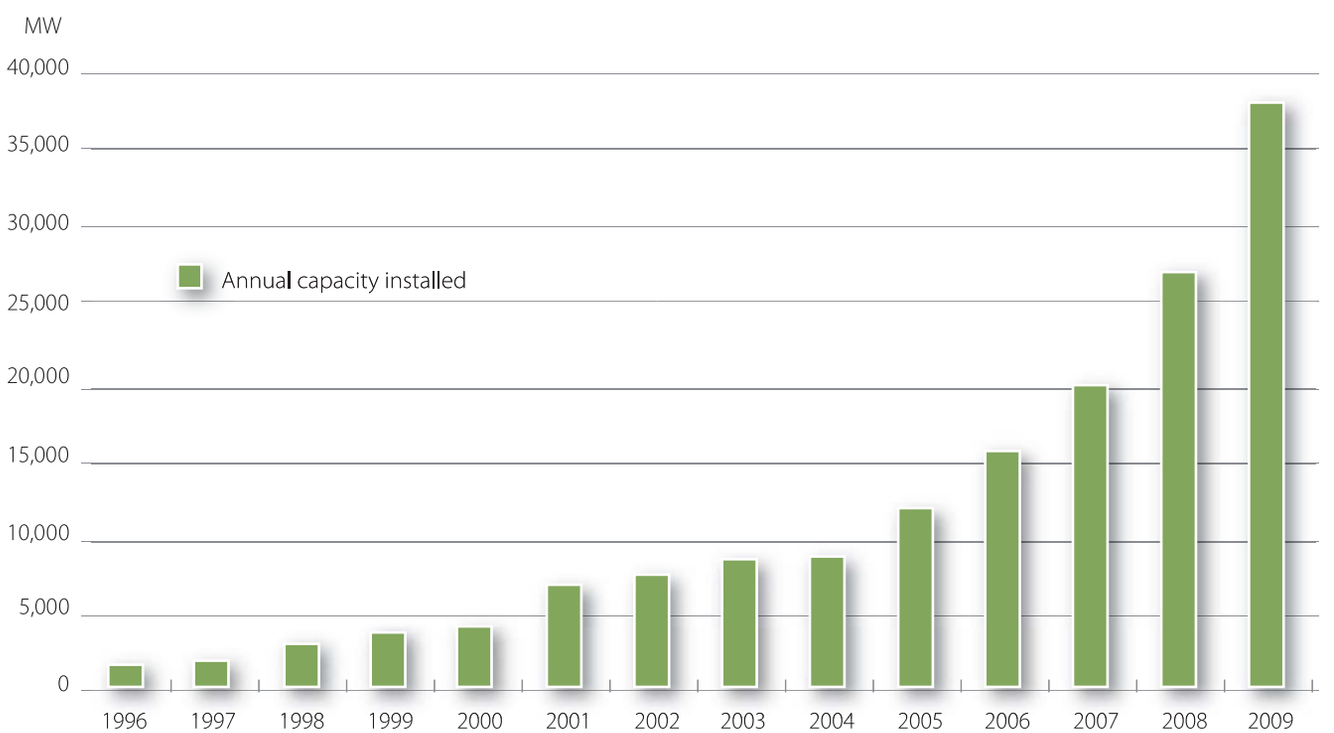
Domingo López.

In 2009, wind power reached a series of demand coverage landmarks

II.3 Wind power worldwide

We are not alone. Despite the voices of opposition, the facts and figures prove Spain is on the right path with its commitment to renewables in general and wind power in particular. And interest in wind power is not confined to within our borders, as is sometimes argued from certain quarters. Rather, some of the world's leading countries have also made major commitments to wind, converting it from a token technology limited to a few countries into a **worldwide reference technology** among the main powers. After outlining wind power progress in Spain (section 1 of this chapter), a look at other countries is also revealing, especially the takeoffs in China and USA over the past year or so.

Graph II.24. Worldwide installed capacity. 1996-2009



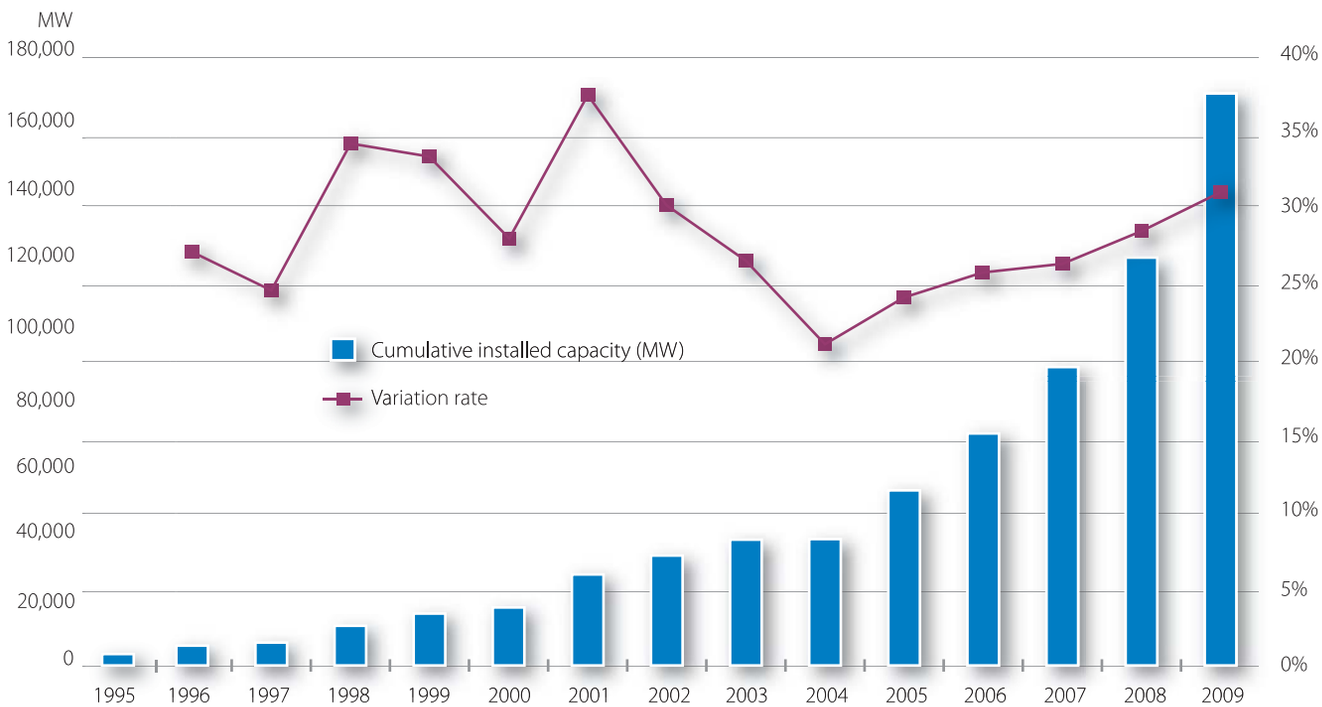
Source: GWEC, EWEA and AEE

In 2009, the world record in new installed annual wind capacity was broken again, with **37,466 MW** installed over the 12 months, according to the **Global Wind Energy Council (GWEC).** That figure has roughly doubled the 19,547 MW of new capacity GWEC counted in 2007.

Interest in wind power is not confined to within our borders

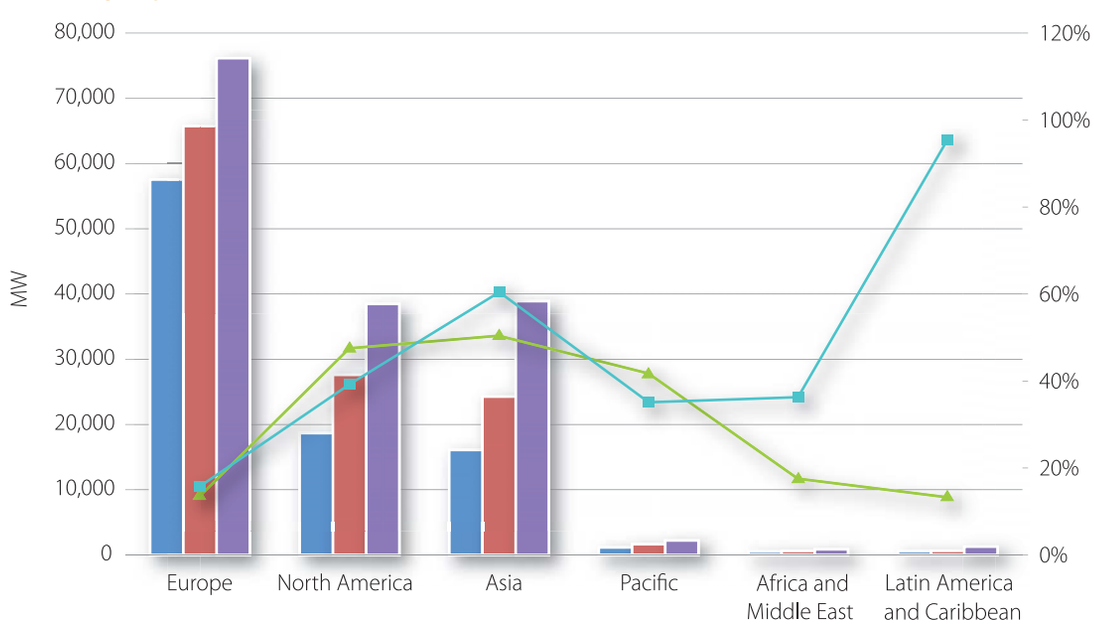
With 2009's new capacity, the cumulative figure **reached 157,899 MW worldwide**, 31% up on the figure 12 months earlier, the second highest growth rate experienced in the decade (in 2001, global capacity grew 37%). Furthermore, 2009 was the sixth consecutive year of rising growth rate percentages.

Graph II.25. Worldwide cumulative capacity rate variation. 1995-2009



Source: GWEC, EWEA and AEE

Graph II.26. Regional installed capacity and variation rate. 2007-2008-2009



	Europe	North America	Asia	Pacific	Africa and Middle East	Latin America and Caribbean
To 01/01/2008	57,546	18,670	16,091	1,158	538	573
To 01/01/2009	65,740	27,606	24,272	1,644	635	652
To 01/01/2010	76,152	38,478	38,909	2,221	865	1,274
Variation rate 2008/2007	14%	48%	51%	42%	18%	14%
Variation rate 2009/2008	16%	39%	60%	35%	36%	95%

Source: GWEC, EWEA and AEE.

While all regions sustained an upward wind power growth rate tendency, standing out in absolute figures is Asia, which went from installing 8,000 MW in 2008 to 14,000 MW over the 12 months of 2009. Second and third places are occupied by North America and Europe, both comfortably exceeding 10,000 MW of new capacity in 2009.

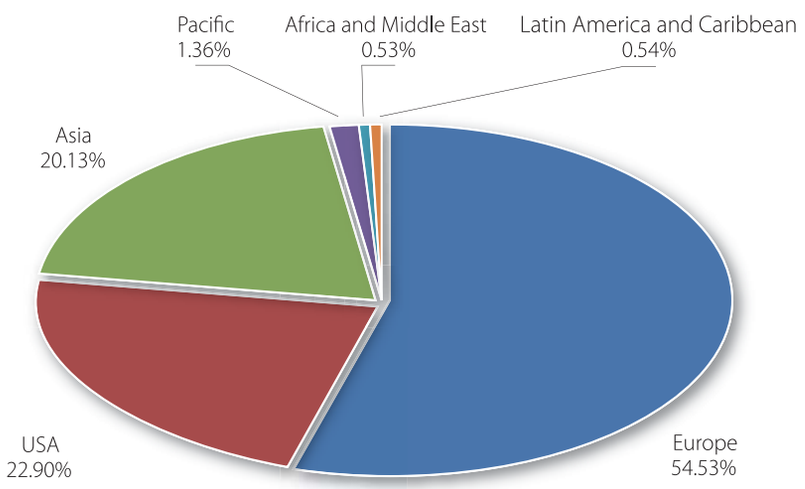
The most striking aspect of **Graph II. 26** is the strong relative growth rate of the Latin America and the Caribbean region, where new wind capacity over 2009 pushed the cumulative figure up 95% above that reached end-2008.

Graphs II.27 and II.28 are especially revealing. Both show the continued leadership of Europe above other regions. Yet, on observing the percentage figures, two rising stars appear: North America and Asia.

In fact, in just one year, Europe has gone from cornering 54.59% of total global capacity to 48.23%. That difference is at least partly due to the growing North American and Asian markets, which have gone from occupying 20.17% of the whole to 24.64%.

In contrast, while the Pacific and Latin America and Caribbean regions experience modest growth, the market share of Africa and the Middle East remains stagnant at 0.55%.

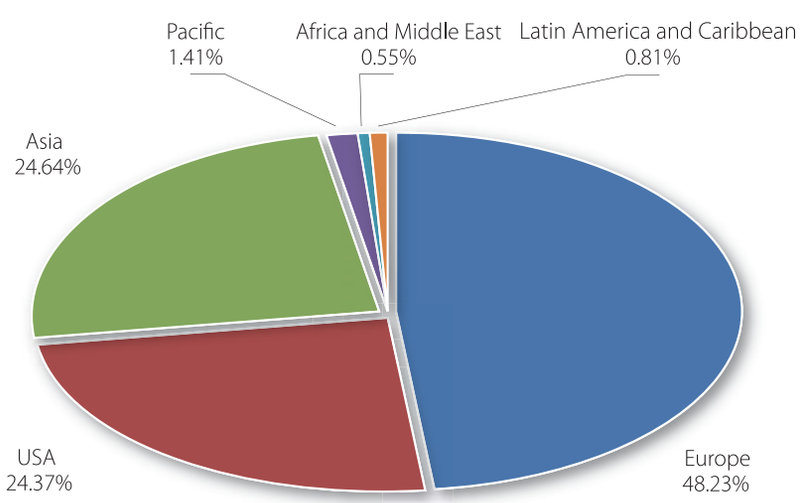
Graph II.27. Regional breakdown of worldwide cumulative installed wind capacity to 01/01/2009



Source: GWEC, EWEA and AEE

Graph II.28. Regional breakdown of worldwide cumulative installed wind capacity to 01/01/2010

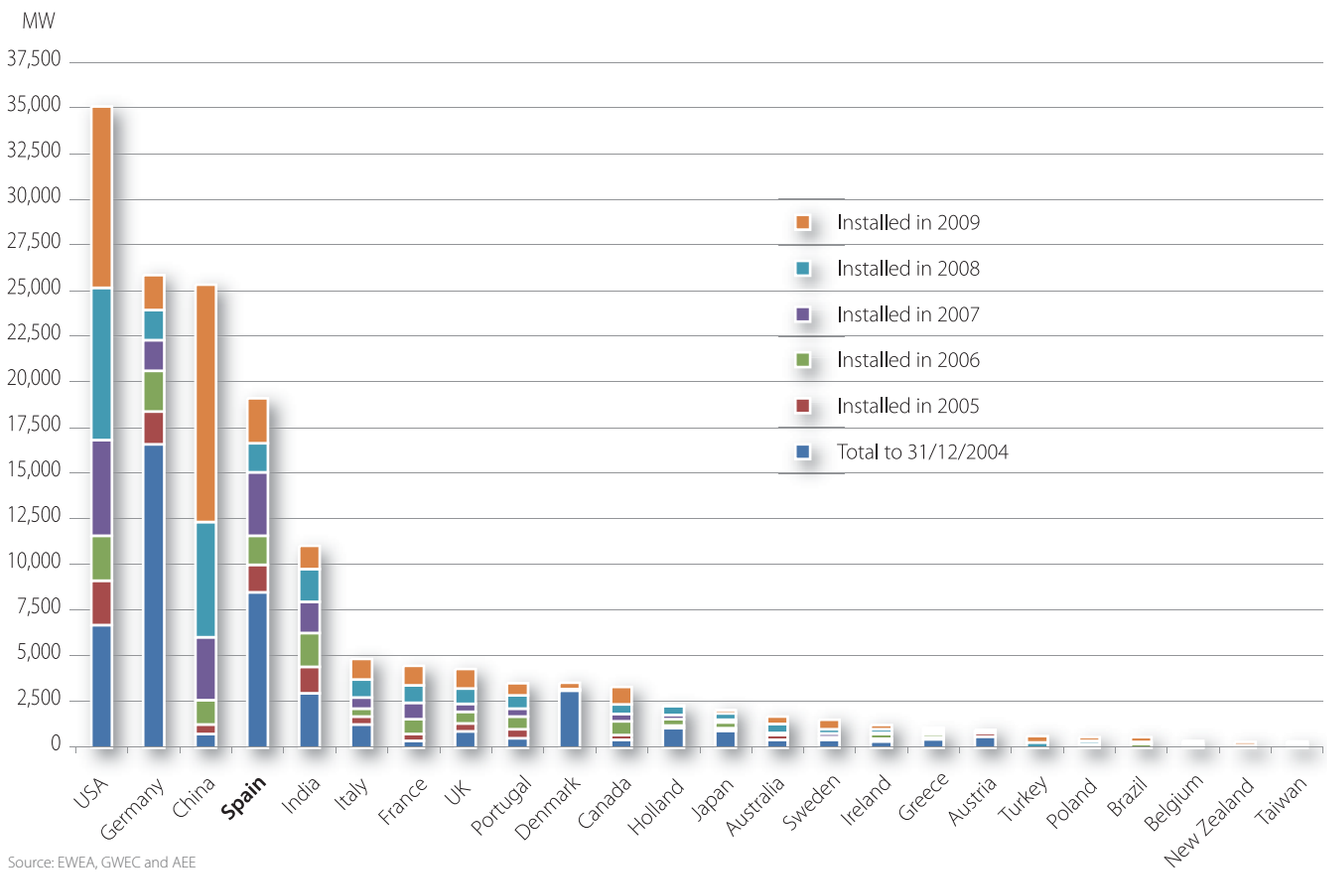
In absolute terms the region of Asia stands out, passing from 8,000 MW in 2008 to over 14,000 MW



Source: GWEC, EWEA and AEE

II.3.1 The countries

Graph II.29. Country breakdown of installed wind capacity worldwide. 2004-2009



Source: EWEA, GWEC and AEE

Without a doubt, and as expected, the main growth engine of 2009 was **China**. With 13,000 MW installed in just one year, the country replaced **Spain** as the third largest in terms of cumulative installed capacity. **Germany**, in second place, finished the year with just 600 MW more than China. Two of the world's biggest powers, **USA** and China, are consolidating their positions within a ranking where Spain sits among the leaders in a forth position that seems difficult take from it, at least in the near future. In fact, Spain was the third biggest country in terms of new installed capacity in 2009, after pulling off its second best annual performance, as mentioned in the first part of this chapter.

USA, which exceeded 35,000 MW of cumulative capacity to end-2009, turned in the second biggest performance last year in terms of new installed capacity, exceeding 9,000 MW, the country's best result since starting out in wind power.

Other countries worthy of a special mention include **India**, the fifth-ranked wind market—both in terms of cumulative and new capacity in 2009—while in Europe, **Italy**, **France**, **UK**, **Portugal** and **Denmark**, all have a cumulative capacity of over 3,000 MW, as does **Canada**.

Table II.06. Installed wind capacity in different countries (MW)

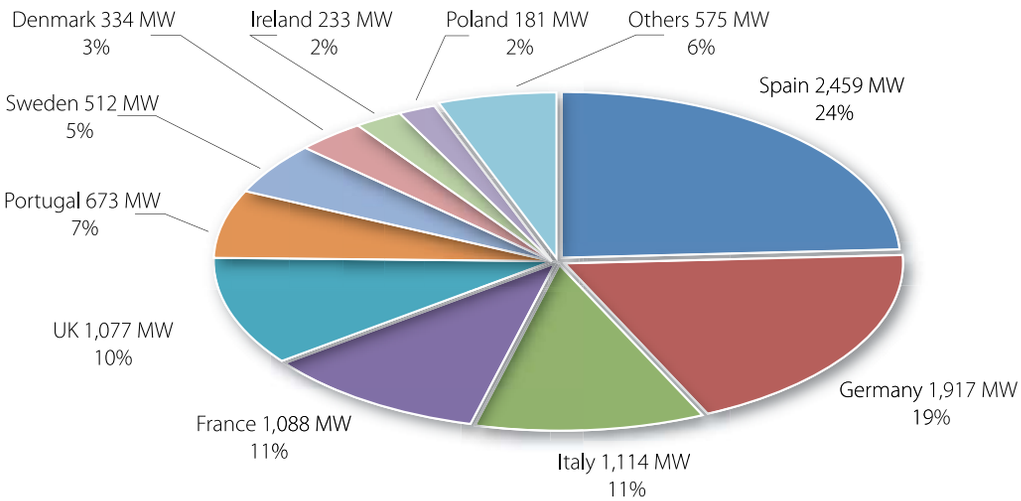
Country	Cumulative to 31/12/2008	Growth Rate (2008/2007)	Installled in 2009	Cumulative to 31/12/2009	Growth Rate (2009/2008)
USA	25,237	50%	9,922	35,159	39.30%
Germany	23,903	7.40%	1,917	25,777	7.80%
China	12,104	100.10%	13,000	25,104	107.40%
Spain	16,690	10.70%	2,459	19,149	14.70%
India	9,655	20.70%	1,271	10,926	13.20%
Italy	3,736	37.10%	1,114	4,850	29.80%
France	3,404	38.70%	1,088	4,492	32%
UK	2,974	24.50%	1,077	4,051	36.20%
Portugal	2,862	33.10%	673	3,535	23.50%
Denmark	3,163	1.20%	334	3,465	9.50%
Canada	2,369	28.30%	950	3,319	40.10%
Holland	2,225	27.40%	39	2,229	0.20%
Japan	1,880	22.20%	178	2,056	9.40%
Australia	1,306	58.50%	406	1,712	31.10%
Sweden	1,048	33%	512	1,560	48.90%
Ireland	1,027	27.60%	233	1,260	22.70%
Greece	985	13.10%	102	1,087	10.40%
Austria	995	1.30%	0	995	0%
Turkey	458	211.60%	343	801	74.90%
Poland	544	97.10%	181	725	33.30%
Brazil	342	38.50%	264	606	77.20%

Source: GWEC, EWEA and AEE

Batidas por el viento. Miguel Márquez.

II.3.2 European Union

Graph II.30. Breakdown of EU member new wind capacity installed in 2009

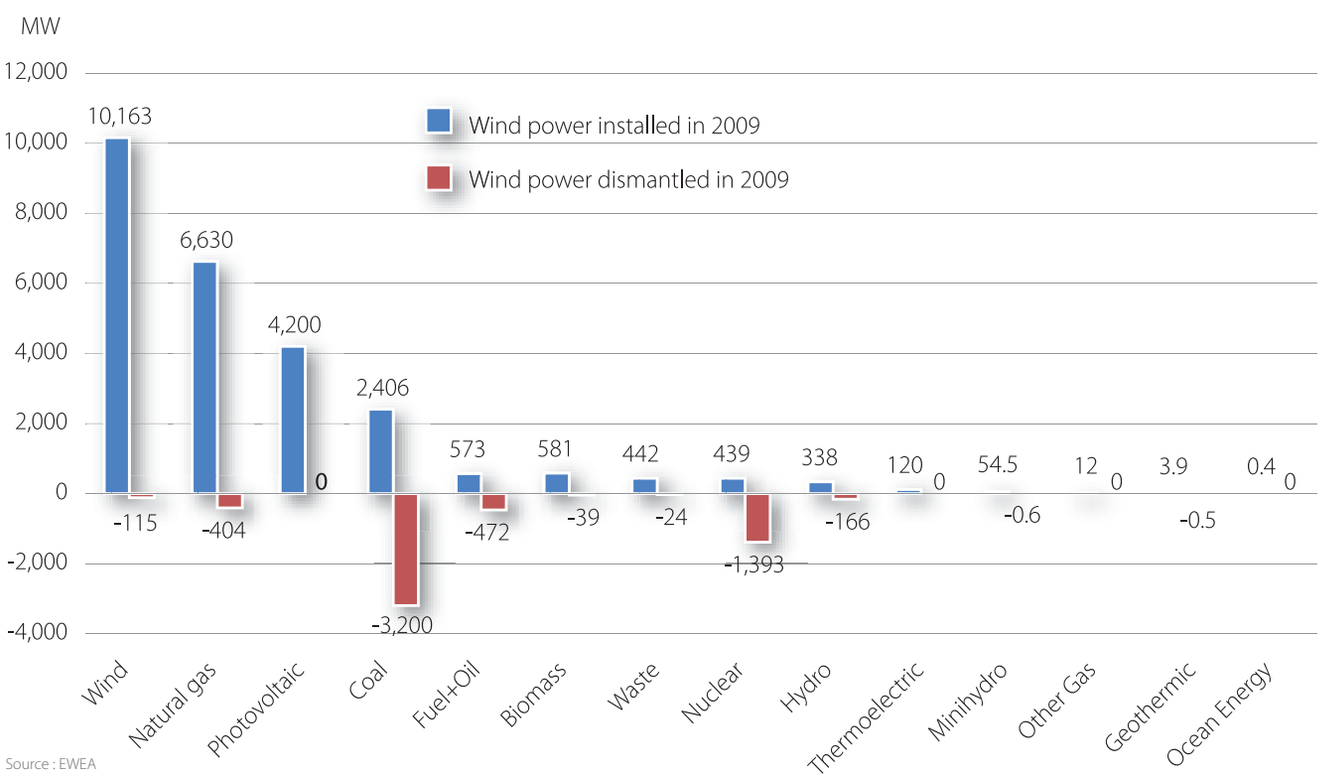


Source: EWEA.

The countries of the old continent installed 10,526 MW in 2009, though **Graph II.30** shows only member state capacity, which totalled **10,163 MW**. The pie chart clearly illustrates the leadership of Spain (24%) and Germany (19%), which make up a combined 43% of new EU installed capacity and which are ranked globally in second and fourth place.

Italy, France and UK each installed over 1,000 MW of new capacity, improving of performance in 2008.

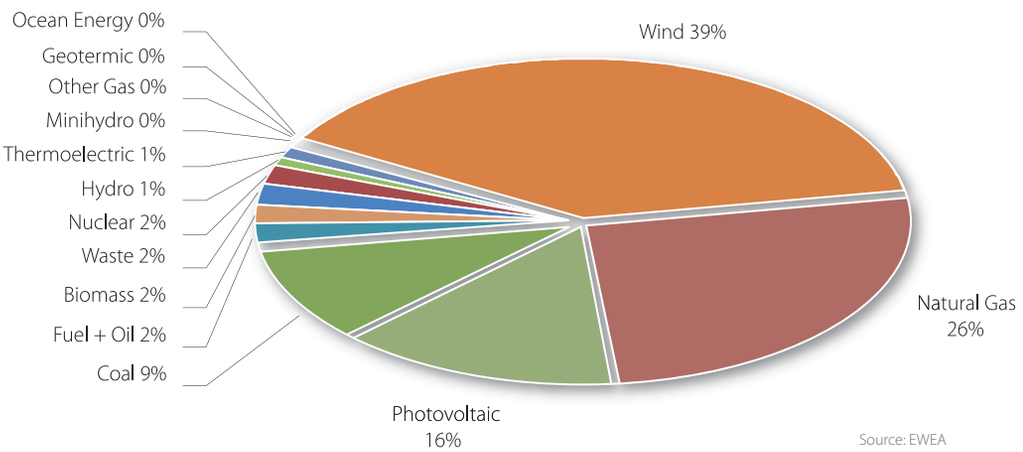
Graph II.31. Increase in capacity installed in the European Union in 2009



Source : EWEA

Once again, wind power has situated itself as the **generation technology to have incorporated most new capacity in the European Union** in 2009. Furthermore, its lead was reinforced. Whereas wind installed 1,500 MW than combined cycle gas in 2008, in 2009 that lead has leapt to 3,500 MW. Third place goes to solar photovoltaic power, with 4,200 MW of new capacity installed overall, followed by coal, with 2,406 MW, though 3,200 MW of coal capacity was decommissioned, making the net figure negative, at – 794 MW.

Graph II.32. Technologies behind new capacity installed in 2009

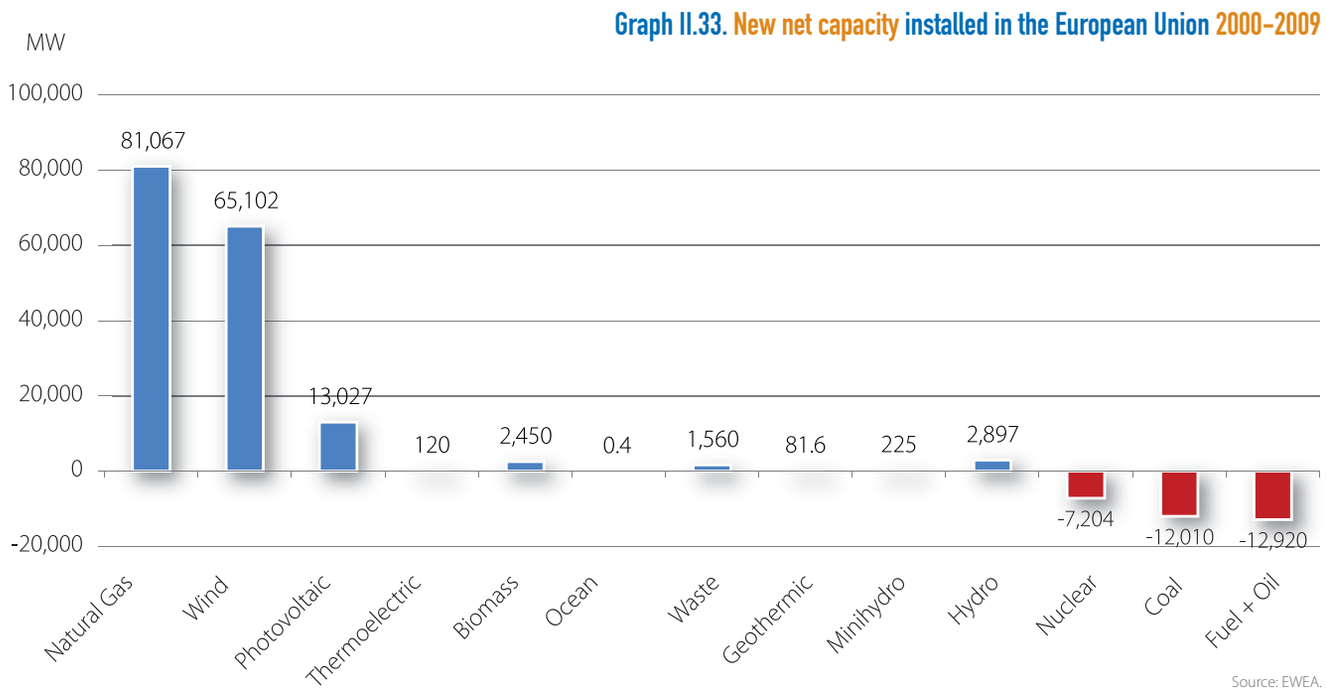


Source: EWEA

While **Graph II.31** clearly displays wind power supremacy in terms of the absolute volume of new capacity installed in the EU in 2009, even more strikingly, **Graph II.32** illustrates the proportions, with 40% coming from wind. Furthermore, together with solar photovoltaic power, renewables makes up 55% of the total.

Gas fired capacity, with over a quarter of the total, cannot be ignored, though nuclear and coal manage just 2% and 9%, respectively.

Graph II.33. New net capacity installed in the European Union 2000–2009



Source: EWEA.

Viewing the performance of the power technologies over a longer period, namely 2000-2009, gas and **wind** emerge as the two main power sources, contributing 81,067 MW **65,102 MW** of new capacity, respectively. Photovoltaic deployment is also notable, bringing a total of more than 13,000 MW over the same period.

None of the other technologies manages to reach 3,000 MW. Moreover, nuclear, coal and fuel oil technologies experienced a 32,000 MW combined net reduction during the period.

Wind power contributed more new installed capacity than any other power technology in Europe in 2009

Table II.07. Installed capacity, turbine units, turbine size, wind generation, demand and percentage of demand covered by wind worldwide in 2008

Country	Total installed wind capacity	Installed wind capacity offshore	New annual wind capacity	Total numbers of wind turbines	Average turbine size	Wind generation	Electricity demand	Wind power's coverage of demand*
	(MW)	(MW)	(MW)	(turbines)	(kW)	(GWh)	(TWh)	%
Australia	1,306	0	482	756	2,000	3,462	267.0	1.3%
Austria	995	0	14	618	2,000	2,050	70.7	0
Canada	2,369	0	523	1,681	1,863	5,800	575.0	1.0%
Denmark	3,163	423	39	5,101	2,000	6,975	36.2	19.3%
Finland	143	13	33	118	3,000	260	87.0	0.3%
Germany	23,902	0	1,665	19,568	1,667	40,400	615.1	6.6%
Greece	990	0	115	1,190	1,650	2,300	51.0	4.5%
Ireland	1,002	25	208	834	1,696	2,298	26.2	8.8%
Italy	3,736	0	1,010	3,588	1,566	6,637	337.6	2.0%
Japan	1,880	11	342	1,508	1,247	2,856	913.2	0.3%
Korea	236	0	43	152	1,579	421	422.0	0.1%
Mexico	85	0	0	104	NA	254	209.7	0.1%
Holand	2,214	228	490	2,053	2,219	4,259	119.3	3.6%
Norway	430	0	45	200	2,531	921	128.6	0.7%
Portugal	2,819	0	694	1.500	1,900	5,737	50.6	11.3%
Spain	16,740	0	1,609	>16,000	1,600	31,100	266.5	11.7%
Sweden	1,047	133	216	1.151	1,700	1,974	145.9	1.4%
Switzerland	14	0	2	28	2,000	19	57.4	0.0%
UK	3,331	598	912	1,952	1,060	5,274	406.0	1.3%
USA	25,369	0	8,558	>15,000	1,670	71,000	3,736.8	1.9%
Total	**91,771**	**1,431**	**17,000**	**55,056**	**1,886**	**193,997**	**8,522**	**2.28%**

*% of national electricity demand from wind = (wind generated electricity /national electricity demand) * 100

Source: International Energy Agency

II.3.3 The companies

Three Spanish companies sit among the four top global wind operators, according to the annual report by consulting firm **BTM**, which places **Iberdrola Renovables** in top place in terms of cumulative installed wind capacity to end-2009 with 10,350 MW. **Acciona** finished the year in third place with 6,230 MW to its name, only a hair's breadth above **EDP Renováveis**, which came forth with 6,227 MW. US firm **FPL Energy** slotted in at second place with 7.544MW.

Regarding turbine manufacturers, **Vestas** continues dominating the market with 39,705 MW of cumulative capacity installed worldwide, while **Gamesa** ranks sixth, with 19.225 MW. One striking feature of the global table is that three Chinese companies come third, fifth and seventh.

Table II.08. Installed capacity by the world's top wind operators

Wind plant operator	Cumulative capacity to end 2007 (MW)	Cumulative capacity to end 2008 (MW)	Cumulative capacity to end 2009 (MW)
Iberdrola Renovables	7,362	8,960	10,350
FPL Energy	5,077	6,374	7,544
Acciona Energy	3,824	4,566	6,230
EDP Renováveis	3,639	5,052	6,227
Long Yuan Electric Power	1,620	2,924	4,842
Datang Corporation	1,008	2,154	3,023
E.O.N. Climate and Renewables	855	1,890	2,873
EDF Energies Nouvelles	1,218	2,031	2,650
Invenery	887	1,723	2,018
Eurus Energy Holding	1,385	1,722	1,903
Infigen Energy (formerly BBW)	1,859	1,530	1,739
RWE Innogy	489	639	1,568
Huaneng New Energy	129	402	1,550
Enel	857	1,237	1,510
GDF Suez	690	1,054	1,492
Total	**30,899**	**42,258**	**55,519**

Source: BTM Consult ApS – March 2010

Table II.09. Installed capacity by the world's top turbine manufacturers

	Cumulative capacity to end 2008 (MW)	In 2009 (MW)	In 2009 (%)	Cumulative capacity to end 2009 (MW)	Cumulative capacity to end 2009 (%)
Vestas	34,939	4,766	12.5%	39,705	24.8%
Gewind	18,220	4,741	12.4%	22,961	14.3%
Sinovel	2,148	3,510	9.2%	5,658	3.5%
Enercon	16,576	3,221	8.5%	19,798	12.4%
Goldwind	2,589	2,727	7.2%	5,315	3.3%
Gamesa	16,679	2,546	6.7%	19,225	12%
Dongfang	1,290	2,475	6.5%	3,765	2.4%
Suzlon	7,250	2,421	6.4%	9,671	6%
Siemens	8,949	2,265	5.9%	11,213	7%
Repower	3,597	1,297	3.4%	4,894	3.1%
Others	19,407	7,033	18.5%	26,440	16.5%
Total	**131,644**	**37,002**	**97.2%**	**168,645**	**105.3%**

Source: BTM Consult ApS – March 2010

Table II.10. Cumulative wind capacity installed by Spanish developers in different countries, to end 2009

Country	Net power
Germany	289.7
Australia	225
Belgium	48.65
Brazil	289.8
Canada	157.998
Chile	58.6125
South Korea	61.5
USA	4,024.9425
France	563.89
Greece	275.25
Hungary	89.16
India	60.9
Italy	137.61
Mexico	654.4
Poland	187.16
Portugal	1,283.502
UK	802
Grand total	**9,210.075**

Source: AEE

It is not just the big Spanish companies like **Iberdrola**, **Acciona** or **EDP Renováveis** listed in the BTM ranking that have gone international. Many other compatriot companies are active in different countries across the world, contributing to the more than **9,200 MW** of capacity installed by Spanish firms outside Spain.

From Germany to **USA,** passing Portugal, South Korea and UK, Spanish megawatts are in place. The most significant case is USA, home to **over 40%** of Spanish capacity installed outside our country.

Recogiendo Sostenibilidad. Jose Claudio Gallego.

Looking at the figures for 2009 alone, Spanish companies installed almost 1,200 MW outside Spain, which is more than 10% of our industry's cumulative figure abroad. Once again, the most important countries last year in this respect were USA and Portugal, though Italy and Germany were also significant markets for our industry.

Many other Spanish companies are present in different countries worldwide

II.4 Spanish wind industry implantation

There are now over 100 industrial facilites in Spain dedicated to wind, as illustrated in **Table II.12.** The figure is higher than the one for 2008, as smaller component factories not included in previous years have been taken into account. **Gamesa** takes up practically a quarter of the list, with centres across Castile and León, Galicia, Navarre, Madrid and Basque Country, among other regions. The regions cited, together with Castile-La Mancha, harbour the bulk of the sector's industrial facilities.

As the table shows, the facilities cover practically **the whole supply chain**: turbine assembly, and the manufacturing of generators and electrical components, together with blades, gearboxes, towers and mechanical parts.

Table II.11. Geographical distribution of industrial facilities (data to 2009)

	COMPANY	ACTIVITY	CLASIFICATION	MUNICIPALITY	PROVINCE	AUTONOMOUS REGION
1	3M ESPAÑA, S.A.	COMPONENT MANUFACTURER	GENERATORS AND ELECTRICAL COMPONENTS	MADRID	MADRID	MADRID
2	ACCIONA BLADES	BLADES	BLADES	LUMBIER	NAVARRE	NAVARRE
3	ACCIONA WIND POWER	WIND TURBINE MANUFACTURING	WIND TURBINE ASSEMBLY	BARASOAÍN	NAVARRE	NAVARRE
4	ACCIONA WIND POWER	WIND TURBINE MANUFACTURING	WIND TURBINE ASSEMBLY	LA VALL D'UIXÓ	CASTELLÓN	VALENCIA
5	ACCIONA WIND POWER	HUBS AND OTHER COMPONENTS	BLADES	TOLEDO	TOLEDO	CASTILE LA MANCHA
6	AEROBLADE	BLADE MANUFACTURING	BLADES	VITORIA	ÁLAVA	BASQUE COUNTRY
7	ALSTOM POWER SERVICE, S.A.	COMPONENT MANUFACTURER	WIND TURBINE TOWER MANUFACTURING	MADRID	MADRID	MADRID
8	ALSTOM WIND	CALDERERIA TORRES ALTAMIRA, S.A.	WIND TURBINE TOWER MANUFACTURING	CORESES	ZAMORA	CASTILE AND LEON
9	ALSTOM WIND	ECOTÈCNIA GALICIA, S.L.	WIND TURBINE ASSEMBLY	AS SOMOZAS	CORUNNA	GALICIA
10	ALSTOM WIND	ECOTÈCNIA GALICIA, S.L.	CONTROL SYSTEMS	CASTRO (NARÓN)	CORUNNA	GALICIA
11	ALSTOM WIND	ECOTÈCNIA NAVARRA, S.A.	WIND TURBINE TOWER MANUFACTURING	BUÑUEL	NAVARRE	NAVARRE
12	AREVA T&D IBÉRICA, S.A.	PROTECTION AND CONTROL SYSTEMS	GENERATORS AND ELECTRICAL COMPONENTS	SAN FERNANDO DE HENARES	MADRID	MADRID
13	ASEA BROWN BOVERI, S.A.	COMPONENT MANUFACTURER	GENERATORS AND ELECTRICAL COMPONENTS	MADRID	MADRID	MADRID
14	AVANTI WIND SYSTEMS, S.L.	ELEVATORS AND STAIRS MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	LA MUELA	SARAGOSSA	ARAGÓN
15	C.C. JENSEN IBÉRICA, S.L.	COMPONENT MANUFACTURER	TOWERS AND MECHANICAL COMPONENTS	BARCELONA	BARCELONA	CATALONIA
16	COASA	AERONAUTIC COMPONENTS	BLADES	SAN CIBRAO DAS VIÑAS	OURENSE	GALICIA
17	COIPER	WIND TURBINE TOWER MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	PONFERRADA	LEÓN	CASTILE AND LEON
18	COMPAÑÍA EOLICA TIERRAS ALTAS S.A.	INTEGRAL MAINTENANCE OF WIND FARMS	INTEGRAL MAINTENANCE OF WIND FARMS	SAN PEDRO MANRIQUE	SORIA	CASTILE AND LEON
19	CORUÑESA DE COMPOSITES, S.L.	NACELLES	WIND TURBINE ASSEMBLY	ARTEIXO	CORUNNA	GALICIA
20	DANOBATGROUP S. COOP.	COMPONENT MANUFACTURER	MACHINERY	ELGOIBAR	GUIPÚZCOA	BASQUE COUNTRY
21	DIMECO	BOLD MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	ALCALÁ DE HENARES	MADRID	MADRID
22	ELEVADORES GOIAN	ELEVATOR MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	LAZKAO	GUIPUZCOA	BASQUE COUNTRY
23	EMESA	WIND TURBINE TOWER MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	COIROS	CORUNNA	GALICIA
24	ENERGEA	CONTROL AND MAINTENANCE OF WIND FARMS	GENERATORS AND ELECTRICAL COMPONENTS	FERREIRA DO VALADOURO	LUGO	GALICIA
25	ENERGEA	CONTROL AND MAINTENANCE OF WIND FARMS	GENERATORS AND ELECTRICAL COMPONENTS	A CAÑIZA	PONTEVEDRA	GALICIA
26	ENERGEA	CONTROL AND MAINTENANCE OF WIND FARMS	GENERATORS AND ELECTRICAL COMPONENTS	MAZARICOS	CORUNNA	GALICIA
27	ENFLO WINTEC IBÉRICA	MANUFACTURE OF SMALL WIND GENERATORS	WIND TURBINE ASSEMBLY	ORCOYEN	NAVARRE	NAVARRE
28	EOZEN	WIND TURBINE MANUFACTURING	WIND TURBINE ASSEMBLY	FERREIRA	GRANADA	ANDALUSIA
29	EOZEN	BLADE MANUFACTURING	BLADES	FERREIRA	GRANADA	ANDALUSIA
30	FIBERBLADE NORTE II	WIND TURBINE TOWER MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	AS SOMOZAS	CORUNNA	GALICIA
31	FLUITECNIK	COMPONENT MANUFACTURER	TOWERS AND MECHANICAL COMPONENTS	ORCOYEN	NAVARRE	NAVARRE
32	FLUITECNIK	MECHANIZED WORKSHOP	TOWERS AND MECHANICAL COMPONENTS	NOAIN	NAVARRE	NAVARRE
33	GALOL, S.A.	COVERING ITS PIECES		OLLEIRA	VALENCIA	VALENCIA
34	GAMESA	NACELLE ASSEMBLY	WIND TURBINE ASSEMBLY	ÁGREDA	SORIA	CASTILE AND LEON
35	GAMESA	NACELLE ASSEMBLY	WIND TURBINE ASSEMBLY	SIGÜEIRO	CORUNNA	GALICIA
36	GAMESA	PROTOTYPE ASSEMBLY	WIND TURBINE ASSEMBLY	IMARCOAIN	NAVARRE	NAVARRE
37	GAMESA	NACELLE ASSEMBLY	WIND TURBINE ASSEMBLY	TAUSTE	SARAGOSSA	ARAGÓN
38	GAMESA	NACELLE ASSEMBLY	WIND TURBINE ASSEMBLY	MEDINA DEL CAMPO	VALLADOLID	CASTILE AND LEON
39	GAMESA	ELECTRICAL EQUIPMENT MANUFACTURING	GENERATORS AND ELECTRICAL COMPONENTS	REINOSA	CANTABRIA	CANTABRIA
40	GAMESA	ELECTRICAL EQUIPMENT MANUFACTURING	GENERATORS AND ELECTRICAL COMPONENTS	COSLADA	MADRID	MADRID
41	GAMESA	ELECTRICAL EQUIPMENT MANUFACTURING	GENERATORS AND ELECTRICAL COMPONENTS	BENISANÓ	VALENCIA	VALENCIA
42	GAMESA	GEARBOX MANUFACTURING	GEARBOXES	ASTEASU	GUIPUZCOA	BASQUE COUNTRY
43	GAMESA	GEARBOX MANUFACTURING	GEARBOXES	MUNGIA	VIZCAYA	BASQUE COUNTRY
44	GAMESA	GEARBOX MANUFACTURING	GEARBOXES	BERGONDO	CORUNNA	GALICIA

45	GAMESA	GEARBOX MANUFACTURING	GEARBOXES	BURGOS	BURGOS	CASTILE AND LEON
46	GAMESA	BLADES	BLADES	ALSASUA	NAVARRE	NAVARRE
47	GAMESA	BLADES	BLADES	MIRANDA DEL EBRO	BURGOS	CASTILE AND LEON
48	GAMESA	BLADES	BLADES	SOMOZAS	CORUNNA	GALICIA
49	GAMESA	BLADES	BLADES	TUDELA	NAVARRE	NAVARRE
50	GAMESA	BLADES	BLADES	ALBACETE	ALBACETE	CASTILE LA MANCHA
51	GAMESA	BLADES ROOTS	BLADES	CUENCA	CUENCA	CASTILE LA MANCHA
52	GAMESA	BLADES MOULDS	BLADES	IMARCOAIN	NAVARRE	NAVARRE
53	GAMESA	WIND TURBINE TOWER MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	OLAZAGUTIA	NAVARRE	NAVARRE
54	GAMESA	WIND TURBINE TOWER MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	CADRETE	SARAGOSSA	ARAGÓN
55	GAMESA	WIND TURBINE TOWER MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	LINARES	JAÉN	ANDALUSIA
56	GAMESA	WIND TURBINE TOWER MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	AVILÉS	ASTURIAS	ASTURIAS
57	GAMESA	WIND TURBINE TOWER MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	TAJONAR	NAVARRE	NAVARRE
58	GANOMAGOGA	TOWERS	TOWERS AND MECHANICAL COMPONENTS	PONTEAREAS	PONTEVEDRA	GALICIA
59	GE WIND ENERGY S.L.	WIND TURBINE ASSEMBLY	WIND TURBINE ASSEMBLY	NOBLEJAS	TOLEDO	CASTILE LA MANCHA
60	GLUAL HIDRAULICA	COMPONENT MANUFACTURER	HYDRAULIC OIL COMPONENTS	AZPEITIA	GUIPUZCOA	BASQUE COUNTRY
61	GRUPO EYMOSA-VENTOGAL	NACELLES	WIND TURBINE ASSEMBLY	NARÓN	CORUNNA	GALICIA
62	HORTA COSLADA	TOWERS	TOWERS AND MECHANICAL COMPONENTS	ARCOS DE JALÓN	SORIA	CASTILE AND LEON
63	IM FUTURE, S.L.	BLADES REPAIR . OPERATION AND MAINTENANCE OF WIND FARMS	BLADES	NOIA	CORUNNA	GALICIA
64	INDAR ELECTRIC, S.L.	COMPONENT MANUFACTURER	GENERATORS AND ELECTRICAL COMPONENTS	BEASAIN	GUIPUZCOA	BASQUE COUNTRY
65	INDRA SISTEMAS	ENGINEERING AND SERVICES OF MAINTENANCE OF WIND TURBINES	LOGISTIC SERVICES	ARANJUEZ	MADRID	MADRID
66	INDRA SISTEMAS	SERVICES OF MAINTENANCE OF WIND TURBINES. SYSTEMS OF PREDICTIVE MAINTENANCE	LOGISTIC SERVICES	EL FERROL	CORUNNA	GALICIA
67	INDRA SISTEMAS	SYSTEMS OF PREDICTIVE MAINTENANCE. ENGINEERING EQUIPMENTS OF MEASURE	LOGISTIC SERVICES	SAN FERNANDO DE HENARES	MADRID	MADRID
68	INDRA SISTEMAS	SERVICES OF MAINTENANCE OF WIND TURBINES	LOGISTIC SERVICES	EL PUERTO DE SANTA MARÍA	CÁDIZ	ANDALUSIA
69	INDRA SISTEMAS	(*) CENTRE OF LOGISTIC SYSTEMS FOR RENEWABLES ENERGIES	LOGISTIC SERVICES	SAN ROMÁN DE BEMBIBRE	LEÓN	CASTILE AND LEON
70	INGETEAM PANELES, S.A.	ELECTRICAL EQUIPMENT MANUFACTURING	GENERATORS AND ELECTRICAL COMPONENTS	SESMA	NAVARRE	NAVARRE
71	INGETEAM SERVICE, S.A.	OPERATION AND MAINTENANCE SERVICES IN WIND FARMS	OPERATION AND MAINTENANCE OF WIND FARMS	ALBACETE	ALBACETE	CASTILE LA MANCHA
72	INGETEAM SERVICE, S.A.	OPERATION AND MAINTENANCE SERVICES IN WIND FARMS	OPERATION AND MAINTENANCE OF WIND FARMS	VILALBA	LUGO	GALICIA
73	INNEO TORRES	PREFABRICATED CONCRETE TOWERS	TOWERS AND MECHANICAL COMPONENTS	TALAVERA DE LA REINA	TOLEDO	CASTILE LA MANCHA
74	INTORD S.A.	SCREWS	TOWERS AND MECHANICAL COMPONENTS	LEGANÉS	MADRID	MADRID
75	KINTECH INGENIERIA, S.L.	DATA LOGGERS	GENERATORS AND ELECTRICAL COMPONENTS	ZARAGOZA	SARAGOSSA	ARAGÓN
76	LASO ABNORMAL LOADS S.A.	SPECIAL TRANSPORT	TRANSPORT WIND MATERIAL	BADAJOZ	BADAJOZ	EXTREMADURA
77	LM WINDPOWER, S.A.	BLADE MANUFACTURING	BLADES	LES COVES DE VINROMÁ	CASTELLÓN	VALENCIA
78	LM WINDPOWER, S.A.	BLADE MANUFACTURING	BLADES	PONFERRADA	LEÓN	CASTILE AND LEON
79	MAECO EOLICA	MAINTENANCE AND OPERATION OF WIND FARMS	MAINTENANCE, CORRETIVES, RETROFIT, SPARE PARTS	LAS NAVAS DEL MARQUÉS	ÁVILA	CASTILE AND LEON
80	MAECO EOLICA	MAINTENANCE AND OPERATION OF WIND FARMS	MAINTENANCE, CORRETIVES, RETROFIT, SPARE PARTS	SORIA	SORIA	CASTILE AND LEON
81	MAECO EOLICA	MAINTENANCE AND OPERATION OF WIND FARMS	MAINTENANCE, CORRETIVES, RETROFIT, SPARE PARTS	AS PONTES	LUGO	GALICIA
82	MAECO EOLICA	MAINTENANCE AND OPERATION OF WIND FARMS	MAINTENANCE, CORRETIVES, RETROFIT, SPARE PARTS	ARNEDO	LA RIOJA	LA RIOJA
83	MANUFACTURAS ELÉCTRICAS, S.A.U.	COMPONENT MANUFACTURER	GENERATORS AND ELECTRICAL COMPONENTS			
84	MATZ-ERREKA S. COOP.	BOLD MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	ANTZUOLA	GUIPÚZCOA	BASQUE COUNTRY
85	MECHANICAL LINKAGE SOLUTIONS, S.L.	MLS INTELLIGENT CONTROL DYNAMICS	CONTROL SYSTEMS	VILLANUBLA	VALLADOLID	CASTILE AND LEON
86	MONTAJES DEL ATLÁNTICO	WIND TURBINE TOWER MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	FERROL	CORUNNA	GALICIA
87	MONTAJES DEL ATLÁNTICO	WIND TURBINE TOWER MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	MUGARDOS	CORUNNA	GALICIA
88	M-TORRES	WIND TURBINE MANUFACTURING AND ASSEMBLY	WIND TURBINE ASSEMBLY	ÓLVEGA	SORIA	CASTILE AND LEON
89	NAVANTIA	MECHANIZED AND ASSEMBLY	WIND TURBINE ASSEMBLY	FERROL	CORUNNA	GALICIA
90	RONAUTICA RENOVABLES	REPAIR OF BLADES	BLADES	TUI	PONTEVEDRA	GALICIA
91	SANTOS MAQUINARIA ELÉCTRICA, S.L.	COMPONENT MANUFACTURER	GENERATORS AND ELECTRICAL COMPONENTS	GETAFE	MADRID	MADRID
92	SSB	CONTROL AND MAINTENANCE OF WIND FARMS	OPERATION AND MAINTENANCE	MADRID	MADRID	MADRID
93	SSB	CONTROL AND MAINTENANCE OF WIND FARMS	OPERATION AND MAINTENANCE	JUMILLA	MURCIA	MURCIA
94	TECNOARANDA	WIND TURBINE TOWER MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	ARANDA DE DUERO	BURGOS	CASTILE AND LEON
95	TRACTEL IBÉRICA, S.A.	ELEVATOR MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	HOSPITALET DE LLOBREGAT	BARCELONA	CATALONIA
96	TRACTEL IBÉRICA, S.A.	ELEVATOR MANUFACTURING	TOWERS AND MECHANICAL COMPONENTS	HUESCA	HUESCA	ARAGÓN
97	VESTAS BLADES SPAIN, S.L.U.	BLADE MANUFACTURING	BLADES	DAIMIEL	CIUDAD REAL	CASTILE LA MANCHA
98	VESTAS CONTROL SYSTEMS SPAIN, S.L.	CONTROL SYSTEMS	GENERATORS AND ELECTRICAL COMPONENTS	ÓLVEGA	SORIA	CASTILE AND LEON
99	VESTAS NACELLES SPAIN, S.A.U.	WIND TURBINE ASSEMBLY	WIND TURBINE ASSEMBLY	VILLADANGOS DEL PÁRAMO	LEÓN	CASTILE AND LEON
100	VESTAS NACELLES SPAIN, S.A.U.	WIND TURBINE ASSEMBLY	WIND TURBINE ASSEMBLY	VIVEIRO	LUGO	GALICIA
101	VOITH TURBO, S.A.	PUMPS	TOWERS AND MECHANICAL COMPONENTS	COSLADA	MADRID	MADRID
102	ZF SERVICES ESPAÑA, S.A.U.	MAINTENANCE GEARBOX	GEARBOXES	SAN FERNANDO DE HENARES	MADRID	MADRID

(*) The Centre of logistic systems for renewable energies will start activities in the second quarter of the year.

Source: AEE

El viento contra la oscuridad. Ignacio Carmona.

Molinos o Gigantes
Yago Pico

Chapter III
The Pre-allocation Register: an unnecessary regulation

Ignoring the special characteristics of wind

Up to May 2009, the wind industry was tackling the economic crisis much better than other sectors. True, our activity was not completely immune to the international economic downturn. Indeed, financing conditions had got tougher, with increased demands of guarantees against payback. Financing decisions were also taking longer than usual. Even so, the sector maintained its development pace, contrasting starkly with the harsh economic backdrop. But then came the unexpected government decision that would so badly harm the Spanish wind sector. Royal Decree Law 6/2009 (**Real Decreto Ley 6/2009**) was published May 7 in the Official State Bulletin. Without previous consultation with the sector, the law included an article—Article 4—which established a **Pre-allocation Register** for Special Regime projects.

According to the Ministry of Industry, Tourism and Trade, this new administrative obstacle was born of the need to prevent capacity surpassing the objectives set by the **Renewable Energy Plan 2005-2010 (PER)** for each different technology and to guarantee that capacity falling within those objectives—20,155 MW in the case of wind—was eligible to the pay schemes established by RD 661/2007.

In reality, the government wanted to avoid what had already happened with solar thermoelectric technology, which had piled up numerous projects about to start construction. The same had also happened with solar photovoltaic projects which, in the final year before eligibility to **RD 661** expired (the countdown starts once each technology passes 85% of its objective), had installed 400% more than planned. Unfortunately, the government decided to apply the same measure to wind, impervious to the unique characteristics of that technology. The change is a fundamental one. Instead of eligibility to RD 661 residing in whether the installed capacity is completed within the indicated timeframe, the regulation now requires a series of documents beforehand.

The ministry set a deadline of one month to present those documents and promised to resolve the applications quickly. Nevertheless, a procedure that should have taken just weeks to complete, stretched out until December. That meant companies **had to wait seven months** before knowing which projects presented had been included in the Register. During that wait, the sector lost thousands of jobs and numerous factories were closed.

III.1 An unexpected and unnecessary regulation

As mentioned, the first blow from Article 4 of RDL 6/2009 (which created the Pre-allocation Register) was that it was drawn up without consulting the sector; an unprecedented step since the beginning of renewables development in Spain. Up to that point, all regulations affecting the sector had at least involved a consultation process with the companies and associations involved, as well as the following the procedures set by the Eletricity Sector Law.

But a second vital point is that the wind sector did not need any kind of additional ordering. That point is perfectly illustrated by the wind sector's development track record, which is strictly in line with planning as established in the Renewable Energy Plan 2005-2010.

It is clear that the government improvised a regulation with its eye on solar thermoelectric power and with the aim of preventing that technology making a repeat performance of the chaotic photovoltaic rush to get under the wire before the more favorable pay mechanism expired (RD 661/2007). But by including wind within the new regulation, the government completely failed to take into account the special characteristics of wind plants: development lead times, the logistics involved, industrial capacity, etc. In short, it did not recognize certain inherent aspects of wind power that prevent uncontrolled development from one year to the next, as had happened with photovoltaic power.

The wind sector did not need any kind of additional ordering

What was also surprising was that in the preamble explaining the reasons behind the new regulation, the industry ministry cited arguments such as the non-sustainability of renewables development. The preamble referred to the "growing incidence on the [electricity] tariff deficit", justifying, in its eyes, the introduction of "mechanisms related to the pay schemes for Special Regime installations", given that "the current tendency of these technologies could put at risk, in the short term, system sustainability, both from an economic viewpoint, due to impact on the electricity tariff, and a technical one, compromising as well the economic viability of already finalised installations, whose functioning depends on an adequate balance between manageable and non-manageable generation technologies". The argument was totally contradictory to the government's previous view of renewables as a positive commitment for our country.

The government now considered it "necessary to adopt an urgent measure that will guarantee the necessary legal security to those already with realized investments and which sets the bases for establishing new economic regimes that foster compliance with established objectives: attaining the capacity objectives for each technology at a reasonable cost to the consumer and a technological evolution gradually reducing the costs of each one and, therefore, concurring with conventional technologies".

Lastly, the preamble justified the Register in the following way: "the existing Special Regime regulation does not establish enough mechanisms enabling the planning of installations for this type of energy or of the total amount and distribution over time of the incentives paid or, in consequence, of the impact costs incurred by the tariff system. The measure presented in the Royal-Decree

Law, via the creation of the pay mechanism Pre-allocation Register, enables the situation described above to be corrected immediately on enforcement. It will show in the timescales established in the Royal Decree Law the installation projects not only currently lined up but also complying with the conditions for building and to connect to the electricity system with all legal requirements and regulations, together with the capacity volume involved and the timing and impact of costs on the electricity tariff. In any case, the rights and expectations of the installation owners are respected, with due caution taken and with a view to a transitional regime facilitating adaptation."

III.2 Paper work instead of working plants

Inscription in the Register demands a series of administrative requirements, such as the attainment of certain permits and adequate financing. Furthermore, a new deposit of 20€ Kw must be made. In short, the Pre-allocation Register (PAR) requires documents in the place of a built and ready wind plant, which is what the previous RD 661 required for the established one-year period following attainment of 85% of the PER objective.

These are the new requirements:

a) *Written proof of the electricity distribution or transmission company's concession of a grid access and connection point for the plant's entire capacity.*

b) *Administrative authorisation for the plant, awarded by the appropriate body. In the case of installations no bigger than 100 kW, this is not required.*

c) *Building permit issued by the appropriate local authority.*

d) *Proof of payment of deposit necessary for applying for access to the transmission or distribution network .*

e) *Proof of sufficient economic resources of the applicant's own or, alternatively, of sufficient finance to cover at least 50% of the building investment, including feed-in lines and connection to the transmission or distribution grid.*

f) *A purchase agreement, signed by the project developer and the turbine manufacturer or supplier equivalent to at least 50% of the total value of the machines needed for the complete project.*

g) *Proof of availability of a gas supply point conceded by the gas provider in the case of installations that need gas.*

h) *A favorable report regarding water use issued by the appropriate body, when water is necessary for plant operations.*

i) *Proof of pay-in of deposit in the General State Administration Deposit, made out to the General Department of Energy and Mines Policy to the sum of 20 €/Kw. For solar thermoelectric technology, the sum is 100 €/kW.*

As a consequence of not having any other opening, developers opted for applying to

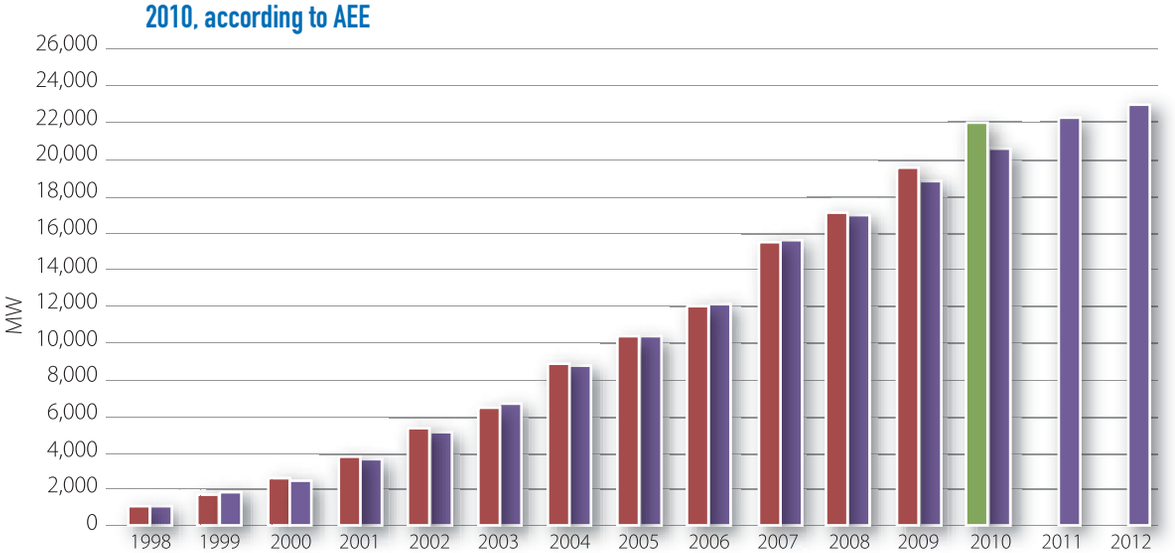
The PAR demands the presentation of paper work in place of a built and ready plant, which is what the previous RD 661 required

Carlos Cazurro.

place all of their projects on the Register. Some projects, despite having certain insurmountable obstacles or which were planned for realization later down the road, often managed to obtain the right documents. Others, however, including projects that were near commissioning stage, found they lacked some of the documents. The latter case affects plants totaling around 400 MW, which did not make the Register.

AEE holds that, if the government had simply maintained as was RD 661—which rule that, once the 85% of the REP objective was reached, developers had a year to connect capacity to remain eligible to that regulation—the capacity brought forward would have been lower than under the industry ministry's new regulation. That conclusion takes into account information from projects presented to the Register, as shown in **Graph III.01.** According to those figures, within a year from October 2009, when the 85% mark was reached, the capacity that would have fallen under RD 661 would have been 21,569 MW (less than 7% above target capacity), while with the PAR the figure rises to 22,825 MW (13% above target). The difference is 1,256 MW.

Graph III.01. Capacity growth under RD-L 6/2009 compared to a continued RD 661/2007 scenario to 2010, according to AEE



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Installed wind power (MW) Data AEE	723	1,415	2,365	3,530	5,026	6,169	8,460	10,011	11,586	15,104	16,689	19,149	21,569		
Evolution according to the Spanish Ministry of Industry (MW) *	839	1,585	2,198	3,389	4,879	6,206	8,504	10,028	11,623	15,104	16,436	18,320	20,204	21,863	22,825

* RD-L 6/2009 and Resolution of November 19, where is publicated the Council of Ministers' agreement of November 24, 2009. (Power associated to different Registry phases).

Source: Council of Ministers' agreement, Pre-allocation Register and AEE

While criticising the lack of dialogue with the sector, the **Spanish Wind Energy Association** (Asociación Empresarial Eólica - **AEE**) initially opted for highlighting the positive side of the new law, which guaranteed the RD 661/2007 pay mechanism to projects complying with requirements, without limiting capacity. AEE did, however, criticise the additional processing complications introduced.

At the same time, AEE emphasised the need to start negotiations on the new regulation that would substitute RD 661/2007. The ministry, however, was overloaded with the flood of projects; evidently, it is easier to come up with documents than build wind plants. Applications piled high and the weeks sailed past without any indication to the sector regarding which projects had been accepted.

A first meeting on the matter with the State Energy Secretary, in May, was followed by several others in which AEE reiterated its concern about a possible paralysis of wind development (a paralysis which eventually came about). That concern increased as time went on. Later, the round of meetings was extended, involving other government departments and regional government officials, as well as trade unions and other related bodies.

Towards the end of July, AEE passed a proposal incorporating the main economic parameters the future "post RD 661" should take into account, backed by a report by Intermoney.

AEE presented its proposal to the ministry, requesting flexible application of the RDL 06/2009 and, most importantly, immediate flexibility in the case of projects with investments already underway.

Throughout October and November, AEE made new contacts with different offices and bodies parallel to its talks with the ministry and, in December, it held a press conference where it warned of the grave consequences of the ministry's new regulation on employment.

The consequences of the new rules suffered by the wind industry towards the end of 2009 were paradoxical

Fernando Mas.

III.3 Consequences

The consequences of the new rules suffered by the wind industry towards the end of 2009 were paradoxical. On the one hand, project developers who had already started building and spending hard money carried on doing so. In fact, they even stepped up work due both to the uncertainty created by the new rules and the regulation vacuum ahead. That rush explains why 2009, with 2,459 MW of new capacity installed, was the second best year—behind only 2007, as noted in the previous chapter. That rush only means less capacity will be installed in 2010, with little more than 1,000 MW expected.

However, those projects that had not entered construction remained frozen, as no bank would put up finance against the uncertainty created by the new regulation, at least not without knowing whether they had entered the ministry's Register (and that was not known until mid-December). A domino effect ensued: banks postponed finance; developers cancelled orders; manufacturers stockpiled but cancelled orders to auxiliary industries. Month by month, and week by week, job regulation and rationalisation measures were taken affecting, at first, small component manufacturers but eventually larger ones too, which stopped renewing contracts with part-time and temporary employees.

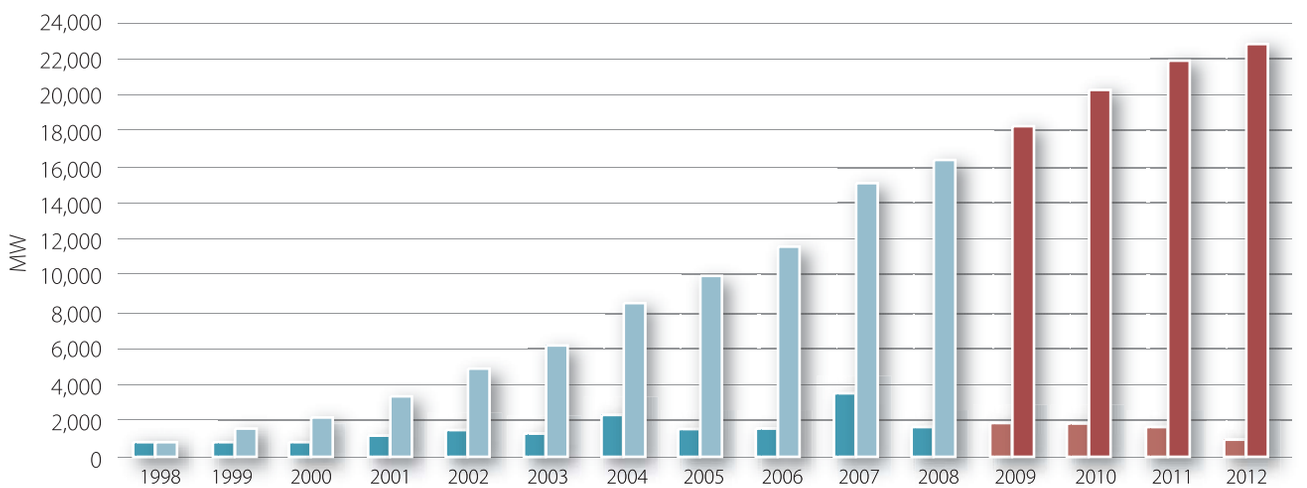
It should be noted that, while the State Energy Secretary pre-allocated 1,600 MW at the beginning of September on the new register, that capacity was tied up mainly in projects that had already been set in operation (including some operating months before the publication of RDL 6/2009 and which, because they had not been registered in the Special Regime plant production register, had to pass first onto the PAR). Consequently, the 1,600 MW "freed" did not bring workload to the industry.

III.4 The industry ministry resolution

Three months later, on December 15, the list of projects finally entered onto the PAR was published, producing an unpleasant surprise. For a start, the allocations were split into **three period phases**: phase 1, 2009 and 2010; phase 2, 2011 and phase 3, 2012 (**Graph III.02.**). Furthermore, of the los 6,389 MW entered, over hal - specifically, 4,042 MW - was already built or building. That meant a new annual workload of just 780 MW for the industry for 2010, 2011 and 2012, as illustrated in **Graph III.03.**. Accordingly, after analysing the resolution, the volume of new capacity for the industry went from 2.000 MW annually 2004-2009, to **780 MW annually over the next two years**. The situation was not much better for developers, as illustrated in **Graph III.04.**, given that only 1,200 MW of the capacity allocated over the next three years was for projects that had not already entered construction. In fact, some 2,950 MW already possessed the final commissioning certificate.

AEE urged the government to advance part of the quota, namely to pass 700 MW from 2011 to 2010 and the entire 2012 quota to 2011. But on finalising this yearbook, there was still no answer on this. The aim of the demand was clear: to recuperate the pace of industrial activity and avoid the migration of the main manufacturers, which would harm the position of the national industry against competitors in coming years.

Graph III.02. Wind power installed in Spain 1998-2008 and capacity allocated by the PAR



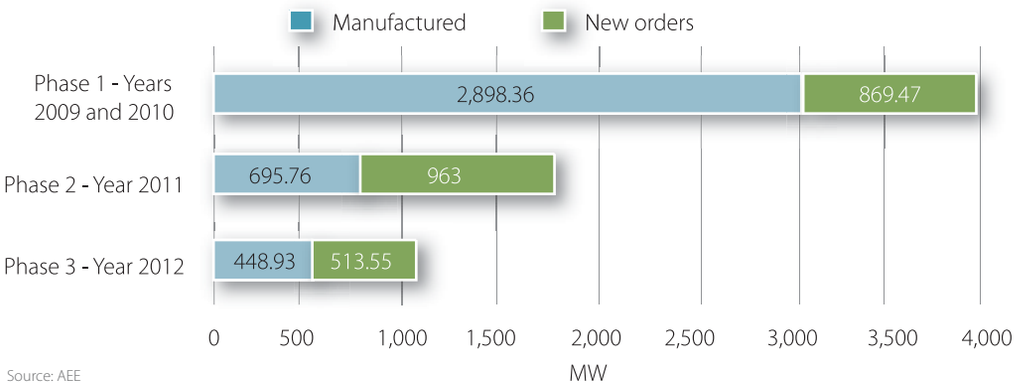
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Annual	839	746	613	1,191	1,490	1,327	2,298	1,524	1,595	3,508	1,609	1,884	1,884	1,659	962
Cumulative	839	1,585	2,198	3,389	4,879	6,206	8,504	10,028	11,623	15,131	16,436	18,320	20,204	21,863	22,825

Instalation average 2,100 MW

Instalation average 1,780 MW

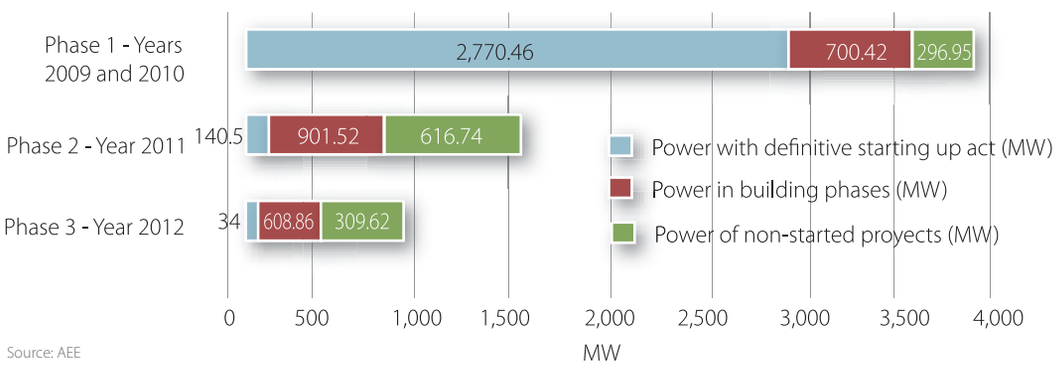
Source: Ministry of Industry, Tourism and Trade and AEE

Graph III.03. Impact on the industry of the limited new capacity allocated by the PAR



Source: AEE

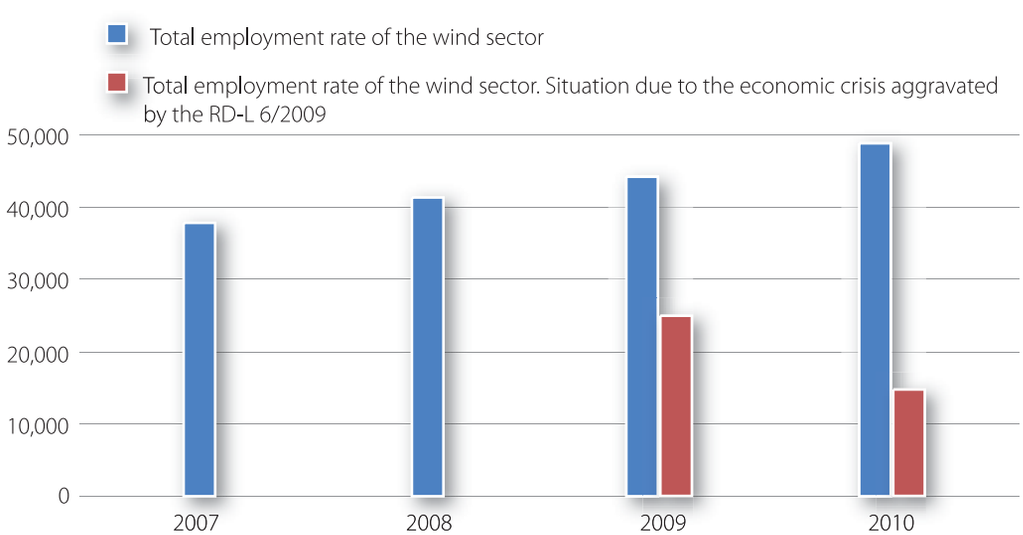
Graph III.04. Impact on developers of the capacity allocated by the PAR



Source: AEE

The figures speak for themselves. As AEE explained in the December press conference mentioned earlier, the paralysis caused by the new regulation produced the loss of 5,000 direct jobs and possibly a similar number of indirect jobs; figures which would continue rising throughout 2010, as shown in Graph III.05..

Graph III.05. Foreseen wind employment 2007-2010 and the effect of the PAR



Source: AEE

Paxareiras
Juan Fabeiro

Chapter IV
Grid integration

IV.1 Adapting to voltage-dip ride-through

Adaptation to the different types of wind plant to the grid code P.O. 12.3 -which establishes how they should respond to the various voltage dip requirements- has been completed. Moreover, it has been a complete success judging by the figures available to the **Spanish Wind Energy Association** (Asociación Empresarial Eólica - AEE) to December 31, 2009. Specifically, of the **19,149 MW** online in Spain by that date, 16,225 MW, or **84.7%** of the whole, had already been certified. Taking into account AEE's request that **865 MW** be excluded from the requirement due to specific difficulties, the relative percentage is even higher. Looking at last year's performance, the tremendous effort carried out over the 12 months is clear to see.

IV.1.1 The rules

RD 661/2007 imposed a series of conditions forcing wind stations to undergo adaptation to meet requirements by the grid code Procedimiento de Operación, better known as P.O. 12.3. Briefly, the code demanded the following:

- New wind capacity (that registered in the Special Regime power plant register-RAIPRE- after 01/01/2008), without certification demonstrating adaptation to P.O. 12.3, may not receive the Special Regime production incentive, though they may access and connect to the grid.

- Wind stations achieving the RAIPRE before that date, were obligated to carry out adaptation before 01/01/2010, unless they have been officially excluded from that obligation. Those adapted wind stations receive a specific complementary payment 2008-2013. That payment is set at € cents 0.38 kWh (€3.8 MWh), regardless of the chosen powers sales mechanism, index linked to inflation.

In 2006, a Working Group concluded some important grid integration work. It was made up of plant owners, turbine and FACTS manufacturers, laboratories and certification bodies, and with the participation of TSO, REE, regulator CNE and the Ministry of Industry. The Group, later denominated the Technical Verification Committee (CTV in its Spanish acronym), drew up and approved the procedure for verifying wind turbine compliance, for validating turbine and plant models and for certifying compliance with the Verification, Validation and Certification Procedure (PVVC in its Spanish acronym) of P.O. 12.3. Now, as CTV, the Working Group meets periodically, monitoring compliance with the procedure.

IV.1.2 The Technical Verification Committee's work

Throughout 2009, the Technical Verification Committee (CTV) met on four occasions (March, June, July and October) to monitor the current situation and tackle the challenge of adapting existing wind stations to grid code P.O. 12.3 requirements. Those meetings produced a report, dated October 22, 2009, authored by AEE's Technical Department in its capacity as Technical Secretary of the Technical Verification Committee, and which has served as the basis for existing wind stations to apply either for exemption from the requirements or an extension of the deadline.

IV.1.2.1 Report on the current situation and the problems adapting existing wind stations to the requirements of grid code P.O. 12.3

Once completed, the report was sent to the appropriate departments of the Industry Ministry and of regulator CNE with the aim of extending deadlines and admitting exemptions for certain plant types. Applications for exemption and extension were made in duplicate and sent to both bodies before end 2008.

A) Deadline extension:

Among other requests, the CTV called for an extension of deadlines set by RD 661/2007:

- Regarding the first part of Transitional Disposition (TD) 5 and the obligation to adapt existing capacity online before January 1, 2008, CTV requested the deadline be extended to **January 1, 2012, instead of January 1, 2010.**

- Regarding the third part of TD 5, CTV requested extending to **January 1, 2011** the deadline for applied solutions for plants and individual turbines, instead of **January 1, 2009.**

Regarding wind plants with turbines of the same typology (or potentially adaptable to that typology) and with accreditation verifying compliance with the PVVC (Verification, Validation and Certification Procedure, as mentioned above), their certification poses different problems (insufficient component manufacturing capacity, meteorological conditions, lack of installation manpower …). An extension of deadline is therefore needed in that case also. Within this group, it is important to underline the efforts made to fine-tune the solution for first-generation DFIG turbines (mainly the G-47 model). That solution is the result of four years of work, with test verification reports achieved on the first turbines on April 28, 2009.

The problem and deadline extension requirement is similar in the case of wind plants with turbines not adaptable to compliance with the PVVC—due to not having been verified—though similar to those that have. In that case, the appropriate testing must be carried out in the type-turbine in order to proceed to the certification of the entire wind plant.

B) Exemption

Additionally, there are some wind turbine models, which, for different reasons, should be exempt from grid code P.O. 12.3 requirements, as no broadly accepted solution exists. In total, such exemption is requested for plants totaling just under 924 MW, well below previous estimates.

There are three situation types for which exemption is requested:

- Lack of space for retrofits inside the turbine itself -chiefly those of 500 kW or lower- coupled with difficulties in applying exterior, multi-turbine or plant-scale solutions (chiefly Flexible AC Transmission Systems, or FACTS), due to administrative problems with permits and with land occupation close to the substation.
- Turbines manufactured by now defunct companies, resulting in insurmountable problems in providing compliance solutions.
- Machines once classed as "special design" turbines, with limited presence.

The CIRCE truck used for verifying the adaptation of wind plants to low voltage ride through requirements. *Photo CIRCE*

IV.1.2.2 CTV meetings

As mentioned earlier, the Verification Technical Committee (CTV) met four times during 2009. Those meetings dealt with matters such as the certification of wind plants or approval of changes to certain norms.

Some of the most relevant aspects of the meetings are summarized as follows:

- Approval of norms PVVC-5 and PVVC-6.
- Approval of the proposal to modify the PVVC in order that, in the certification procedure, compliance status be granted to a wind plant if up to 90% or more or its capacity complies. That means, if only 5%

or less of its capacity has failed to adapt, such plants should not be considered mixed but, rather, compliant, given that the tolerance threshold is the same that exists in the general certification procedure.

- The decision not to request extension to 2015 of the complimentary payment made to adapted capacity, fixed by RD 661/2007 at December 31, 2013.

IV.1.3 Progress in the certification and adaptation process for complying with grid code P.O. 12.3

This chapter summarises the state of play of the certification/adaptation of wind plants and turbines to December 31, 2009. It should be pointed out that the figures for adapted capacity come from the bodies that have certified wind plants: AENOR, Germanisher Lloyd, TÜV (in March, a TÜV representative said the company was now ready and able to certify wind plants under P.O.12.3).

According to PVVC indications, there are two possible ways to certify wind plants:

- **Particular procedure** (also known as the **particular process**), in which turbine with P.O. 12.3 is verified throughout the plant.

- **General procedure** (also known as the **general process**), in which a dynamic compensation system, or FACTS, is incorporated, carrying out the simulation of the entire plant, once turbine tests have been concluded. For some turbine types, such as asynchronous squirrel cage models and asynchronous turbines with switchable rotor resistance insertion, simplified models may be used, without field tests needing to take place.

The incorporation in the machine of FACTS enables the application of the particular procedure, the onus falling on the certifying body to accept or not the accreditations supplied or to demand, instead, the general procedure.

Furthermore, since 2009, FACTS may be directly incorporated at the substation, instead of fitting them into each turbine.

IV.1.3.1 Certified plants

By December 2009, out of the 16,195 MW total capacity certified (591 plants), 14,942 MW had done so following the particular procedure. Of that amount, 1,367 MW incorporated FACTS solutions. The remaining 1,253 MW were certified using the general procedure, using FACTS solutions. Of that figure, 705 MW were certified with individual turbine FACTS solutions, while 548 MW did so with FACTS at the substation.

These figures are especially notable taking into account that the **Spanish Wind Energy Assoction** (AEE) had expected 13,000 MW to have achieved certification; that is, 3,000 MW below what was actually achieved. **By the beginning of 2010, 2,824 MW** of existing capacity was still pending certification, mainly due to delays in fine-tuning the manufacture and installation of FACTS solutions.

By current trends, it seems very likely that by January 1, 2009, all capacity will have completed adaptation, with the exception of turbines of 500 kW or lower, those from defunct manufacturers and a small number of special design turbines, as indicated above.

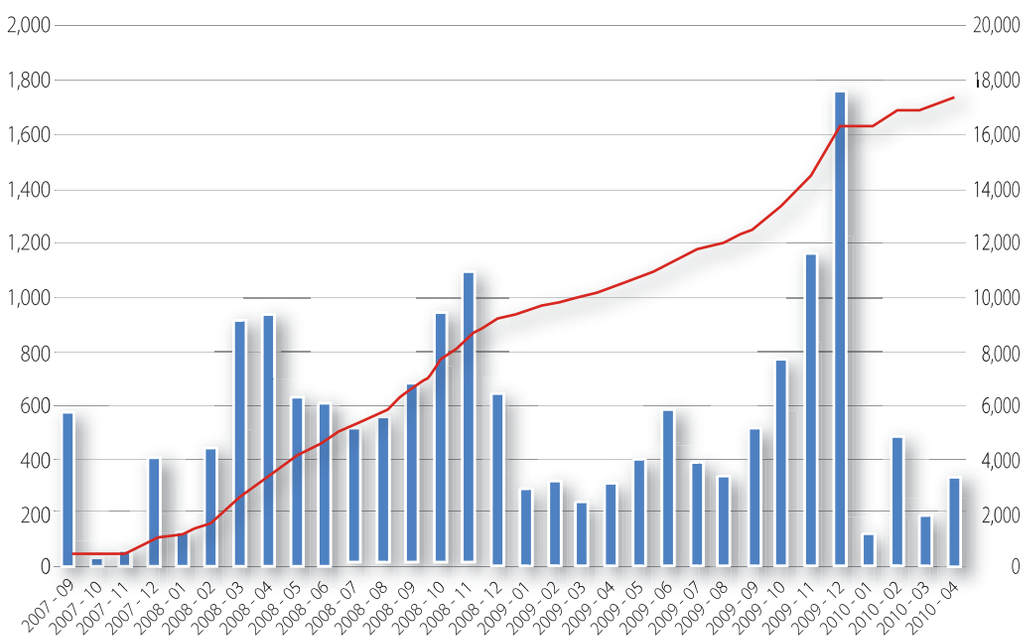
IV.1.3.2 Simplified turbine models

Within the Technical Verification Committee (CTV), a specific Working Group has been created to define simplified models, both for squirrel cage and double fed turbines, with the aim of achieving model validation in accordance with the general procedure thus avoiding, wherever possible, the need to carry out field tests.

The parameters of the new models have been included in the new version of the Verification, Validation and Certification Process 6 (PVVC-6).

Meanwhile, the new version of PVVC-7 incorporates criteria applicable to "singular" plants, understood to mean those comprising experimental machines, which require a certain degree of technological development.

Graph IV.01. Monthly and cumulative certified capacity (MW)



Source: AENOR

IV.1.4 Requirements in Island and Enclave Electricity Systems

The above criteria are applicable to wind plants to the peninsular, or mainland electricity system (Sistema Eléctrico Peninsular, or SEP). To date, there is no defined precedent for plant connected to the Island and Enclave Electricity Systems (Sistemas Eléctricos Insulares y Extrapeninsulares, or SEIE), due to increased vulnerability to brusque voltage dips.

According to the regulator, specific rules are being drawn up for SEIE-connected plants, which will determine the requirements and the methods for verifying compliance. While that solution is being fine-tuned, the Special Regime incentives will not be affected. Nevertheless, determination of the requirements for the Canary Islands is pressing given that, once the public wind power competition is resolved, construction will commence.

IV.2 The new rules coming: grid code P.O. 12.2

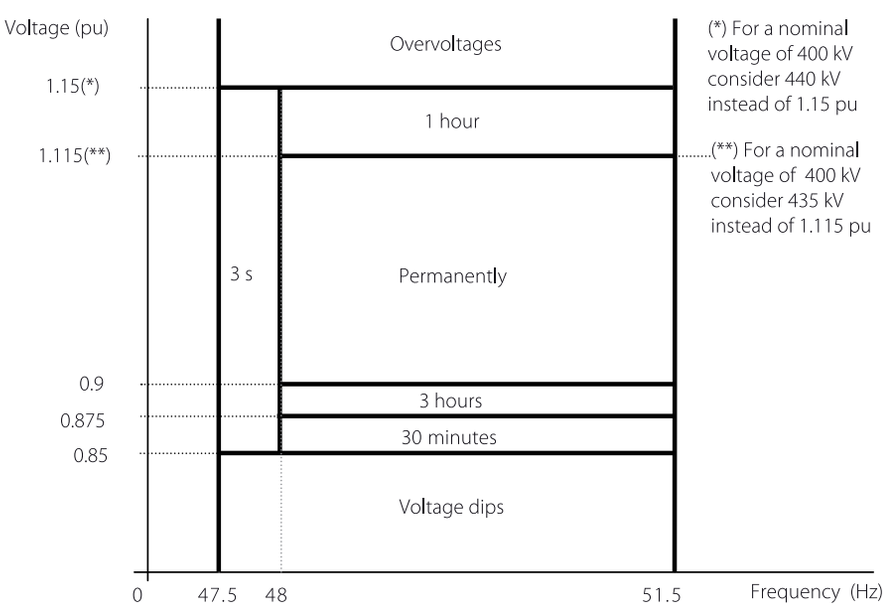
Wind power's fast increasing coverage of electricity demand poses a series of technological challenges, both for wind turbines and for wind plants as a whole. But this is par for the course for the wind sector, which has always shown a high degree of commitment to finding cost effective solutions to its challenges. In fact, that predisposition, and the need to compete globally, is one of the reasons why it has grown so much.

Against the backdrop of growing wind penetration and of reaching 40,000 MW in 2020, system operator **REE** has drawn up a **new grid code, Procedimiento de Operación 12.2** (P.O. 12.2). The new code may set technical requirements for all transmission and generation installations, but it lays special emphasis on Special Regime generation (renewables and combined heat and power) and most pointedly on wind power.

The draft, which has been sent to **AEE,** aims at January 1, 2012, as the starting date for the new rules. But meeting the requirements before January 1, 2013, seems difficult, given the unavoidable delays in certifying the different turbine and plant retrofit requirements implied. Those new requirement are summarised as follows:

- Minimum periods in which the plant must remain connected to the grid in accordance with the fluctuations in voltage/ frequency, both in normal operations and during perturbations, as presented in the following diagram:

Diagram IV.01. Minimum periods the plant must withstand voltage (at busbars) and frequency fluctuations without disconnecting



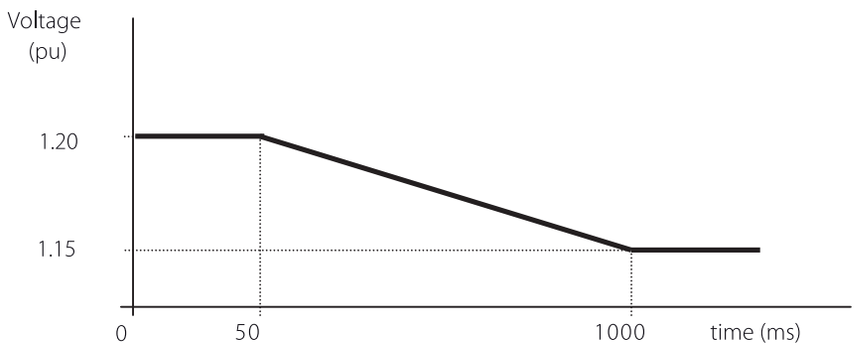
Source: REE

AEE's believers these variables should be set in accordance with the different capabilities of turbines.

- Adittionally, the levels are set for staying online in the case of voltage overload. AEE believes those levels are set excessively high and, accordingly, has made its own proposal.

Wind power's fast increasing coverage of electricity demand poses a series of technological challenges

Diagram IV.02. Minimum periods plants must remain online in case of sporadic voltage overload in one or all phases at the busbars



Source: REE

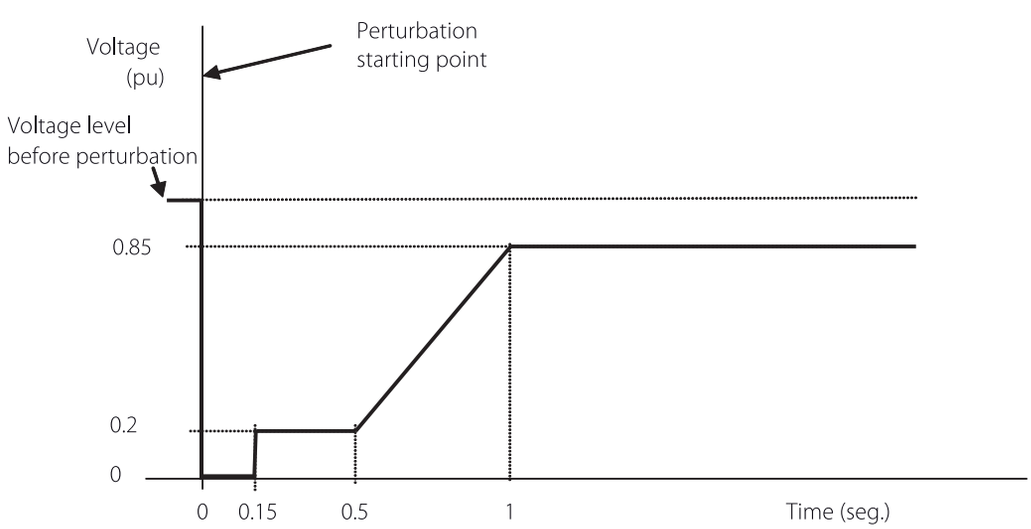
As Graph IV.02 shows, it is more realistic to start from the 1.15 points and drop to 1.1, as is the case of other grid codes, extending the time period to 1.5 seconds.

In general, one of the weak points of grid code P.O. 12.2 is that requirements do not distinguish between single turbines and entire plants; also a failing, to some degree, of P.O. 12.3. That complicates compliance monitoring as, in many cases, electrical fluctuations are experienced in different ways by the two and there are numerous interconnection elements affecting both turbines and plant.

Part of AEE's comment on the code therefore includes a request to separate requirements for turbines and plants.

- With regards to the voltage dip, the requirement is to withstand drops to zero voltage and then remain at 0.85 of nominal voltage, as illustrated in the following diagram.

Diagram IV.03. Period-voltage curve defining the "voltage perturbation" area, at the busbars, to be withstood by the plant. Phase-earth voltage for the perturbed phases



Source: REE

Regarding this requirement, the proposal is to reach 0.9 pu and stretch the response period to three seconds. A problems arises here concerning certification, as the requirement is at plant level, whereas it is only possible to measure at turbine level.

Aspects such as the injection/absorption of reactive current are new, even at international level, requiring adaptation of machines and plants.

An undoubtedly fundamental point, given the future implications for wind plants, is **power control /frequency**. Here, realistic upward and downward ramps should be established for plants, applying criteria no more demanding for wind than for conventional generation. It is important to consider the possibility that of some of those services being provided indirectly.

In short, P.O. 12.2 is fundamental for guaranteeing the integration of the 40,000 MW expected by 2020 in the most secure and reliable way possible for the electricity system. Still, it should incorporate some of the aspects that **AEE** has communicated to the system operator and which are summarised as follow:

- Separate requirements, distinguishing between turbines and plants.
- Take into account the advantages of employing the latest technology but also it limitations, together with the time scales needed to adapt plants.
- Use, wherever possible, the integrated and coordinated operational tools provided by the generation dispatch control centres.
- Base compliance on self-certification.
- Take into account the breadth and scope of requirement in other countries.
- Avoid potencial conflicts between technologies and patented procedures.

Crepusculo. Eduardo Margareto.

Ayer y Hoy
Eva Filgueira

Chapter V
Pay mechanisms and returns

Electricity market volatility

Each time the government makes a change in renewables regulation, the sector reiterates the same message: regulation should not be made based mainly on the prices of the year behind but, rather, with the longer term vision of useful plant life. The year 2009 marked another example of electricity market volatility, with a **reduction in the average daily market price of 42.6%**, against a 63.7% increase in 2008 compared with the previous year. With an average market price of **36.96 €/MWh**, last year's was **the lowest since 2004**. That drop was due mainly to the fall in demand, brought about both by the economic crisis and the considerable drop in fossil fuel prices. The incorporation of more new wind capacity was not without its effect on the price either, as that technology always pushes off stream the more expensive technologies that generally mark the pool price.

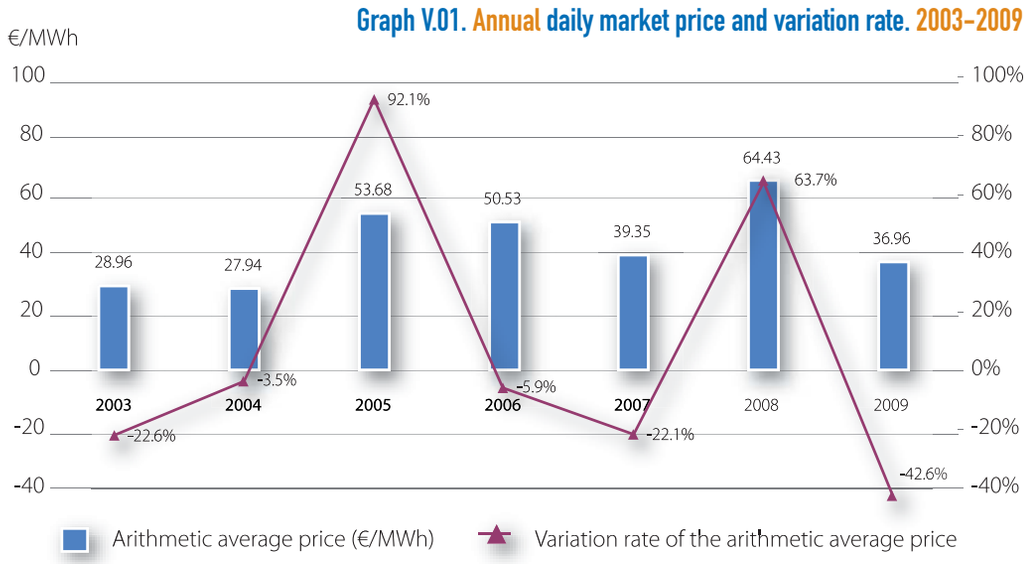
For wind operators, the average price achieved in 2009 was **77.05 €/MWh** for plants governed by the new rules in RD 661/2007 and **74.07 €/MWh** for those governed by that regulation's transitional clauses, laid down in Transitional Disposition 1ª, which maintains the previous incentive established in RD 436/2004.

V. 1. Analysis of the daily market price

The daily market prices of 2009 were the lowest of the past five years. The fall in demand together with falling fossil fuel prices and increased wind generation, were the chief contributors to the reduced price. In the final months of the year, the price hovered around the region of 30-35 €/ MWh. The average price throughout 2009 was **36.96 €/MWh**, 42.6% below that of 2008 (64.43 €/MWh).

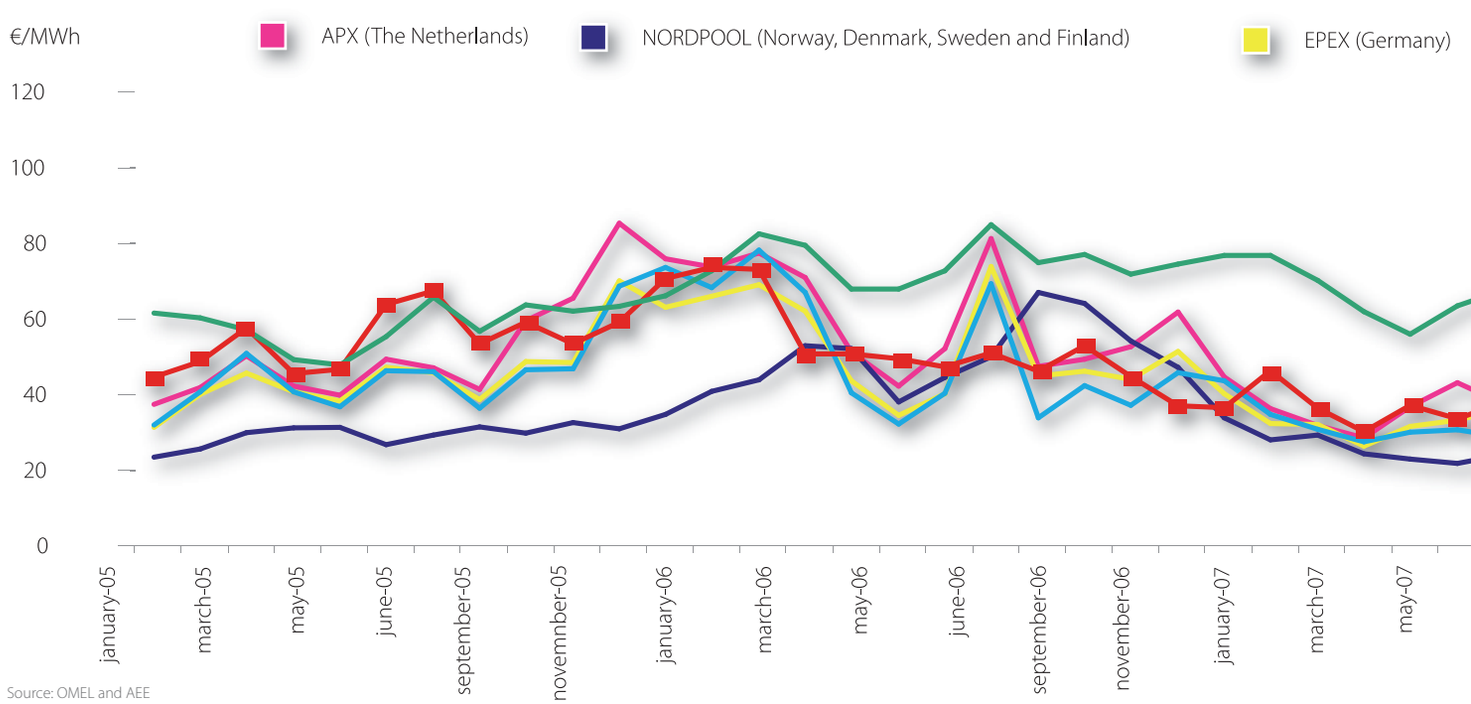
In an international context, the prices of the Spanish and Portuguese market in the final months of 2009 fell with respect to the rest of Europe, eventually becoming the lowest.

Graph V.01. Annual daily market price and variation rate. 2003-2009



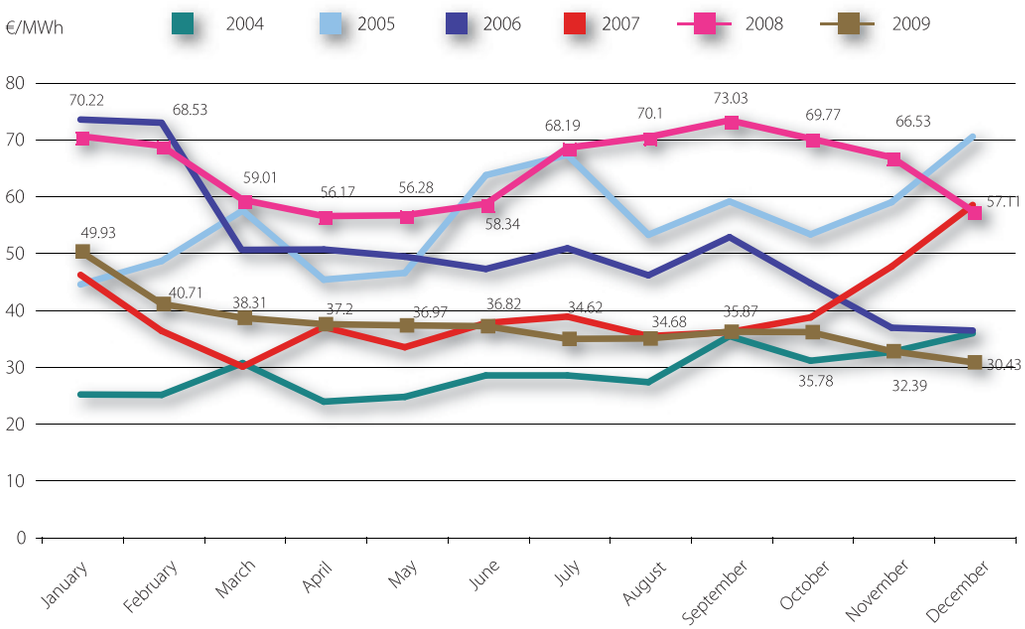
Source: OMEL and elaboration AEE

Graph V.02. Comparison of average monthly prices of the main international markets. 2005-2009



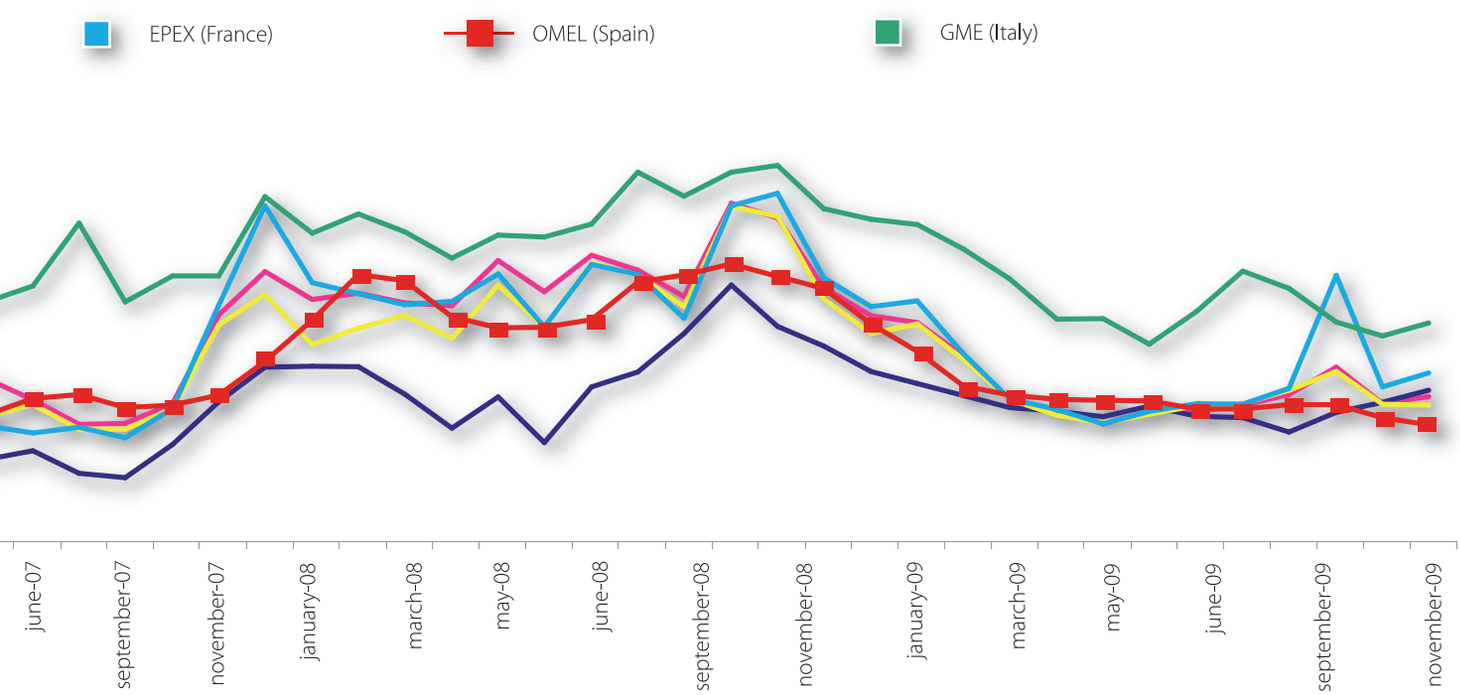
Source: OMEL and AEE

Graph V.03. Monthly pattern of the daily market price. 2004-2009



Source: OMEL

Nube. Emilia Gómez.



V.2 Payments received by wind power

The ministerial Order ITC/3801/2008, of December 26, 2008, revising the electricity tariff for the new year ahead, established a consumer price index (IPC in its Spanish acronym) of 355.6 basis points applicable to both wind power's regulated tariff and the alternative production incentives (including the applicable floor and ceiling) for 2009. Taking into account the 25 basis points subtracted from the IPC established in the transitional clause of RD 661/2007 to December 31, 2012, and the 50 basis points after that date, the rate effectively increased by 3.30% compared to 2008.

Accordingly, the regulated, or fixed tariff for 2009 was **78.183 €/MWh**, while the floor and ceiling were set at **76.098 €/MWh** and **90.692 €/MWh**, respectively. Capacity governed by Transitional Disposition 1ª of RD 661/2007 (extending for existing capacity the conditions of RD 436/2004), the incentive was 38.295 €/MWh, the same rate as the previous year.

Table V.01. Annual parameters for calculating wind generation payments under Royal Decree 661/2007. 2007-2010

Units: €/MWh	2007	2008	2009	2010
Feed-in-tariff	73.228	75.681	78.183	77.471
Incentive to reference	29.291	30.272	31.273	30.988
Cap	84.944	87.790	90.692	89.866
Floor	71.275	73.663	76.098	75.405
CPI	0	3.60%	3.56%	-0.66%
X Factor	0	0.25%	0.25%	0.25%

Source: AEE

On Thursday, December 31, ministerial Order ITC/3519/2009, of December 28, was approved. That order revised the access tolls for the year ahead, as well as the tariffs and incentives for Special Regime producers.

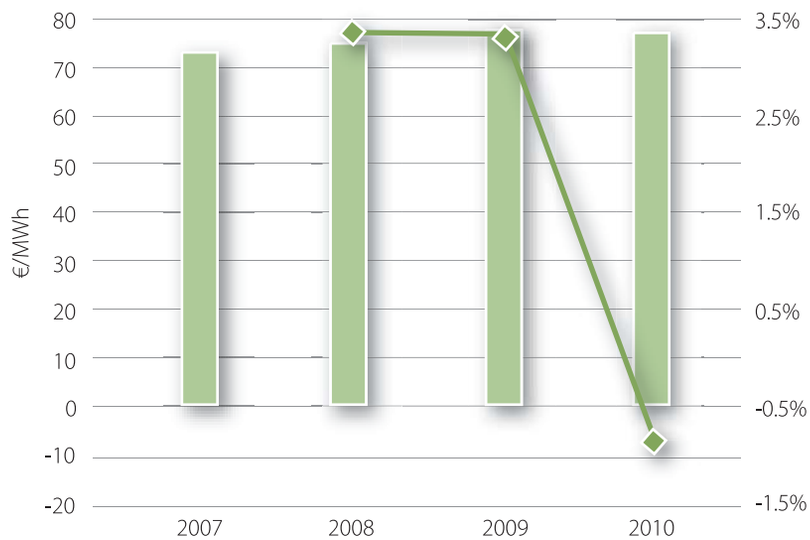
The IPC used for revising both the regulated tariff and the alternative production incentives (including the applicable floor and ceiling) from January 1, 2010, were set at –66.1 basis points (Section 3, Article 8). Taking into account the correction factor of 25 basis points defined in RD 661/2007, the revision of both the regulated tariff and the alternative production incentives (including the applicable floor and ceiling) **was 0.91%**.

Graph V.04. represents the revised tariff rates under RD 661/2007, from 2007 to 2010.

The regulated or fixed tariff for 2009 was 78.183 €/MWh, while the floor and ceiling were set at 76.098 €/MWh and 90.692 €/MWh, respectively

On the clouds. Javier Lopez.

Graph V.04. Annual fixed tariff rates under RD 661/2007. 2007-2010



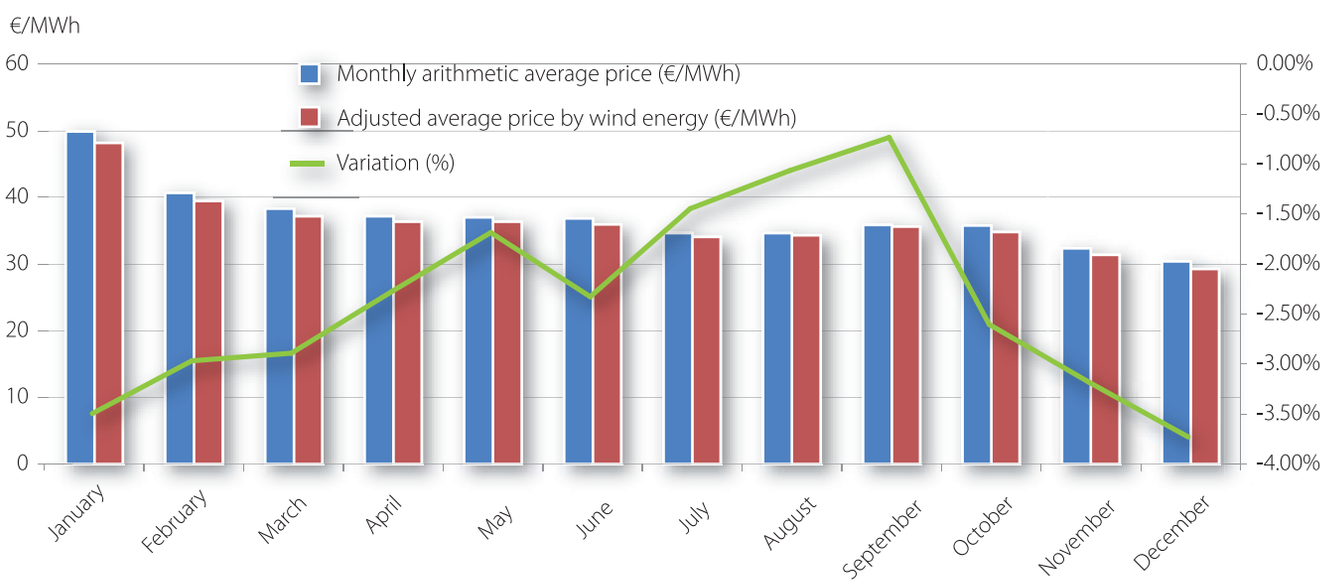
	2007	2008	2009	2010
Fixed tariff RD 661/2007	73.228	75.681	78.18	77.47
Variation rate (%)		3.35%	3.31 %	-0.91%

Source: AEE

In order to analyse payments under the market option, it is necessary to calculate the average price actually received by wind power; that is to say, calculate the average daily market price received by wind power, taking into account that wind production is higher at times of lower price.

The annual average perceived price by wind in 2009 was 3.2% lower than the arithmetic average price, as illustrated in the following graph:

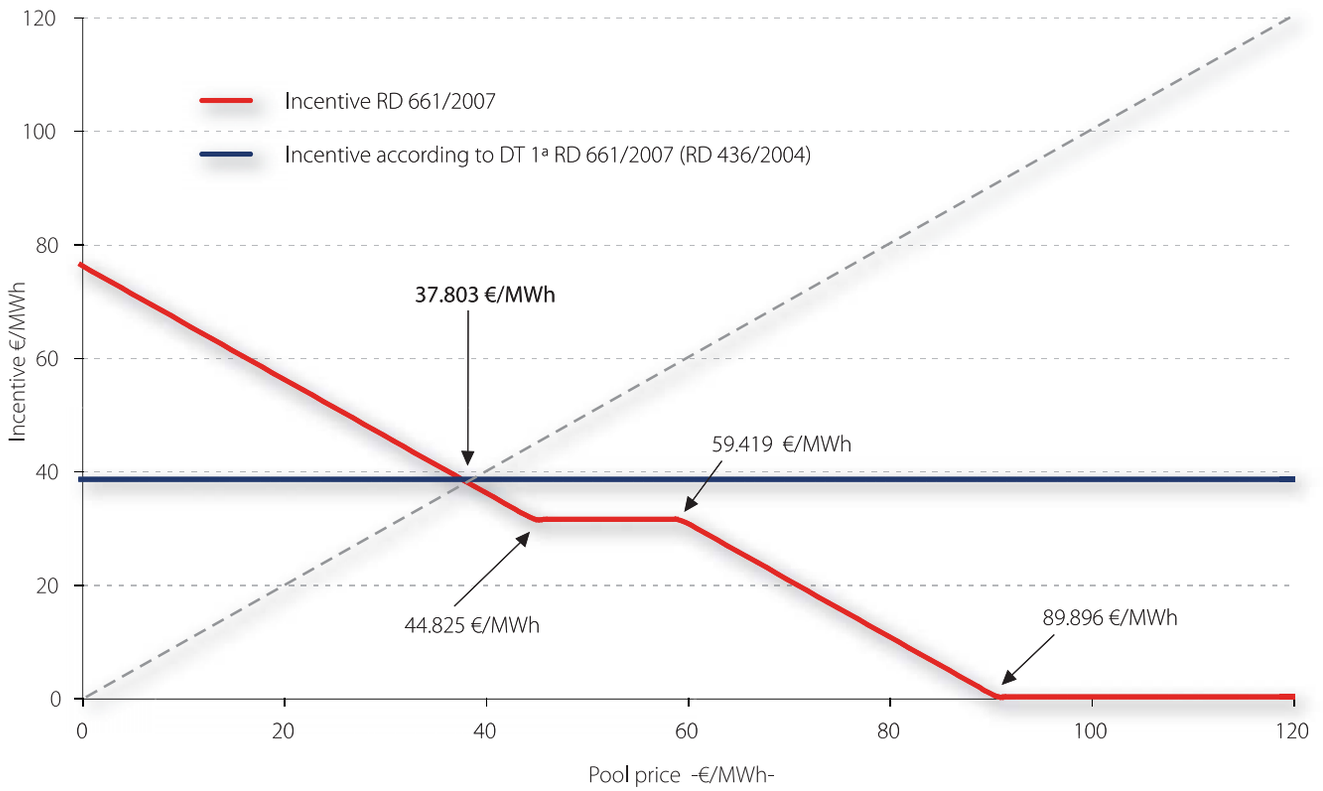
Graph V.05. Comparison between the market price and average price actually received by wind power in 2009



Source: AEE

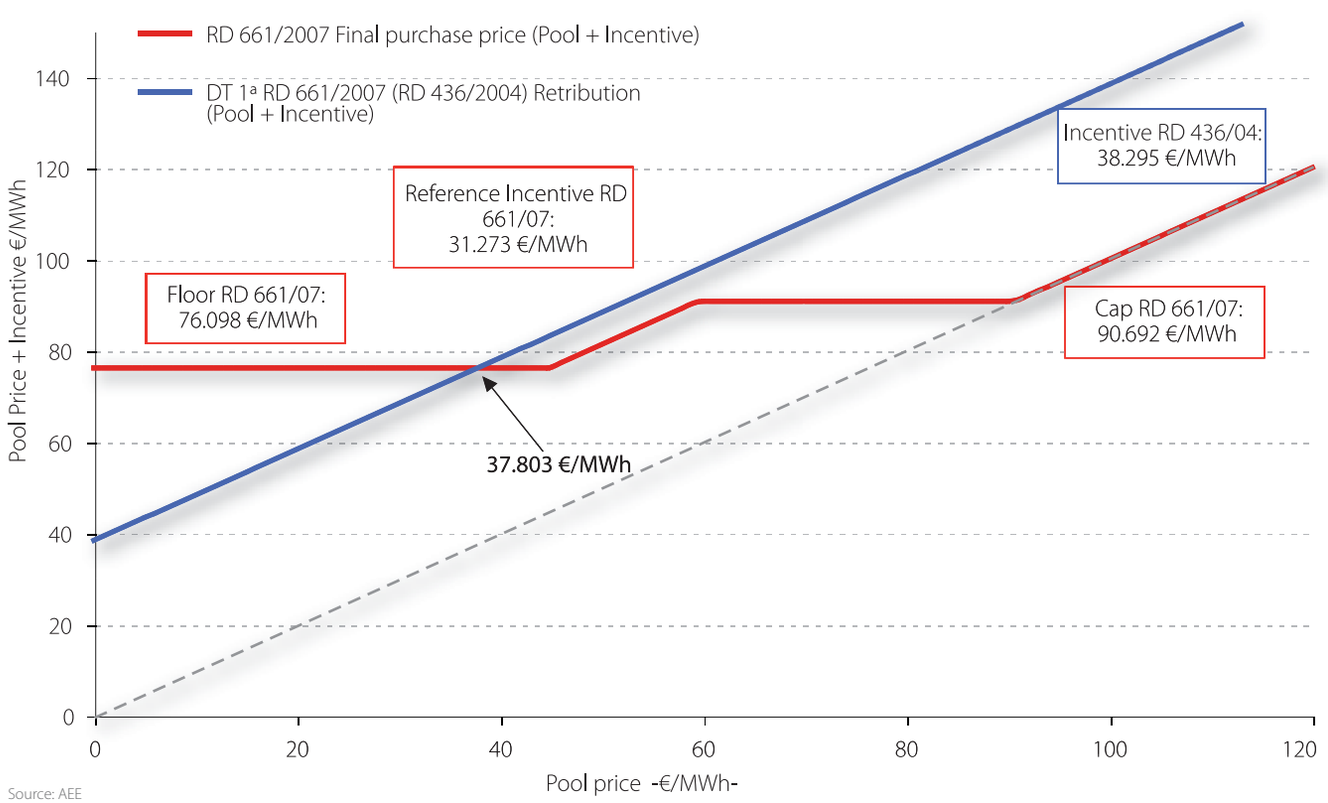
Graph V.06. represents the variations in the production incentive during 2009 under the new rules of RD 661/2007. That incentive varies depending on the daily market price and reaches zero when that price touches and passes the ceiling (90.692 €/MWh). Under the previous rules for older capacity, maintained Under the Transitional Disposition 1ª of RD 661/2007, the incentive remains at a constant 38.295 €/MW, regardless of the market price. For prices above 37.803 €/MWh, the incentive under the new RD 661/2007 rules is below the one under the transitional clause.

Graph V.06. Production incentive variations depending on the market price in 2009



Source: AEE

Graph V.07. Total payment variation depending on the market price in 2009

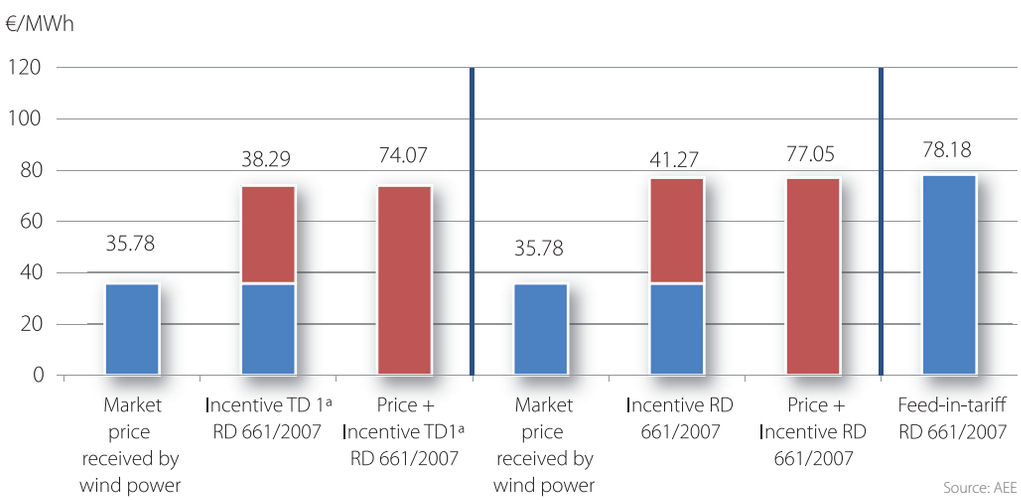


Source: AEE

Payments under the market option logically depend on the going hourly price of the daily market, both under RD 661/2007 and its Transitional Disposition 1ª.

The average payment made to capacity under the Transitional Disposition 1ª of RD 661/2007 was **74.07 €/MWh** (the 35.78 €/MWh market price received by wind power plus the 38.29 €/MWh incentive). Newer capacity opting for trading on the market and governed by the new rules of RD 661/2007 **received 77.05 €/MWh**. Due to low market prices, wind power received the floor price for most hours last year, meaning that the incentive, under that option, was higher (41.27 €/MWh) than that paid under the Transitional Dispostion 1ª. Meanwhile, capacity choosing to sell power under the alternative regulated or fixed tariff option of RD 661/2007 received 78.183 €/MWh.

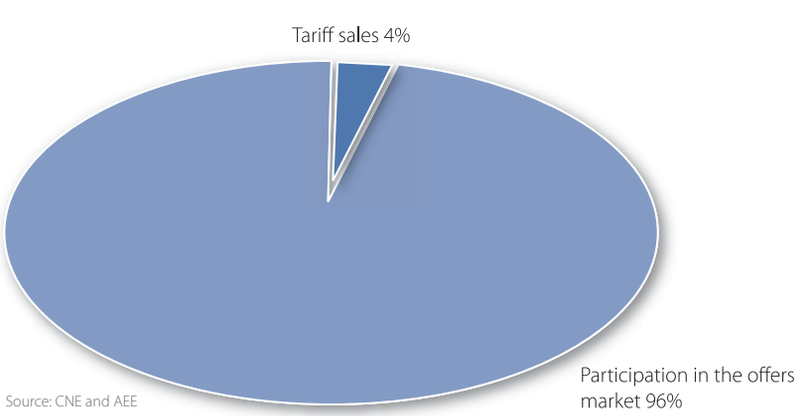
Graph V.08. Pay options in 2009



Source: AEE

According to figures published by regulator Comisión Nacional de la Energía (CNE) for January-October 2009, approximately 96% of wind power sold power under the market option.

Graph V.09. Sales option chosen for wind generation in 2009



Source: CNE and AEE

Operators chose to sell 96% of wind power under the market option

V.3 Comparison between Royal decree 661/2007 and its Transitional Disposition 1ª

In order to calculate monthly payments received by wind power trading on the market, we take into account the average price of wind power. Table V.02. compares the average monthly payments to wind power in 2009 under the market option of the Transitional Disposition and under the rules of RD 661/2007 for new capacity. Except in January, due to low electricity market prices, payments for capacity operating under RD 661/2007 were slightly higher than those under the TD 1ª. The average annual difference for the period is approximately 3 €/MWh.

Table V.02. Analysis of monthly payments under the market options of RD 661/2007 and its Transitional Disposition 1ª in 2009

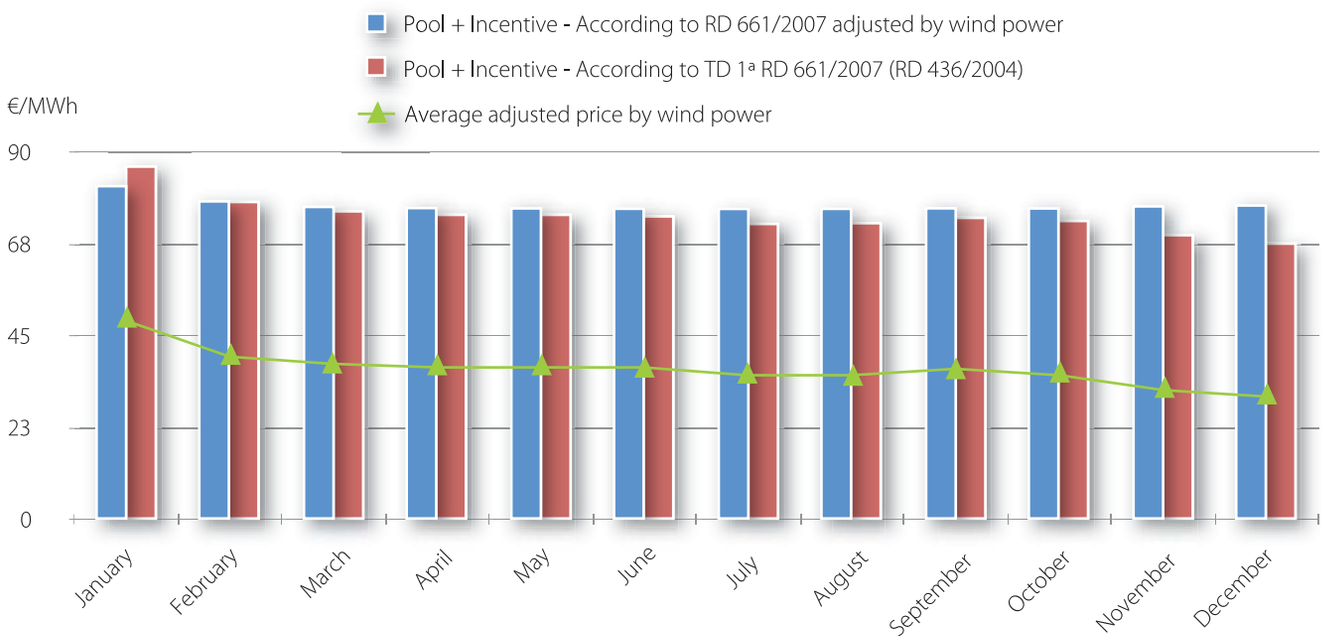
Year 2009 (€/MWh)	Average adjusted price by wind power	Incentive RD 661/2007 adjusted by wind power	Pool+Incentive according to RD 661/2007 adjusted by wind power	Incentive according to TD 1ª RD 661/2007 (RD 436/2004)*	Pool+Incentive according to TD 1ª RD 661/2007 (RD 436/2004)	Difference (Incentive 661/2007 calculation time - Incentive TD 1ª)
January	48.168	33.505	81.673	38.295	86.463	4.790
February	39.497	38.448	77.945	38.295	77.792	-0.153
March	37.201	39.384	76.585	38.295	75.496	-1.089
April	36.345	39.958	76.303	38.295	74.640	-1.663
May	36.344	39.878	76.222	38.295	74.639	-1.583
June	35.960	40.172	76.132	38.295	74.255	-1.877
July	34.111	41.991	76.102	38.295	72.406	-3.696
August	34.300	41.814	76.114	38.295	72.595	-3.519
September	35.602	40.640	76.242	38.295	73.897	-2.345
October	34.843	41.360	76.203	38.295	73.138	-3.065
November	31.353	45.365	76.718	38.295	69.648	-7.070
December	29.293	47.640	76.933	38.295	67.588	-9.345
Period 2009	**35.778**	**41.269**	**77.048**	**38.295**	**74.073**	**-2.974**

* Incentive + Established incentive by the RD 436/2004 = 50% MRT_{2006} without an update since 2006.

Source: AEE

Santa Quiteria. Mónica Valle.

Graph V.10. Monthly payments under the market options RD 661/2007 and its Transitional Disposition 1ª in 2009



Source: AEE

Under RD 661/2007, low daily electricity market prices over 2009 kept wind payments on the market at the floor price for most hours (87.6%) last year, as illustrated in **Table V.03**. That contrasts with 2008, which was dominated by high daily market prices, pushing the payments received by wind close to the ceiling for most of the time, meaning the production incentive was within the zero band.

Table V.03. Monthly breakdown of production incentive bands under RD 661/2007 in 2009

2009	Floor	Constant incentive	Cap	Without incentive
January	32.3%	47.7%	19.8%	0.3%
February	77.4%	16.5%	5.8%	0.3%
March	87.8%	11.3%	0.9%	0%
April	92.6%	7.4%	0%	0%
May	95.3%	4.7%	0%	0%
June	96.7%	3.3%	0%	0%
July	99.5%	0.5%	0%	0%
Agust	98.4%	1.6%	0%	0%
September	95.3%	4.6%	0.1%	0%
October	95.7%	4.2%	0.1%	0%
November	89.7%	8.8%	1.5%	0%
December	90.1%	6.5%	3.5%	0%
Average 2009	**87.6%**	**9.7%**	**2.6%**	**0%**

Source: AEE

V.4 Comparison between 2008 and 2009

In 2008, the average price received by wind power was 2.68% below the arithmetic price, while in 2009, the difference was 3.20% **(Graph V.05).**

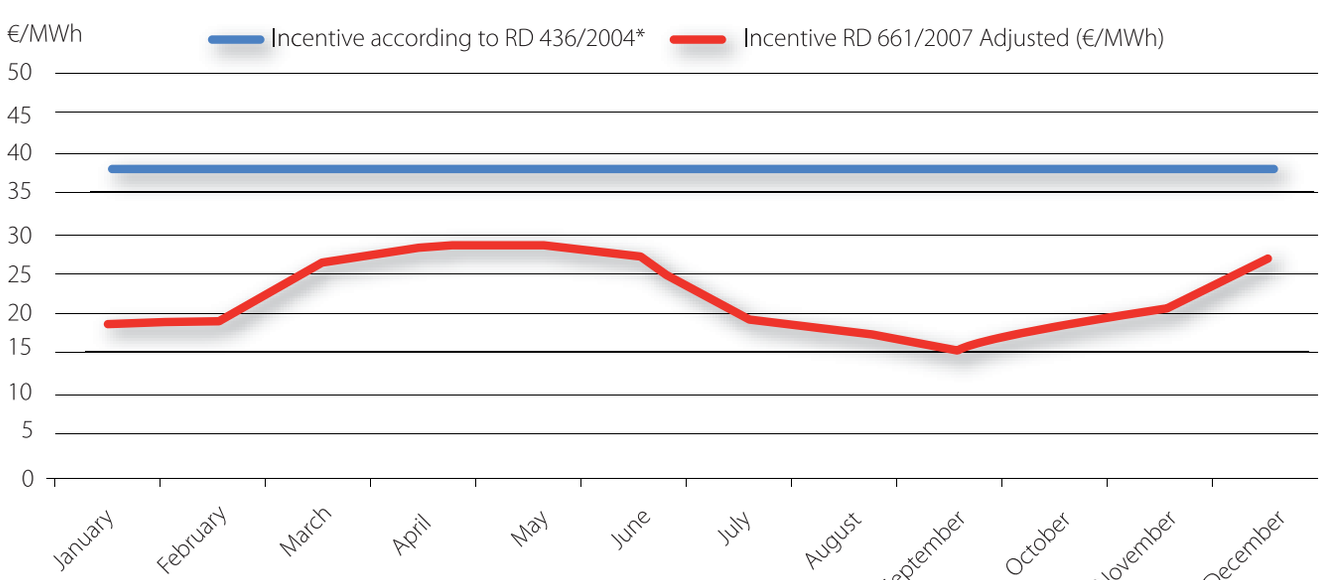
Table V.04. Average arithmetic price vs price received by wind in 2008

Year 2008	Average arithmetical monthly price (€/MWh)	Average adjusted price by wind power (€/MWh)	Variation (%)
January	70.22	67.56	-3.80%
February	68.53	66.50	-2.95%
March	59.01	57.74	-2.14%
April	56.18	55.73	-0.79%
May	56.28	55.78	-0.89%
June	58.34	57.35	-1.68%
July	68.19	67.47	-1.05%
August	70.10	69.60	-0.71%
September	73.03	72.36	-0.92%
October	69.77	68.10	-2.39%
November	66.53	65.42	-1.67%
December	57.11	57.44	0.58%
2008	**64.43**	**62.70**	**-2.68%**

Source: OMEL and AEE

In the following graphs, the resulting monthly production incentive is shown for the market option under RD 661/2007 and under its Transitional Disposition 1ª (**38.295 €/MWh**) in the years 2008 and 2009. As would be expected, the low prices in 2009 placed the RD 661/2007 incentive slightly above that established in the previous RD 436/2004 (maintained under the Transitional Disposition of RD 661/2007).

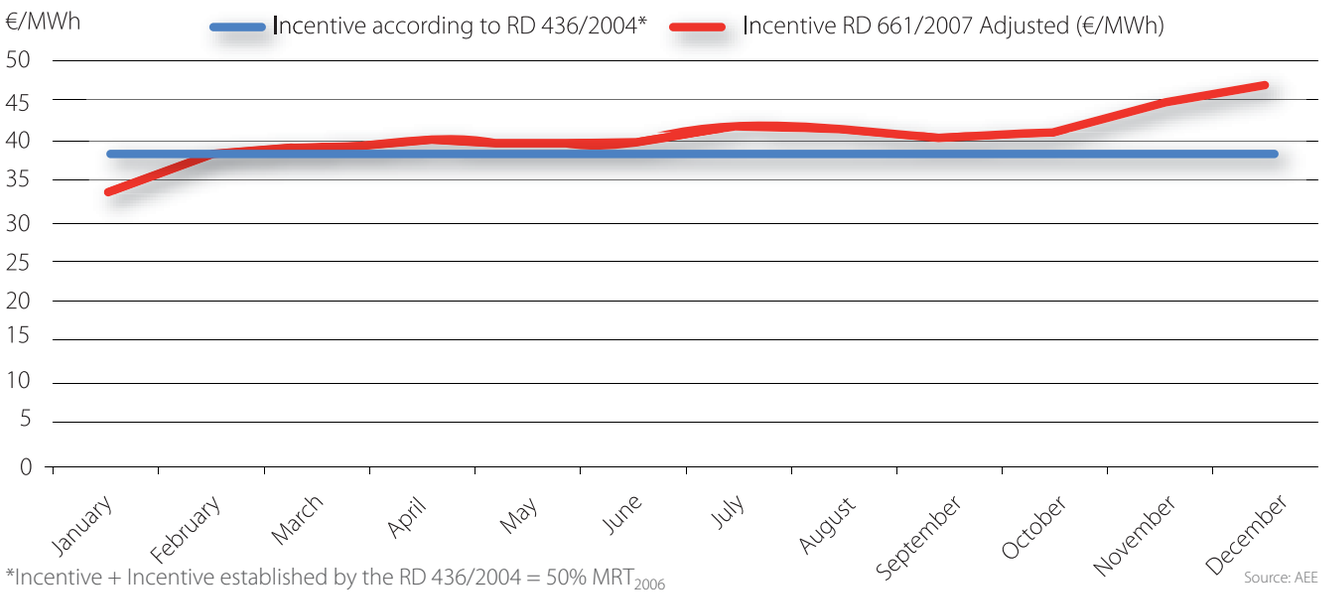
Graph V.11. Monthly production incentive under RD 436/2004 and RD 661/2007 in 2008



*Incentive + Incentive established by the RD 436/2004 = 50% MRT_{2006}

Source: AEE

Graph V.12. Monthly production incentive under RD 436/2004 and RD 661/2007 in 2009

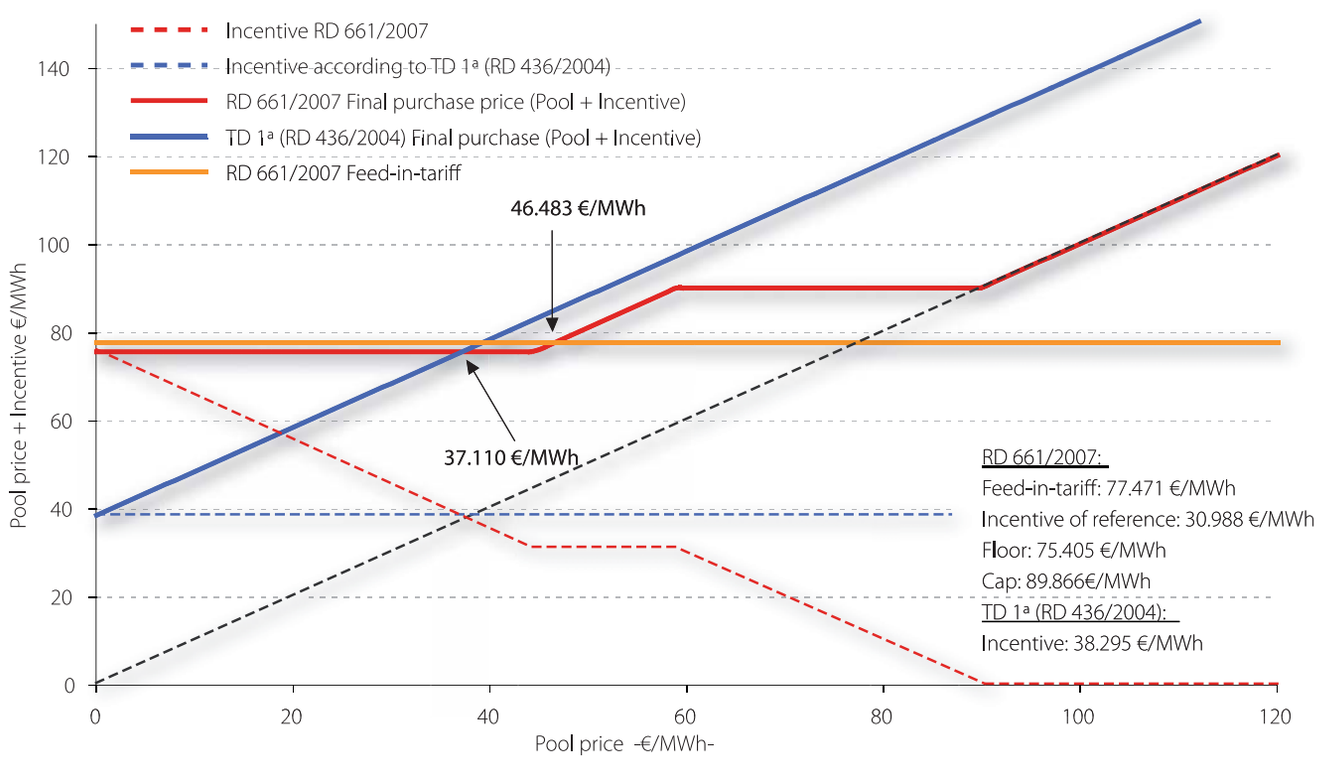


*Incentive + Incentive established by the RD 436/2004 = 50% MRT_{2006}

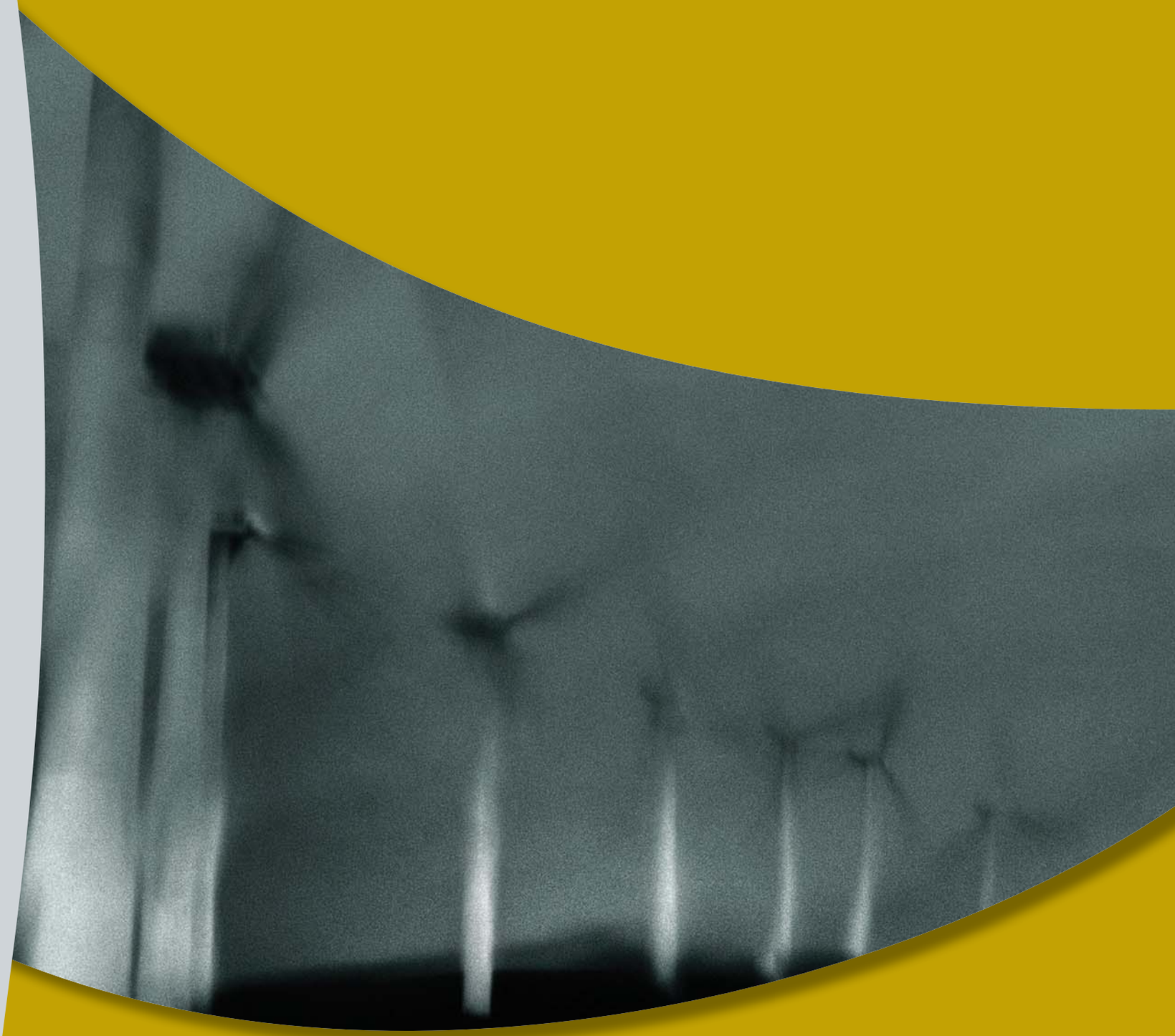
Source: AEE

For 2010, as mentioned earlier, ministerial Order ITC/3519/2009 revised the parameters for calculating payments to wind generation. **Graph V.13.** illustrates the varying payments (Pool+Incentive) and the varying incentive depending on the electricity market price. The graph shows how, for pool prices above 46.483 €/MWh, the market option under RD 661/2007 produces better results than the regulated or fixed tariff under the same regulation. On the other hand, for pool prices below 37.110 €/MWh, payments under the market option of RD 661/2007 are higher than under the Transitional Disposition 1ª.

Graph V.13. Varying payments to wind generation depending on the market price in 2010



Source: AEE



Molinos en Galicia
Josu Izarra

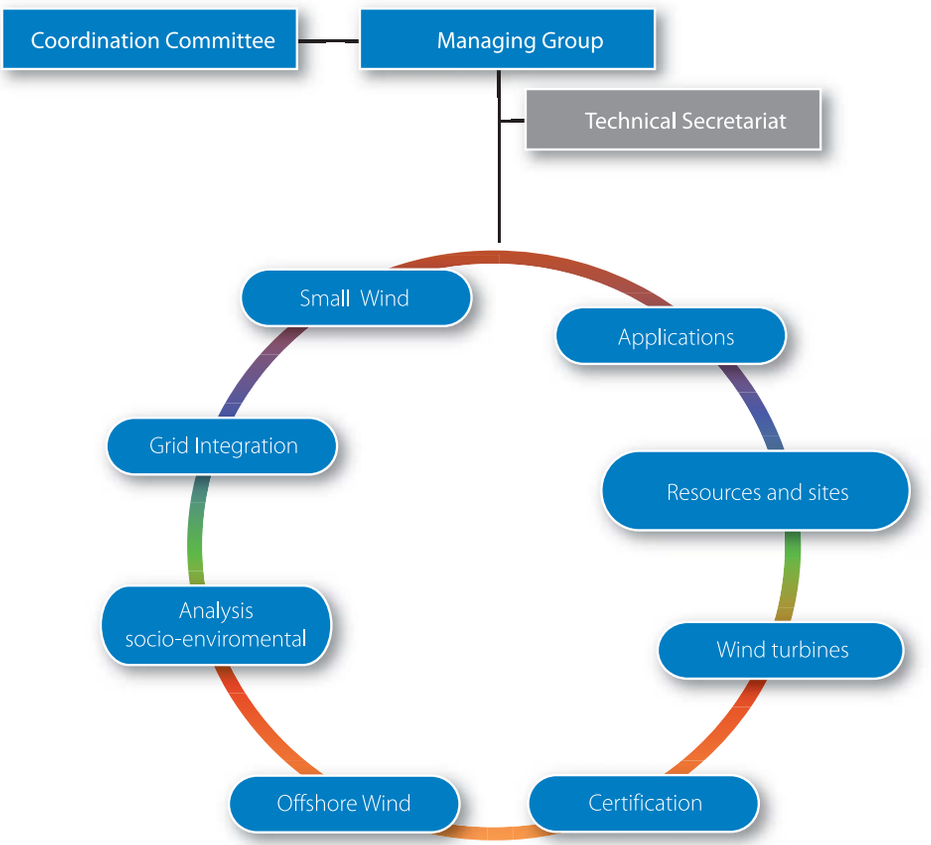
Chapter VI
A look to the future

VI.1 The technological platform REOLTEC

In 2005, and with the aim of coordinating research, development and innovation (R&D&I) activities, the Ministry of Education and Science backed the creation of the Wind Power Technological Platform (**REOLTEC**), made up of companies, laboratories, universities, research centres and other institutions related to wind power technology. The platform's Technical Secretariat is coordinated by the **Spanish Wind Energy Association** (Asociación Empresarial Eólica - AEE).

REOLTEC was born of the need to coordinate the many and varied fields of work in wind power R&D&I. That also means coordinating results' evaluation and defining new areas of joint R&D&I, as well as establishing consensus on priorities in order to attain sector objectives.

Diagram VI.01. Operational structure



Source: AEE

Helping it to carry out its functions, REOLTEC is supported both by a **Managing Body**, representing all the various sector companies (manufacturers, technology centres, developers and laboratories), and a network of Working Groups for different areas. The Technical Secretariat, as well as aiding the Working Group logistics, is also responsible for keeping up activity and injecting dynamism.

REOLTEC is also a **showcase for the Spanish wind industry's position among the global technological leaders.**

In 2009, the platform helped boost the presence of the Spanish sector on the global scene through a series of different international meetings, with delegates from Estonia, Korea, Finland and Sweden. Apart from creating contacts within the Spanish market, the purpose of those visits was also to disseminate certain products. It was also spurred by interest among the different countries' own sectors to get to know REOLTEC's work, in order to create similar structures (industrial clusters) of their own.

Through its activities, REOLTEC tries, above all, to acquire improved knowledge of the global sector and to promote the internationalization of Spanish companies. With that objective in mind, REOLTEC participated in designing a Spanish-Chinese R&D&I project financing programme, aimed at extending co-operation among companies from both countries and of opening markets for cutting edge Spanish subsectors.

In September 2009, REOLTEC activity received a boost thanks to a series of initiatives:

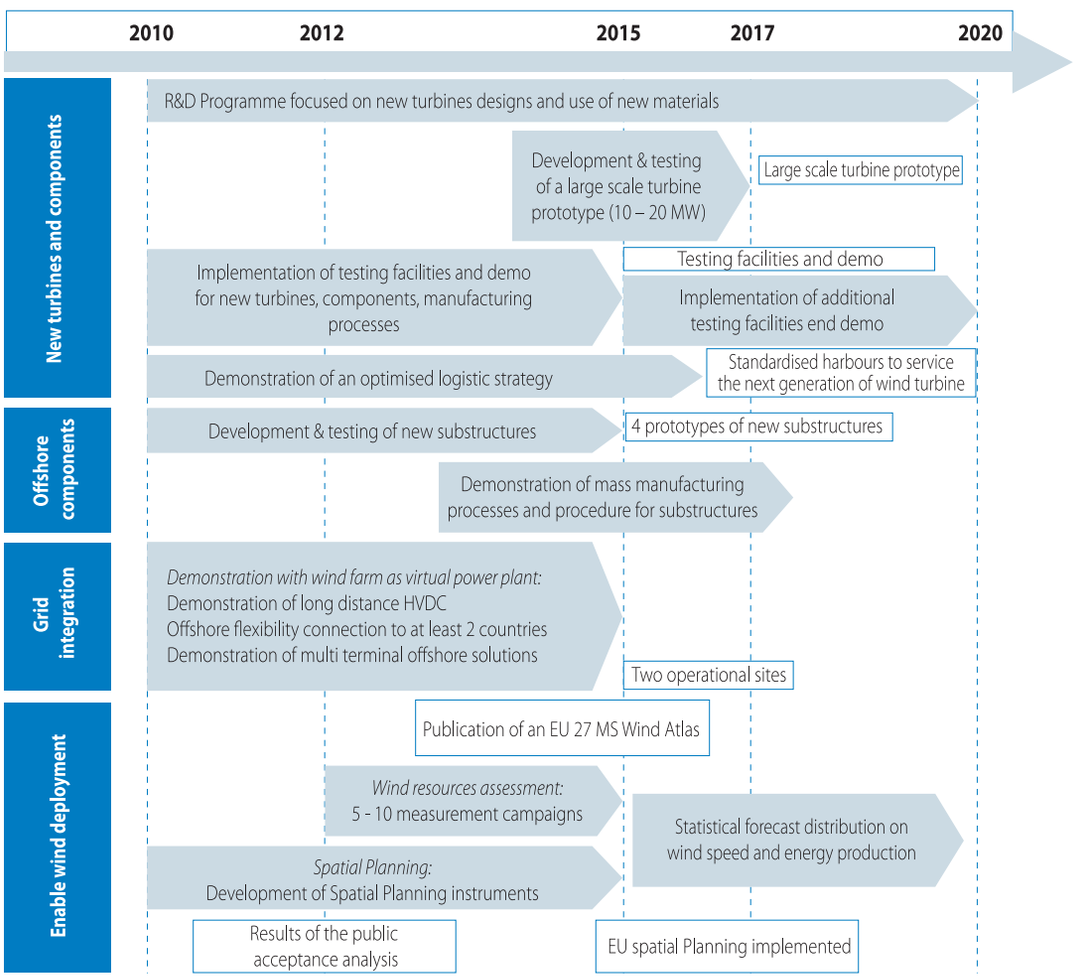
- A clearly increased openness towards Europe.
- Improved coordination with other platforms.
- The launch of a tool diagnosing the position of Spanish wind technology.

VI.1.1 Opening to Europe

In 2007, the European Commission drew up the base of a **SET Plan**, with the objective to accelerate the development of low carbon intensive technologies. The document calls for a "technological route map" defining the broad lines and specific objectives of R&D&I, together with tools indicating the efficacy of different technologies to 2020. Those route maps are being defined within the European Industrial Initiatives (EII), grouping the chief priorities of each sector.

There are six initiatives, of which the European Wind Initiative (EWI) has been the most active and with the best results achieved to date. EWI was presented before the Commission in March 2009. Like the other initiatives, it is fundamental to the wind industry, as it will condition the distribution of resources through the financing programmes, such as the Framework Programme.

Diagram VI.02. Wind technology roadmap 2010–2020



Source: AEE

The EWI and its route map involved a broad consultancy procedure in which the European wind sector platform TPWind has played a key role, mainly as it was based on **TPWind's** Strategic Agenda involving its also its active members.

In order to obtain the best possible returns, the European Commission has contacted with the member states to verify the adaptation of the route map to national priorities. In Spain, the regulator has been the **Centre for Industrial Technology Development** (CDTI in its Spanish acronym), which contacts with REOLTEC and with wind sector technology companies.

Meanwhile, REOLTEC's Technical Secretariat has tightened its relationship with the Technical Secretariat of TPWind, which actually joined the platform in 2010, specifically **to act as a proactive member** in the implementation planning phases 2010-2012 and to monitor the progress and results of activities.

VI.1.2 Increased coordination with other platforms

In the national setting, REOLTEC gave much importance during 2009 to **offshore** wind power, whose development in Spain has not yet begun, due to technical matters. The platform has fostered dialogue with all interested parties (developers, technological centres, etc) through a series of offshore Working Group meetings and through the creation of a round table dedicated to this topic in the IV REOLTEC General Assembly.

The platform is supporting demonstration projects for floating wind turbines, both in the Atlantic and the Mediterranean (see section VI.4), given the importance of offshore for the future of the wind power sector and which, in our country, is becoming very pressing.

At the same time, REOLTEC participated in 2009 in the creation of a **committee monitoring** other technological platforms, such as hydrogen, fusion, fission, Bioplat (biomass platform) and Geoplat (geothermal), CO_2, energy efficiency, etc. The creation of that committee was in response to a push from the Ministry of Science and Innovation (MICINN) for increasing interaction among different technological platforms, either vertically or horizontally, in order to promote the cooperation among different business sectors. In 2010, REOLTEC will continue organising meetings for the committee but, at the same time, will also seek synergies with other platforms. In this regard, REOLTEC has already made its first contacts with the Maritime Technological Platform and with the Material Technological Platform (MATERPLAT).

In the national setting, REOLTEC gave much importance during 2009 to offshore wind power

VI.1.3 The technological position of the wind sector en Spain

Another important part of REOLTEC activity in 2010 will be the making of an **action plan** aimed at strengthening the technological position of the Spanish wind sector. Against the backdrop of the growth of global markets and the appearance of numerous competitors to the Spanish industry, especially in Asia (China and India), REOLTEC proposes carrying out a study of Spain's R&D&I strategy, looking at organization, public-private financing and results management. The study will also have a comparative aspect, weighing up the Spanish industry against its competitors.

The study will be based on:

- An assessment of how closely company R&D&I activities match the real needs of the sector.
- An assessment of the relevancy of aid programmes for European, national and regional projects in terms of sector needs.
- A comparative study of the Spanish sector's R&D&I dynamism with respect to that of its competitors.

The results will be presented with both administration and companies in mind and will identify any weak points of the Spanish R&D&I system. They will also be accompanied by a series of **proposed solutions** aimed at improving the technological positioning of Spanish wind companies.

VI.2 Project REVE

After so many years of growth, starting in the mid-1990s, wind power has become a staple and valuable contributor to the Spanish electricity system. Indeed, as indicated in **Chapter II**, cumulative installed wind capacity reached **19,149 MW by end 2009**, covering 14.3% of electricity demand during that year.

Nevertheless, there is one major problem that looms increasingly large and which requires a solution: What to do when there is too much wind production in trough hours, when electricity demand is especially low? The matter is also influenced by regulation concerning conventional power technologies. For instance, nuclear, coal and combined cycle gas capacity must remain active for technical reasons, mainly in order to be able to respond quickly to drops in wind power production and to the needs of the system. (The combined minimum night-time capacity from those three conventional technologies is 12,000 MW).

There is also another aspect to take into account: demand during nighttime trough demand hours is largely inflexible due to the drop in industrial activity. **That means wind power**, which is in continual growth, **experiences repeatedly reduced margins year after year** during trough demand hours. That also means the risks of wind generation curtailment are constantly growing. And as there are not enough systems available (pump storage is limited), the only viable solution, at present, is to shut down the wind turbines. According to system operator REE's study on Special Regime penetration, 3-10% of wind production will face the risk of curtailment in 2014.

Against that problematic backdrop, one solution arises in the form of regulation allowing storage in batteries belonging to a fleet of **Electrical Vehicles (EV)**. That would enable management of a load curve, as the batteries can recharge during times of "excessive" wind power production.

Nevertheless, **AEE** defends the argument that the electric car only makes sense if it is **powered by renewables**. The strategic advantage resides in the fact that substituting petrol by electricity sourced to clean, indigenous sources, improves the economic and ecological balance of the transport system while boosting renewables.

Within that framework, the sector's technological experience together with market maturity, comprise sufficient credential for participating in the future development of the infrastructures needed for the deployment of electric vehicles.

VI.2.1 The REVE project: Regulating Wind Power with Electric Vehicles

With the aim of pushing those ideas forward, **AEE** launched in 2008 the 28-month **REVE Project,** running from December 2008 to May 2010, and which receives the active collaboration of the Reseach Centre for Energy Resources and Consumption (Centro de Investigación de Recursos y Consumos Energéticos - CIRCE), the National Renewable Energy Centre (Centro Nacional de Energías Renovables - CENER), utility Endesa and the Catalonian Institute of Energy Reseach (Institut de Recerca en Energia de Catalunya - IREC).

The work programme lined up over the two years will enable:

- An analysis of the current situation, including aspects such as wind power growth, load curve characteristics and the future development outlook given different contingencies.
- The monitoring of electric car R&D or commercial projects.

The electric car only makes sense if it is powered by renewables

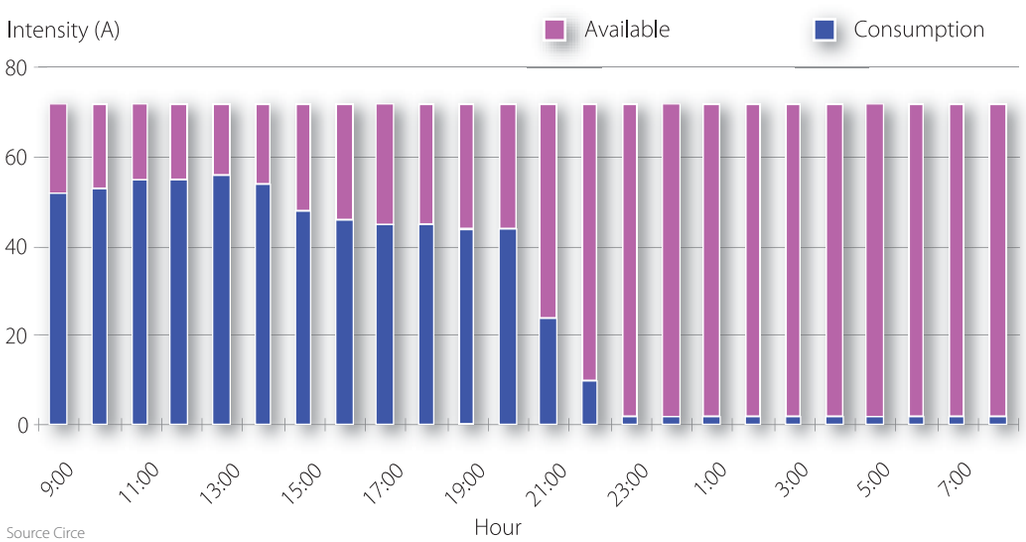
- Clarification of key electric vehicle and ion-lithium battery technology concepts (current technology, future development, logistics).
- A study of the electricity system, taking into account the different outlook scenarios for developing the project. In order to do that, installed capacity forecasts for wind and other Special Regime technologies are being taken into account, together with demand forecasts 2009-2020.
- An estimation of the future generation cost curve and of the impact on system emissions
- An analysis of the adaptation requirements of the existing electricity distribution network in order to connect electric vehicles.

The REVE project has already produced some results, including the analysis of existing infrastructure capacity in order to enable electric vehicle battery charging at the lowest cost possible. CIRCE, which participates in the project as mentioned earlier, studied two scenarios: the first in a center dedicated to work places and the second in a residential building block.

Work place

Work place, with 350 parking spaces occupied at 100% capacity during working hours
Two transformers, each at 1,250 kVA.

Graph VI.01. Transformer intensity consumed and available



Source Circe

Assuming that the vehicles connect when they are at 40% of nominal capacity and considering that consumption is similar in both transformers, the following times are calculated for recharging. The differences in intensities correspond to slow recharging (8, 10 y 15 A) and "extra-fast" charging (250 A).

The REVE project has already produced some results, including the analysis of existing infrastructure capacity

Table VI.01. Recharging time of batteries at 40% given different charging intensities

Vehicle load (constant intensity)	8 A	10 A	15 A	32 A	250 A
Recharging time (h) / VE	4.9	3.9	2.6	1.2	0.2

Source: Circe

Each of the time and intensity levels has a limited acceptable number of cars, which varies throughout the day depending on consumption.

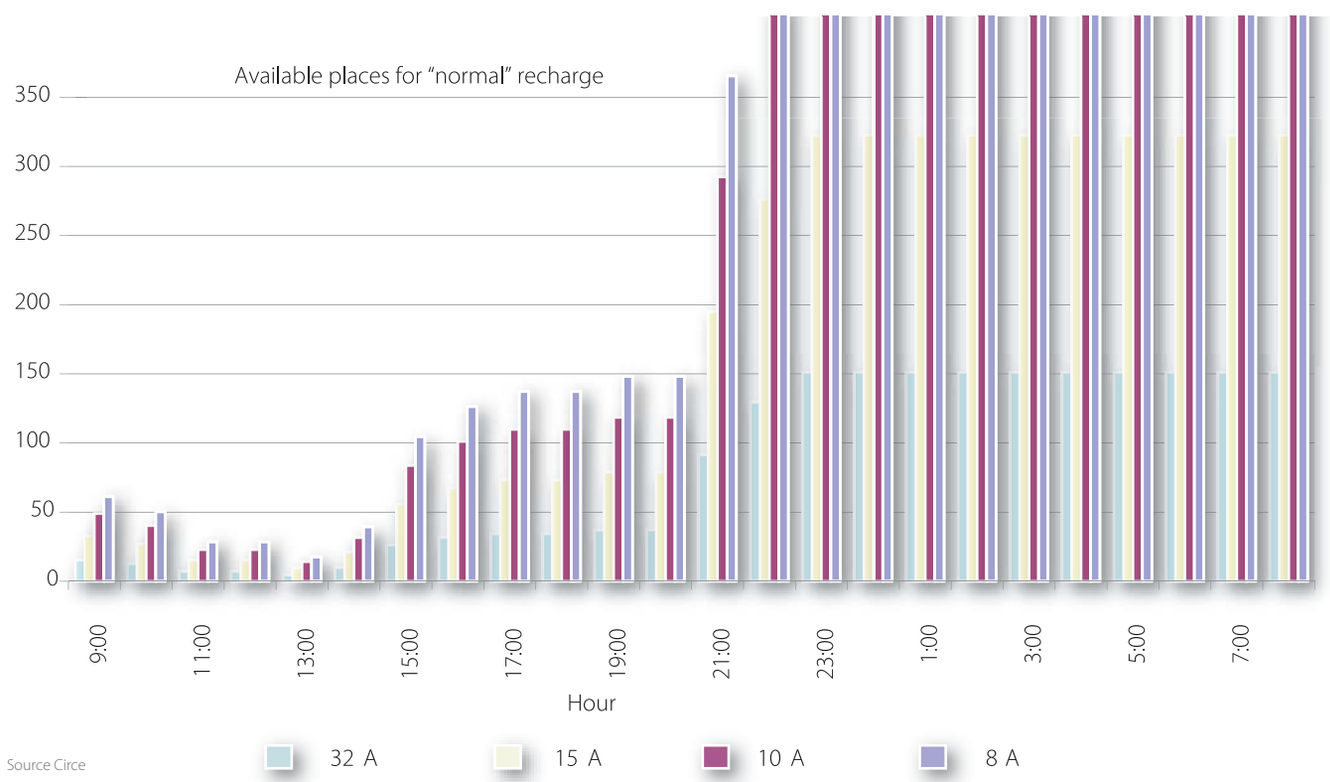
Graph VI.02. Available places using the two transformers of 1,250 kVA

Source: Circe

Graph VI.02. illustrates how, throughout the day, and at an intensity of 15 A, 100 recharging parking places would always be available, for slow charging.

If five places are reserved for "extra-fast" recharging (see **Graph VI.03.**), the availability of slow recharging points drops to less than 30 (for an intensity of 15 A).

Graph VI.03. Available places for "normal" recharge, with five "extra-fast" recharging points



Source Circe

To summarise:

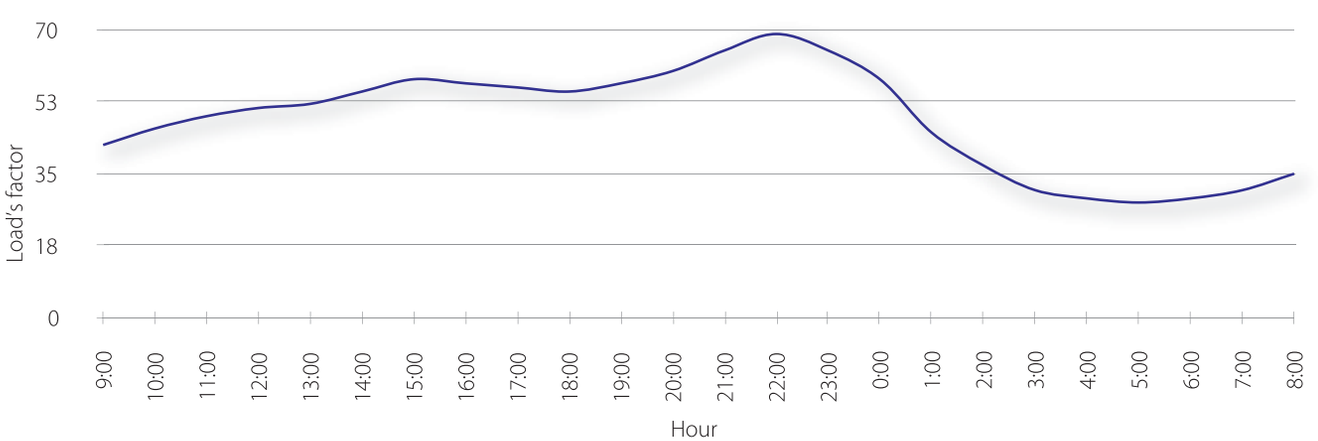
- Supposing a recharge intensity of 15 A, 30% of the parking spaces could be equipped with a plug socket. An employee arriving at 10.00h would be able to have the electric car fully recharged by 12.30. To increase that number, it would be necessary to reinforce the distribution network.
- An "extra-fast" recharging service for five spaces would require a 70% reduction in the total number of spaces with plug sockets.
- The "extra-fast" recharging service could be restricted to charging stations.

Residential blocks

A block of 40 homes with 60 parking spaces uses at nighttime for 6-8 hours.

Contract power: 5.5 kW and standard domestic consumption.

Graph VI.04. Demand curve of a typical building (% of usage against power contracted)



Source Circe

In this residential block, the above times are calculated for recharging at constant intensity. "Extra-fast" recharging is not considered, rather only low intensities in order to ensure slow recharging.

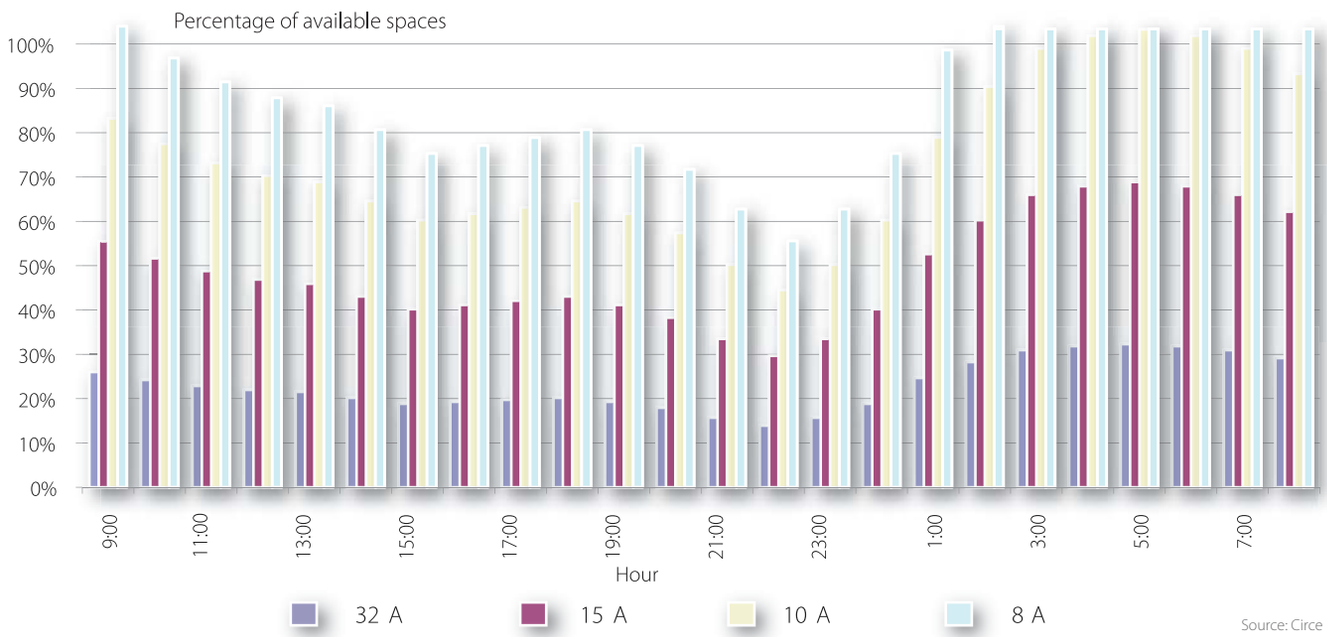
Table VI.02. Recharging times for batteries (total charge) given different recharge intensities

Vehicle load (constant intensity)	8 A	10 A	15 A	32 A
Recharging time (h) / VE	8.7	7	4.6	2.2

Source Circe

For these **recharging times** and intensities, available spaces are distributed throughout the day as shown in the following graph:

Graph VI.05. Percentage of available spaces



Source: Circe

- At 8 A, 100% of spaces are available for over 8 hours.

- A 10 A, 50% of spaces are available for the whole night and a good part of the morning.

In any case, it would be necessary to install plug sockets in garages. That would require a decision to be made on whether billing should be done via the building meters or via intelligent systems capable of identifying users. That latter option, based on the progressive development of **Information and Communication Technologies (ICTs)** could be implemented both in garages and at public recharge points as well as public car parks.

To summarise, existing infrastructure (with minimum changes) allow night time recharging for 100% of cars parked in living-block car parks, given that there are no structural restrictions for night time recharging of electric vehicles in the cases studied. Furthermore, the night time connection of electric cars does not imply important changes in electricity distribution infrastructure.

To conclude, the cases studied show that the electricity distribution network allows a **gradual introduction of electric cars.** Night time recharging, with connection in the residential block, seems to be the favoured option from the point of view of the grid given that it helps smooth the demand curve during night time demand, increasing overall system efficiency and reducing the risks of night time curtailment of wind power.

El nuevo bosque. María Jesús Reoyo.

The cases studied show that the electricity distribution network allows a gradual introduction of electric cars

Table VI.03. Energy density and power of the hyper condensers and ion lithium batteries

	Energy density (Wh/Kg)	Power density (W/Kg)
Ion Lithium Battery SAFT	149	664
Ultracondenser BOOSTCAP	5.52	5400
Hypercondensers (design phase)	341	>5400

Source Circe

VI.2.2 Technical challenges

The deployment of the electric car still depends on the solution to a series of technical problems:

- The capacity and security of batteries/ storage systems need improving in order to guarantee enough minimum autonomy. Currently, the solution best looked upon is ion-lithium batteries. However, expectations regarding hyper condensers and ultra condensers seem to promise a future storage revolution.

- Rechargers are the interface between the electricity distribution grid and the batteries. Their function is to integrate the received current and convert it in accordance with the parameters of the battery. As well as converting from alternate to direct current, the recharger also establishes the levels of voltage and intensity in order to comply with user demands regarding available power and recharging time.

The characteristics of the rechargers under study are:

- Recharge types: both for slow recharging (at constant voltage or intensity) and for Fast recharging (via pulse rechargers).

- Location in or outside the vehicle: the former option offers greater flexibility in electric car use, enabling recharging in different places, both public and private. The use of exterior rechargers means the user must go to specific recharge points with the same compatible system.

- The use of converters with regulators: interesting both from the grid's point of view (greater control over the regulating load) and from the user's (choice of time of recharge).

This study, at distribution level, will be complimented by another study with a broader focus aimed at analyzing the mainland energy system for electric vehicles. The study's point of departure assumes the number of electric vehicles on the roads will reach a total of 3,000,000 by 2020, as shown in the following table:

Table VI.04. Hypothesis for the REVE project on the changing number of electric cars on the road

Year	2012	2016	2020
Number of EV	400,000	1,000,000	3,000,000

Source: AEE

A hypothetical outlook was also established for installed capacity growth of the different technologies in the electricity mix, as shown in the following table:

Table VI.05. Forecast installed capacity for renewables and the rest of the Special Regime

Forecast installed capacity (MW)	2009	2012	2016	2020
Wind power	17,000	22,000	29,000	40,000
Offshore wind power	0	0	1,000	5,000
Hydro	16,700	17,600	19,600	21,400
Mini hydro	2,000	2,100	2,500	3,000
Photovoltaic	3,000	4,500	6,500	8,500
Thermoelectric	800	2,000	4,500	7,000
Cogeneration	7,100	7,400	8,000	8,500
Waste and biomass	1,500	3,100	3,700	4,200

Source: Cener

Using that base as a point of departure, CENER is carrying out a series of simulations of the electricity system for 2012, 2016 and 2020. The variables studied are:

- The influence of electric car consumption on the risks of wind plant curtailment and the identification of "threat" technologies.
- The generation costs associated with the new structure of demand coverage.
- The reduction in CO_2 emissions due to the increased use of renewables in general and wind in particular.

Towards end-2009, the REVE Project expanded its base by incorporating within the consortium IREC, which is developing the following activities:

- Demand Management using economic mechanisms.
  - Analysis of the different tools applicable.
  - Demand management using pricing (tariffs).
  - Demand management using "Demand Reduction Programs" (DRPS).
  - Demand management using service interruption.
  - Determining the elasticity of electricity consumption: increased effectiveness of price signals as a mechanism for demand management.
- Introducing demand management systems.
  - Analysis of a series of "use cases" proposed by the Electric Power Research Institute (EPRI) in the Smart Grid stadardisation group.
  - Definition of the most suitable demand management Systems and identification of technical requirements.

The conclusions of all work (finished or ongoing) will be disseminated together with the project's final results. For that dissemination stage, the REVE Project's web site, www.evwind.es, was created in 2009. The statistics (number of visitors) testifies to the quality and dynamism of the site, which has become a reference point in the fields of electric cars and renewable energies, both in Spanish and English.

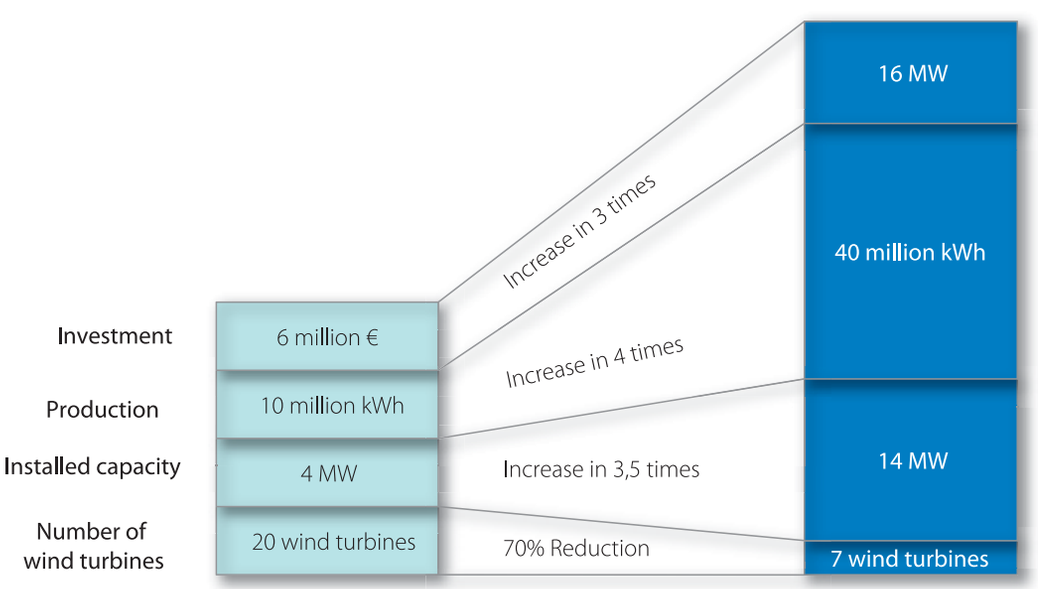
VI.3 Repowering

Repowering is the substitution of old wind turbines, whether stand-alone or in groups, for new ones. That process has many advantages:

- **More wind energy** is produced using the same land surface occupied. Also, on many occasions, the sites in question were selected during the early years of wind development and are therefore the ones with optimum conditions.
- **Fewer wind turbines** are needed to produce the same amount of power.
- **Efficiency is higher**, due to the characteristics of the more modern machines installed. That means cost of energy is lower.
- **The visual impact is reduced** as fewer turbine units are installed.
- **Grid integration** improves as turbines with greater capabilities for meeting grid code requirements are used. Currently, the best-known examples of repowering are in Germany and the Low Countries.

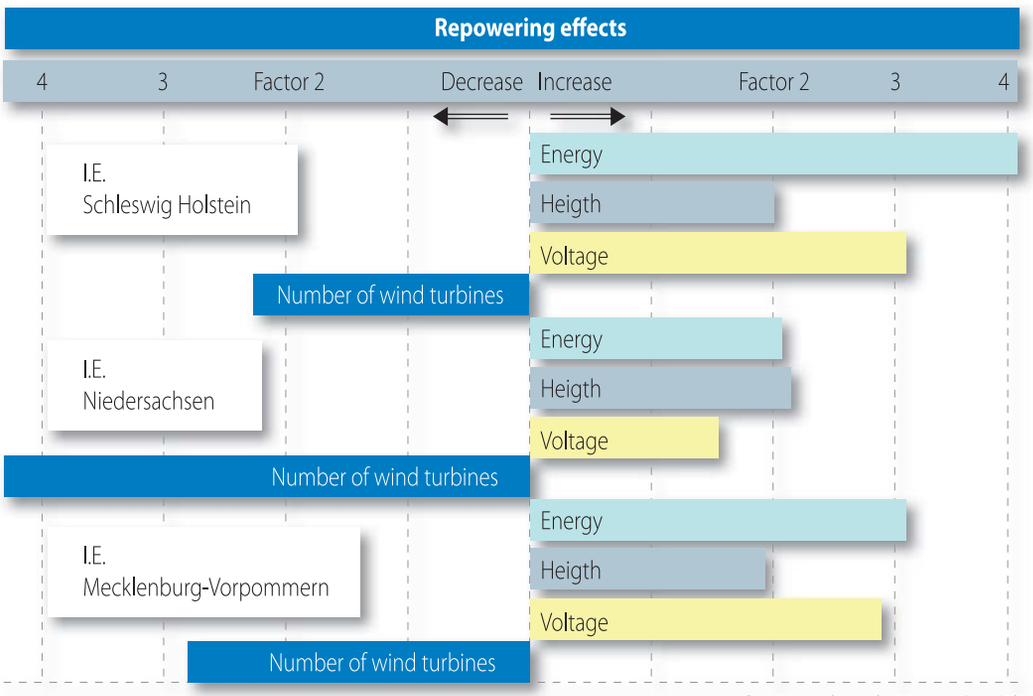
Nocturno. Salvadora Granado.

Diagram VI.03. Typical changes to a plant through a repowering project (Germany)



Source: www.leonardo-energy.org/español

Diagram VI.04. Broad view of the effects of repowering in different parts of Germany



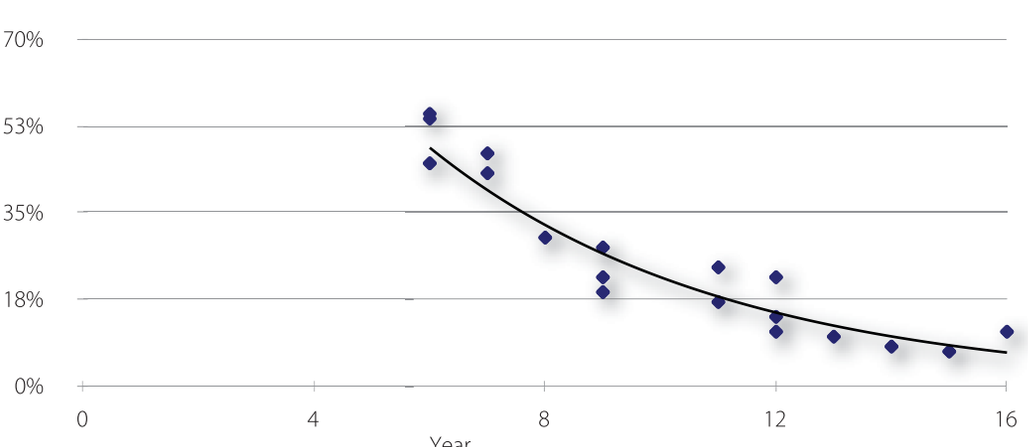
Source: www.leonardo-energy.org/español

The **diagrams VI.03.** and **VI.04.** illustrate how, through repowering, capacity can be tripled and energy production can be tripled or quadrupled with half the number of turbines, depending on conditions.

Repowering is a "natural" solution for wind plants with turbines approaching the end of their useful life. But repowering may also be considered for wind plants with turbines that have not yet reached 20-25 years of useful life. Thanks to the appearance of a **second hand wind turbine market**, previously inexistent, that alternative is beginning to make sense.

The second hand market is especially interesting for **developing countries**, where investment capacity is not strong enough to support the deployment of latest generation wind turbines. Furthermore, it would enable prospecting by Spanish developers in new markets with better controlled financial risk (reduced project lead times) and the adquisition of experience in socio-political spheres of the developing countries.

Graph VI.06. Used wind turbine prices depending on age



Source: www.leonardo-energy.org/español

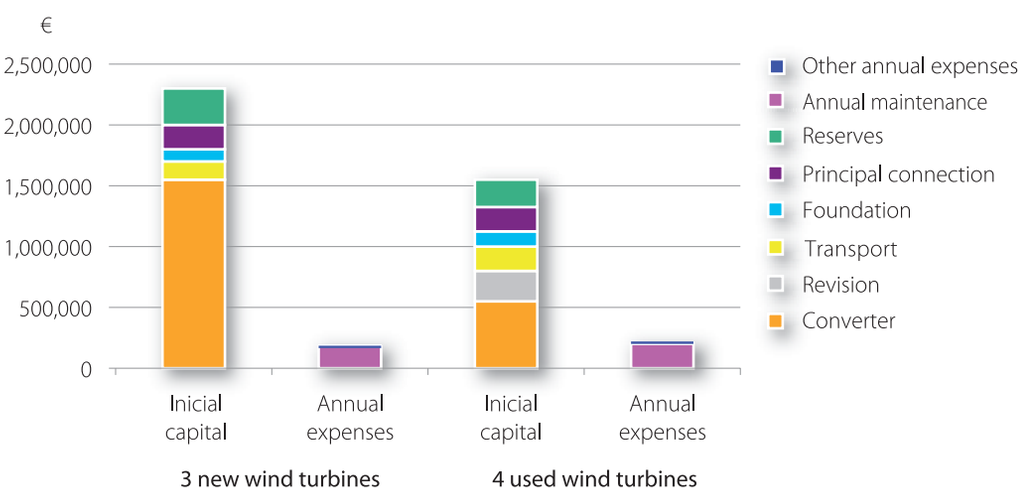
At a technical level, reusing wind turbines has the following advantages:

- The **dismantling** of the turbines facilitates an examination and overhaul of components.
- Turbines up to 600 kW may be **easily transported and installed**, without needing specialist trucks or cranes and basic road networks can be used.
- **Maintenance** of used turbines is **much easier** than in the case of latest generation machines due to the reduced amount of electronic components used and a greater simplicity in general.

Of course, a second hand market also carries with it certain disadvantage. For instance, the used turbines must be examined and a special effort must be carried out in order to select the **most suitable machines** in accordance with the characteristics of each project.

Another obstacle lies in the need to obtain new and spare parts for the future maintenance of the turbines.

Graph VI.07. Comparison of new and used turbine costs



Source: www.leonardo-energy.org/español

Spain has not yet experienced much repowering activity given that most of the early wind plants exceeded expectations in terms of performance longevity. Earlier expectations had foreseen the repowering projects taking place around five years ago. Even so, there have been some repowering projects, carried out in the province of **Cadiz** and in the **Canary Islands**, spurred by developers running out of sites with good wind resources elsewhere.

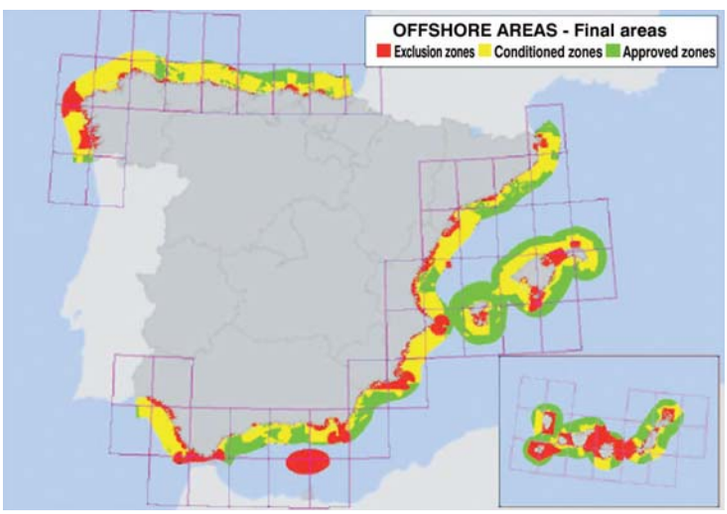
Jonathan Stanly.

VI.4 Offshore wind

Although there are no turbines installed off the Spanish coast to date, the **REOLTEC** platform has observed what **AEE** considers some important development in this field.

In May 2009, and two years over schedule, the Ministry for the Environment and the Ministry for Rural and Marine Areas, approved the **Strategic Environmental Study for the Spanish Coast**. That study determined the marine zones in the public domain suitable, in environmental terms, for the installation of offshore wind turbines. A list has been compiled classifying sites as apt for development, as holding the right environmental conditions and as exclusion zones.

Map VI.01. Zoning of the Spanish coast made by the industry ministry



Source: Mityc

For takeoff in Spain, offshore wind still needs to clear a series of technical and political barriers, which incluye the following:

- Adaptation of machines and parts to the marine environment.
- The incorporation of future feed-in lines within REE grid planning.
- Strong public opposition and local political leader reticence.

The existence of an extensive continental platform in the **North Sea** is enabling the deployment of offshore turbines using fixed concrete or steel structures. The wave of offshore wind plants started in **Germany** and **Denmark**. The year 2009 was marked by the opening of large zones in British waters to the installation of 9,000 MW of offshore capacity. Many Spanish companies are participating in those projects, acquiring valuable experience in aspects such as electrical interconnection offshore, turbine performance and maintenance and wind source measuring and prediction. A key scheme awarded a grant within the EU's Framework Programme 7 was the **Marina Platform Project,** led by **Acciona Energía**. The project aims at unifying the experience and knowhow gained in the North Sea and creating a base, which the Spanish offshore industry can access.

In parallel, the Spanish science and industry ministries are financing a series of R&D&I projects aimed at developing floating turbine structures for wind power installationsin deep waters, as is the Spanish case. Standing out among those projects are:

- **EOLIA, a CENIT project** started in 2007 and led by **Acciona Energía** with the aim of developing technologies enabling the

AEE considers it important to speed up the development of offshore wind power technology

installation of offshore wind plants in deep waters (over 40 m).

- EMERGE, a **Singular Strategic Project** approved in 2009 and led by **Iberdrola Renovables**. Its aim is to develop technical offshore turbine solutions for deep waters from electrical engineering to floating platforms. The project runs to 2012 and aims at the installation of an experimental offshore wind plant.

- **Ocean Lider**, another **CENIT** project, approved towards end-2009 and led by **Iberdrola Ingeniería y Construcción**. This project has a wider scope, as it aims at finding innovative solutions for all marine energy technologies, including wave and tidal power.

Some of Spain's autonomous regions are also supporting offshore wind power, backing different initiatives with the aim of creating demonstration and test areas.

- In **Cantabria,** the Component Technical Centre (Sodercan Group, a public holding) already has two floating measuring towers and is preparing two offshore test areas off the areas of Santoña and Ubiarco.

- In **Catalonia**, the Catalonian Institute of Energy Reseach (Institut de Recerca en Energia de Catalunya—IREC) is preparing two areas on the coast of Tarragona, one for fixed foundation offshore turbines and the other for floating turbines.

Some autonomous regions are also supporting offshore wind power

Antonio Hernández.

Offshore wind plant demonstration projects in Catalonia
Phase 1:
Depth: 35 m Distance from coast: 3.5 Km Number of wind turbines: 3-4 Installed capacity: 10-15 MW Wind turbine substructure: seabed anchored
Phase 2:
Depth: ≈100 m Distance from coast: ≈ 20 Km Number of wind turbines: 6-8 Installed capacity: 50 MW Wind turbine substructure: floating

Offshore wind plant demonstration projects in Cantabria
Santoña area Surface area: 0.24 km^2 Depth: 48-55 m Availabe capacity: 2 MW Components: Submerged transformer / marine cable / land based station / grid connection / experimental centre for wave energy / environmental observation system / Wave, tidal, etc Ubiarco area Surface area: 4,800 Hect Average depth: 150 m Components: Various marine connections / marine cables / onland substation / grid connection / observation system / wave energy systems / fixed or floating offshore turbines

Como ejército en orden de batalla. Juan Angel Brage.

Eolo
Juan Ramón Martín

Chapter VII
AEE, objectives and action

Meeting point

Since it was founded, the Spanish Wind Energy Association (AEE) has conducted three main tasks: defending sector interests before the various public administrations, providing a meeting point for member companies through Working Groups and, lastly, raising awareness of developments in the sector by acting as intermediary between members and the media. Among the many activities this involves, AEE coordinates numerous Working Groups, organises events, takes part in trade fairs, congresses and conferences, works with the media to disseminate news about the sector, prepares reports and studies, responds to external enquiries, and updates its website "www.aeeolica.org" on a daily basis. A summary of the different activities performed by the Association during 2009 is provided in this chapter.

Without doubt, the Working Groups (WG) enable issues that are of most concern to the sector to be brought into the spotlight and analysed in depth, such as the Occupational Risk Prevention WG, which is an area of shared interest among all companies in the industry. The Human Resources WG was established on March 24, 2009, while the Environment WG met seven times last year. These meetings focused on two issues in particular: the Study of the impact of the wind energy industry on birdlife and bats and the preparation of a map of sensitive areas. The work of the Repowering WG is covered in Chapter VI of this annual report, while that of the Grid Integration WG is described in Chapter IV.

The Spanish Institute for Foreign Trade (ICEX) and AEE have been implementing an annual coordinated action plan for several years, which includes attending international trade fairs, visiting certain countries to identify new markets and showcase Spanish companies, and inviting delegations from other countries to introduce them to the sector in Spain.

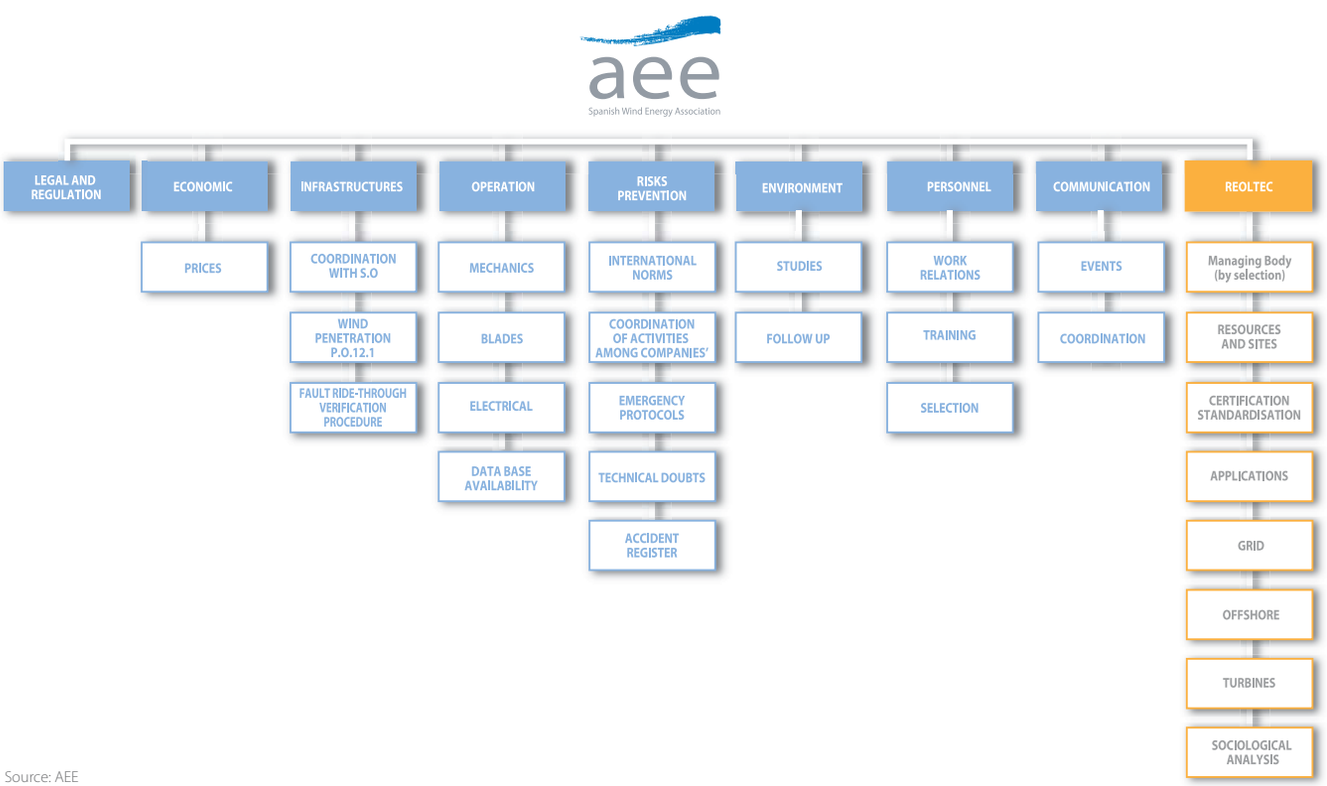
During the year, **AEE** also organised the **Techwindgrid workshops** on grid integration held in April, the **Wind Convention** in June, the **Wind PowerExpo technical conferences** in September, and the **Wind Sector Occupational Risk Assessment Workshop** in October. Senior executives from the Association also attended various conferences and round tables.

The final pages of this chapter cover the public relations work carried out by the Association. In 2009, **AEE** published its Wind Power 09 Annual Report covering events in the sector during 2008, and the **Macroeconomic Study of the Impact of the Wind Power Sector in Spain**, compiling data from the previous year. The **Spanish Wind Energy Association** also issued numerous press releases which were published by the general press, as well as economic and energy media. **AEE**'s website, **www.aeeolica.org**, was, of course, also updated constantly.

VII.1 Working Groups

One of the main duties of the **Spanish Wind Energy Association** is to bring together and coordinate the different facets of the wind energy sector through **Working Groups**, which cover issues that are of concern especially to companies and serve to share know how and experience to identify solutions to the problems raised. Joint proposals are also prepared by these Working Groups.

Diagram VII.01. Structure of Working Groups



Source: AEE

VII.1.1 Occupational Risk Prevention Working Group

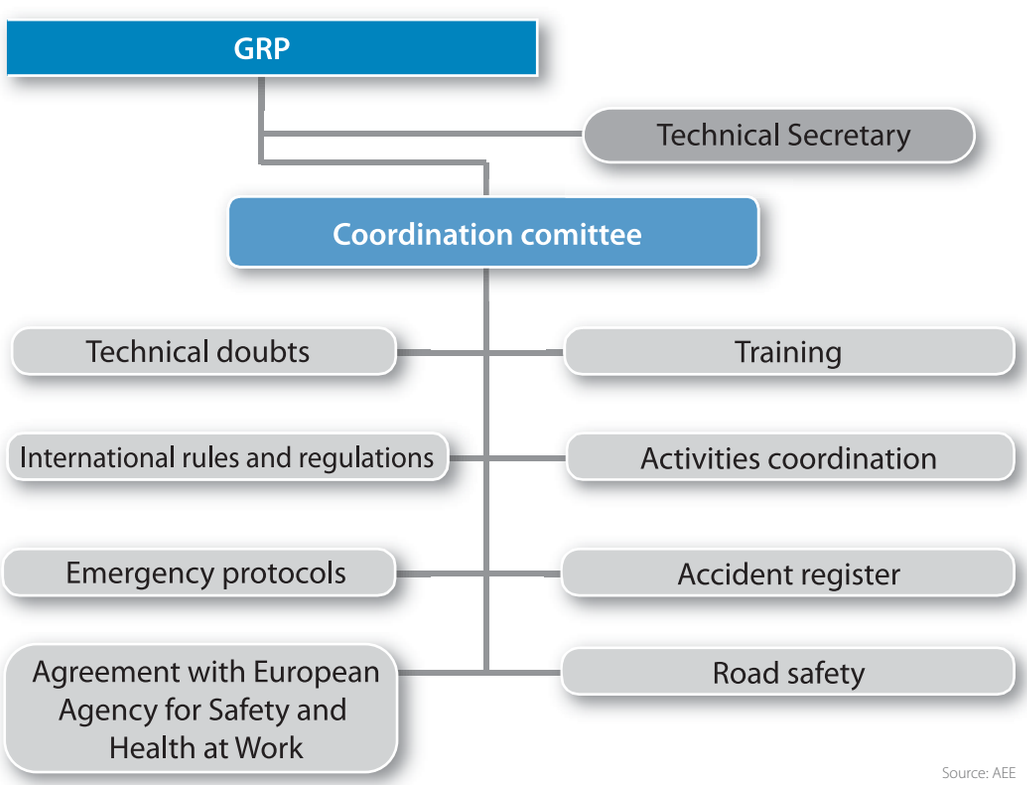
The wind power sector has taken a special interest in **occupational risk prevention** both during the construction and operation of wind plants. It should be noted that risk prevention is a common concern of all companies in the sector. Collaborate, share, resolve, participate—those are all actions companies must take to rapidly and effectively guarantee the health and safety of workers and to ensure they effectively comply with occupational risk prevention legislation.

The work of **AEE**'s Occupational Risk Prevention Working Group (ORPWG) is therefore of utmost importance. The ORPWG Coordination Committee held five ordinary meetings during 2009.

A la sombra del viento.

It should be noted that risk prevention is a common concern of all companies

Diagram VII.02. Structure of Occupational Risk Prevention Working Group



Source: AEE

VII.1.1.1 Working Subgroups

Some of the activities of the different Working Subgroups are set out below:

A) Occupational Risk Prevention Training for the wind energy sector

This Subgroup plays an important role in **building a culture** of risk prevention in the working environment, thereby avoiding unsafe practices which have a negative impact on business and, above all, on occupational accident rates. The activities performed by this Subgroup include:

- Preparing the general content of the "Welcome to the Wind Energy Industry" training course.
- Drawing up requirements for training bodies.
- Implementing the Management Training Programme.
- Formulating questions sent to the Working Subgroup and associated replies.

B) International Occupational Risk Prevention Legislation

Companies are required to comply with a series of occupational risk prevention obligations set out in legislation in the countries in which they operate. In 2009, the Subgroup analysed the requirements of Law 45/1999 of November 29 on the relocation of workers to perform transnational services.

C) Coordination of Business Activities

This Subgroup is responsible for disseminating the procedure for coordinating business activities performed to construct and operate wind plants.

D) Contingency Plans

Business owners must analyse possible emergency situations and adopt the necessary measures to ensure first aid is provided, fire tackling measures and equipment is in place, and workers evacuated as stipulated in Articles 20 and 21 of Law 31/1995. In 2009, the Subgroup therefore:

- Drew up the first draft on a Contingency Plan for wind plants.
- Prepared the content of a training course on safety and guidelines on the steps to be taken during an incident on a wind plant.
- Prepared a document summarising the experience of coordinating action with the emergency services in the La Rioja self-governing region.

E) Technical Consultancy Team

This Subgroup has developed a database on AEE's website which operates as follows:

- Interested parties place an enquiry through the website.
- The question is passed on to the group of experts responsible for analysing the issue.
- The group agrees on a reply.
- The reply is included in the database once it has been given to the inquirer.

F) Accident Rate Register

The Subgroup has built a **database that will include all the most significant incidents in the sector**. Confidentiality agreements are currently being signed by companies in the sector so that they will supply information.

Once it is operational, reports and statistics on occupational accidents will be released to provide information on the most common incidents and the corrective measures required to mitigate such risks.

Jake Abbot.

The Subgroup has built a database that will include all the most significant incidents in the sector

VII.1.1.2 Other activities of AEE's ORPWG

The WG has held meetings with public entities such as the European Agency for Safety and Health at Work, the European Road Safety Charter, and the Spanish Institute for the Verification of Machinery (Instituto Nacional de Verificación de Maquinaria).

The following describes some of the work performed by the WG:

A) AEE's involvement in the European Risk Assessment Campaign

During 2009, AEE and EWEA entered into a collaborative agreement with the European Agency for Safety and Health at Work to participate in the 2008-2009 Risk Assessment Campaign, which involved holding the following events:

- Technical conference on "Risk assessment during the wind turbine design and manufacture phase", in Bilbao.

This event targeted manufacturers and was aimed at identifying dangers, assessing potential risks, and developing mechanisms that should be adapted and incorporated into wind turbine designs to reduce risks to an acceptable minimum.

- In conjunction with the Navarre Employment Service and the Navarre Business Confederation, AEE organised a workshop on risk assessment in the wind energy sector; a preventive event that covered the methodologies and procedures for assessing risks in wind plant assembly and maintenance companies. The workshop was held in Pamplona and was attended by over a hundred participants.

- In September, a meeting was held with those in charge of risk prevention in the head offices of the trade union UGT in Madrid to discuss worker involvement in risk assessment.

B) AEE support for the European Road Safety Charter

In February 2009, AEE signed the European Road Safety Charter, assuming the commitment to encourage, provide information on and raise awareness of road safety best practices among its members. Member companies also received advice each month on driving best practices by email and through a webpage on AEE website focusing on road safety, providing all documents related with road safety prepared by the ORPWG.

C) Organisation of First International Seminar on Risk Prevention in the Wind Energy Sector

During the first quarter of 2009, the programme was drawn up for the International Seminar on Risk Prevention in the Wind Energy Sector, which was held in Barcelona on May 11 and 12, 2010 and focused on the wind power industry.

VII.1.2 Human Resources Working Group

The Spanish Wind Energy Association's Human Resources Working Group (WG) held its first meeting on March 24, 2009. During

AEE signed the European Road Safety Charter, committing itself to encouraging road safety and best practices among its members by providing information and raising awareness

In October, a Risk Assessment in the Wind Energy Sector workshop was held in Pamplona.

the event, members were informed of the proposal put forward by the trade union Comisiones Obreras to develop a collective labour agreement to which all companies in the sector could adhere.

Members were also notified that the Association had received proposals from training centres requesting that **AEE** sponsor or certify several courses.

After evaluating these issues, it was decided that two committees would be formed; one **looking at training** and another **covering labour relations**:

- The Training Committee met twice. During the second meeting, **AEE** proposed preparing a proposal for a training course to be given by the Association, which could then be disseminated among the rest of the Human Resources WG. The consultancy firm **Ginko** highlighted existing training needs, especially for maintenance technicians. On October 7, the Labour Relations Committee of the Human Resources Working Group met to analyse the proposal for a collective labour agreement presented to the Association by Comisiones Obreras. This issue is currently being evaluated along with UGT.

Eolo en el Sabinar. Conchi Sánchez.

During the first meeting, a proposal from the trade union Comisiones Obreras to draw up a collective labour agreement for all companies in the sector was presented

At the start of 2009, Ginko launched the **Job Bank** on the Association's website (managed by Ginko and **AEE**), which currently has over a 1,000 candidates.

VII.1.3 Environment Working Group

During 2009, this Working Group (WG) met seven times to discuss various matters, the most noteworthy of which were: the completion of a *Study of the impact of the wind energy industry on birdlife and bats* and the preparation of a map of sensitive areas. Among several nominees, the consultancy firm **Liquen** was appointed to perform the Study of the impact of the wind energy industry on birdlife and bats, which will be completed during 2010. The various meetings served to agree on the WG's proposals and analyse progress made on the study.

It was agreed that the final purpose of the map of sensitive areas must be to analyse the wind power industry's impact on the environmental and associated sensitive variables, and that it should be for private use only, i.e. just for members. Four bids were received to prepare the map and it was voted that **Basoinsa** would be appointed as first choice and **ESRI/AlborGIS** as second option. It was subsequently discussed whether the two consultancy firms could work together on developing the GIS, which was finally agreed at the end of December. ESRI is responsible for providing technical assistance and designing the application, while Basoinsa will compile and normalise the data to be included in the Geodatabase. Thus, Basoinsa will collate the data to be transferred to ESRI, which will input the data into the application.

It is also important to mention the WG's interest in offshore wind, an issue that was discussed in several of the Group's meetings and could lead to the establishment of a specific Offshore Wind Working Group.

After an initial analysis of the Strategic Environmental Assessment of the Spanish Coast for wind plants, it was concluded that the study is a good starting point, although it leaves a number of matters unresolved. Finally, during 2009 the WG met with the ecologist groups **WWF/Adena, SEO Birdlife and Greenpeace**, among others, to gain an insight into their opinions and concerns about renewable energies and try to resolve their doubts.

VII.1.4 Others

Each month, the **Spanish Wind Energy Association** prepares a long-term monthly forecast report on daily market prices, analysing electricity demand and monthly fluctuations in output from the different technologies (hydroelectric, nuclear, combined heat and power, carbon, oil fuel/gas, wind, and other renewable energies). It also includes an analysis of changes in the daily market managed by the Iberian energy market operator (**OMEL**), and assesses the remuneration of wind energy compared to the various options established by law.

Finally, these reports also include estimates of fluctuations in the variables affecting market price—such as monthly demand of the Spanish electricity system operator (**REE**), forecasts of wind energy and hydroelectric output, fuel prices, and the Euro-US dollar exchange rate—in order to make monthly forecasts on prices.

VII.2 ICEX-AEE 2009 agreement

Over the last decade, wind power has gradually made an increasing contribution to the energy mix in the electricity systems of several countries, with Spain figuring as one of the clear leaders thanks to it being one of the first countries to strongly support this source of energy and the extent to which its wind industry has developed. Spanish companies are therefore world leaders in this sector, with an increasingly firm commitment to **international expansion**.

Against this backdrop, a number of years ago the Spanish Institute of Foreign Trade (ICEX) and the **Spanish Wind Energy Association (AEE)** began a successful collaboration, involving the following:

- ICEX renders its services to Spanish companies, providing them with support and help to expand their international presence. Thus, this institute's activities include:

  * Designing and rolling out programmes to boost trade in foreign markets.

  * Preparing and disseminating information on Spanish products and international markets.

  * Promoting investment, industrial development and business cooperation in foreign markets.

- Meanwhile, **AEE**, which is the leading association in the Spanish wind industry as it represents most of the sector's economic players—manufacturers, developers, regional wind energy associations, etc—contributes to the development of wind power and the consolidation of the growth of associated business activities both in Spain and abroad. Each year **ICEX** and **AEE** implement a coordinated action plan to strengthen Spain's industrial presence internationally by:

- Attending international wind energy trade fairs

- Visiting certain countries to raise awareness of our industry, analyse and obtain informa-

Over the past decade, wind power has gradually made an increasing contribution to the energy mix in the electricity systems of several countries

From left to right: Edison Lobão, Brazilian Energy Minister; Jose Maria Barreda, President of the Castile La Mancha Regional Government; and Jose Donoso, AEE Chairman.

tion on the status of wind markets in the countries visited, and foster commercial relations.

- Inviting institutions and arranging business seminars to raise awareness of the Spanish wind energy sector.

- Coordinating and disseminating information on the Spanish regulatory framework and its impact on the development of the wind energy sector through seminars in target markets.

In conjunction with the **Energy Supply Chain Association in Guipuzcoa**, both entities rolled out the action for 2009, which included an outbound trade mission to Brazil in November, which was similar to the inbound trade mission to Spain by a delegation from the Brazilian government in April 2009; joint participation in the **EWEC**, the technical conference in Helsinki, and visits by Turkish and Columbian representatives to Spain.

The Brazilian delegation was given the opportunity to find out about the wind energy development model in Spain, which is considered to be a reference worldwide

VII.2.1 Inbound trade mission of the Brazilian delegation to Spain

One of the most outstanding events during last year was undoubtedly the visit to Spain on April 1, 2 and 3 by a delegation from the Brazilian Government led by the Minister of Mines and Energy, **Edison Lobão**. The outcome of the event, which was sponsored by a group of **AEE** members (EDP Renováveis, Endesa, Iberdrola, Vestas, Grupo Fortuny and Guascor Wind) was described as "satisfactory" by the **Spanish Wind Energy Association**.

Lobão was accompanied on his visit to Spain by Government representatives and senators (responsible for energy in several states) and entrepreneurs from Brazil. They were given the opportunity to find out about the wind energy development model in Spain, which is considered to be a reference worldwide. The Brazilian minister's trip was a response to an invitation by the Minister of Industry, Tourism and Trade, **Miguel Sebastián**. **AEE** in collaboration with its Brazilian counterpart, **ABEEólica**, and supported by ICEX, was charged with drawing up an intense agenda for the three days. The visit started with a trip to Spain's National Renewable Energy Centre (CENER) in Pamplona. On the same day, April 1, **AEE** hosted a dinner which was attended by a hundred representatives from energy sector institutions, entities and companies.

On the second day, following a conference on "Investment opportunities in the Brazilian energy sector" given by Lobão to around 200 representatives from energy institutions and companies, the Brazilian delegation visited the Lower House of the Spanish Parliament, had lunch at Endesa's headquarters, and in the afternoon visited Red Eléctrica's Control Centre in Alcobendas, where they were met by REE's Operations Director, **Miguel Duvison**. Day 2 ended with a dinner hosted by Vestas, which was attended by the Brazilian delegation and representatives from the Spanish energy sector.

The final day started with a working session in Toledo on *regional development linked with wind energy, which was* co-hosted with the **Department of Industry, Energy and the Environment of Castile La Mancha.** The session covered all the socio-economic implications of investing in renewables, especially wind power. After the session, the delegation visited Iberdrola's Renewable

Energy Operations Centre (CORE), which has become a technological example for other companies to follow. The Brazilian minister was accompanied during his stay in Toledo by Iberdrola Renovables' CEO, **Xabier Viteri.**

VII.2.2 Spanish visits to Brazil

Subsequent to the visit by the Brazilian delegation, **AEE** and the **Energy Supply Chain Association** organised two visits to Brazil: one as part of the **ICEX-AEE** Sectorial Plan (in collaboration with REEP, GWEC and ABEEólica) and another outside the auspices of this plan. The first trip took place between November 16 and 19, during which delegates visited the plants of several companies in **Sao Paulo** and **Arrecife.**

The Spanish delegation included several **AEE** representatives: Toquero Renovables, Eurosat Renovables and Grupo Guascor.

The technical conference on "A support framework for wind energy development in Brazil" was held on16 November, which was attended by representatives of the Brazilian government who provided information on legislative changes aimed at promoting wind energy in Brazil. Representatives of the Spanish and Brazilian wind energy associations and **GWEC** also participated in the seminar, sharing their experience of developing this energy source worldwide, and specifically of the regional economic development in Spain.

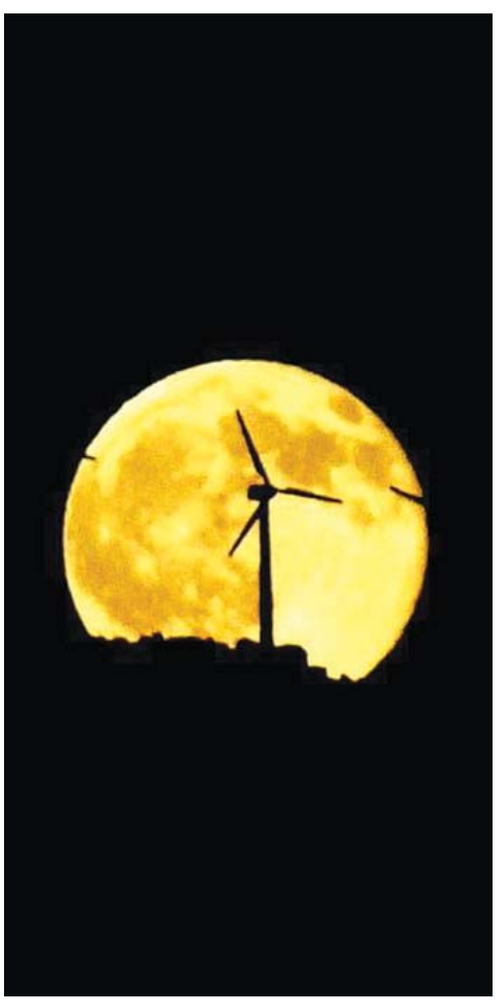
In order to boost Spain's presence in Brazil, the day ended with a discussion about bilateral cooperative investment agreements for Spanish companies and ICEX's support mechanisms.

The 17, 18 and 19 involved visits to several installations of companies related to the wind energy industry in Brazil.

On the side lines of the collaborative agreement with ICEX, at the end of June, AEE visited Brazil to participate in the National Wind Energy Forum in Natal.

This event was attended by **AEE**'s Secretary General, **Ramón Fiestas**, at the invitation of the Secretary of State for Energy of Rio Grande do Norte. The forum also included the Wind Energy Summit during which the "Dos Ventos Letter" was signed, establishing a commitment to develop public policies and targets for wind power output. This commitment received the support of officials including the Brazilian Environment Minister, **Carlos Mino**; and the Governess of the state of Rio Grande do Norte, **Wilma de Faria**; as well as the Vice President of Navarre, **Javier Caballero Martínez**.

During the event, CENER signed an agreement to develop renewable energies in Brazil.



Eolo y la luna. Antonio Benítez.

On the side lines of the collaborative agreement with ICEX, at the end of June, AEE visited Brazil to participate in the National Wind Energy Forum in Natal

VII.2.3 Joint participation in the EWEC 2009 trade fair

The **Spanish Wind Energy Association** also attended **EWEC 2009**, the European Wind Energy Trade Fair organised each year by the **European Wind Energy Association (EWEA)** and held last year in Marseille (France).

AEE manned a stand housing various Spanish companies to show Spanish leadership in the world wind industry. The following Spanish companies also had their own and shared stands at the trade fair: **Energy To Quality, Ereda, Inneo Torres, Kintech Engineering, MTorres, Normawind, Wind to Power System, Aeroblade, Gamesa, Barlovento Recursos Naturales, Meteosim Truewind, Ingeteam and Isastur.**

EWEC 2009 was attended by more than 6,000 participants from over 80 countries.

Verdeazul. Elisa Granado.

During the conference, Spain was represented by 25 speakers who partook in more than 50 sessions. Specifically, **AEE** was involved in a conference entitled "Wind energy and electricity prices", chaired by the Association's Technical Director, **Alberto Ceña**.

VII.2.4 Inbound trade mission by Turkey and Columbia during Wind PowerExpo 2009

This inbound trade mission, comprising nine delegates – eight from Turkey and one from Columbia – was held during the **Wind PowerExpo** trade fair in Saragossa from 22 to 24 September.

The aim of the Turkish delegation was to exchange experiences and ideas between the two countries (Columbia and Turkey), which had signed a renewable energy sector cooperation agreement in Istanbul on 5 April 2009, leading to them being invited to attend the technical conferences hosted by the **Spanish Wind Energy Association** on September 22 and 23.

During a seminar on the Turkish wind energy sector on September 24, the Turkish representatives informed Spanish companies about business opportunities in their country and about the possibilities of holding bilateral business meetings.

VII.2.5 Spanish visit to Helsinki

On September 16, the Minister of Industry, Tourism and Trade, **Miguel Sebastián**, made an official visit to Helsinki.

A business event was held during his stay focusing on the development of wind power and waste treatment.

The event was attended by **AEE**'s Chairman, **José Donoso**, who spoke about the evolution of the sector in Spain and the success of wind energy in our country.

VII.3 Events 2009

During 2009, **AEE** organised some of the most important events in the sector, a description of which is provided on the following pages:

VII.3.1 Grid integration, the star of Techwindgrid 09

Techwindgrid 09 was held in Madrid on April 20 and 21. This event comprised several conferences organised by the **Spanish Wind Energy Association** on grid integrations, which were attended by around 30 professionals.

Over the two days, the conferences tackled the impact wind energy generation has on certain system services such as voltage control and regulation services; the importance of control centres for safety integrating the greatest possible amount of wind energy; the use of storage and new prediction systems as a tool for better managing the electricity system; and the grid integration of offshore wind power.

It should be emphasised that in recent years, Spain has become a world reference with respect to the grid integration of wind power, thanks to the combined effort of the different sector players that has resulted in the design of a unique verification procedure. This procedure will enable almost all the installed wind energy generation capacity to respond to voltage dips, thereby complying with the standards established by the System Operator to guarantee grid security.

The following topics were covered during the nine sessions comprising the seminars:

- Grid stability; solutions for wind plants.
- Voltage control.
- New concepts in turbine and advanced control.
- Wind prediction and operation of the electricity system.
- The development of energy storage systems to regulate wind power.
- Verification, validation and certification models.
- Regulation, harmonisation of grid codes.
- Fluid integration.
- Electric vehicles.

VII.3.2 2009 Wind Energy Convention

On June 8 and 9, **AEE** organised in Madrid its major annual event, the **2009 Wind Energy Convention**: two days of conferences covering the most pertinent issues in the sector. A few days before the Convention, Global Wind Day was held in 30 countries around the world.

Attracting an international presence, the **"Corporate Forum"** area of the event served as a meeting point for all professionals from the sector.

The event culminated with **AEE** giving out its three annual awards during the traditional **Sector Dinner** for an outstanding service to wind power development, journalism and photography.

José Donoso, **AEE** Chairman; **Pedro Luis Marín Uribe**, Secretary of State for Energy; and **Luis Atienza**, Chairman of Red Eléctrica de España were given the task of opening the 2009 Wind Energy Convention. While Uribe stated that "the Government will work to maintain and strengthen the leadership of the Spanish wind energy sector", Luis Atienza agreed with the Chairman of **AEE** that wind power is an example of success and that the electricity system operator is proud of the part played by the grid integration of renewables, stressing that mutual collaboration is needed to identify synergies.

AEE organised its Wind Energy Convention 2009 Madrid on June, 8-9.

Subsequent to the official opening, several round tables were held, up to a total of eight, covering the following issues:

I) Current challenges of wind power

This round table covered the challenges faced by the System Operator, Market Operator and companies themselves, such as the technological, regulatory and economic-financial challenges. It was also stressed that Spain is very well positioned to lead in the development of a sustainable energy model.

II) New organisational charts for financing wind power development

During this session it was noted among other issues that maintaining a **stable legal/regulatory organisational chart over time**, which clearly sets out the "rules of play" for all parties involved, will facilitate the development of appropriate financing mechanisms and access thereto by developers. Changes in financing since before the financial crisis, during the financial crisis, and due to the enactment of Royal Decree 6/2009 were also examined.

III) Creation of an industrial structure in light of foreign competition

This round table was used to underline the interest in **growing and continuing to curb greenhouse gas emissions**. The last presentation showed that renewables are a viable energy alternative and reflected the confidence in renewable energies making a greater contribution to the energy mix.

IV) Sustainable job creation and new professional profiles

It was shown that the renewable energy sector generated 80,001 direct jobs in 2007, which is expected to rise to around **228,435** in 2020. Other issues related with employment were also covered such as the most sought-after profiles, the areas of demand, and common requirements.

This round table closed the conference on 8 June and was followed by the Sector Dinner in the Wellington Hotel in Madrid.

V) The European Renewable Energy Directive and the "Obama effect"

The fifth round table was attended by **Alfonso Gonzaléz** from the Ministry of Industry; **Bruce Douglas** from EWEA; and one of the most popular invitees to the event, **Juan Verde**, **Barack Obama**'s energy and environment advisor. Verde reminded those present that Spanish companies are the top companies with wind power assets in the US and specified that "the Obama effect" is more than just a local business opportunity, since it sends out a message to the whole world about the feasibility of investing in a sustainable alternative energy economy.

VI) Political parties and the Renewable Energy Law

Participants in this round table agreed that this law is "somewhat unknown and uncertain, because a specific text has not yet been drawn up and presented as a draft bill before the Spanish Congress".

It was stressed that environmental

policies "must be the cornerstone of future growth" and that the Law must "guarantee legal certainty, and technical and economic sustainability, and promote R&D&I".

VII) Key points of the new Renewable Energy Plan: objectives and legal framework

It was explained during this round table that the development of renewables in Spain is of significant strategic importance, as they must be one of the main energy **sources of the future**. It was specifically highlighted that wind power will play a key role in this development and several interesting planning tools were presented such as support systems and other measures to promote the roll-out of wind energy.

VIII) World manufacturing market growth

All those involved in this round table concurred that 2009 and most likely 2010 would be complicated years, and agreed on the difficulties Spain faces in maintaining the figures achieved in the period 2004-2008.

Although several countries were mentioned, three key markets still stand out as the preferred choice of companies: **the US**, **China** and, logically, **Europe**.

VII.3.3 Wind PowerExpo

Shortly after the summer, the wind energy sector met once more in Saragossa from September 22 to 24 at the **Wind PowerExpo** trade fair. The **Spanish Wind Energy Association** participated in this event for yet another year by organising the **technical conferences** among other activities.

During the event, the seminars were attended by several speakers from a number of countries, which reflects the objective of strengthening the international nature of **Wind PowerExpo** and making it the leading wind power trade fair in southern Europe.

The development of renewables in Spain is of significant strategic importance, as they must be one of the main energy sources of the future

Various issues relating to the industry were tackled including **wind plant assembly** – including transport and logistics – and the **running thereof**, with a special focus on **operation** and **maintenance**.

Other matters debated were the growth patterns of the **wind turbine market**, future plans, **R&D&I,** repowering of existing wind plants, and **offshore wind**.

I) The importance of an adequate assessment of wind resources

This theme was covered in the first two round tables of the seminars. In the first, attendees looked at key factors in resource assessment, i.e. measurement equipment and methodologies for examining wind resources, as well as wind measurements and data analysis.

The second round table concentrated on diagnosing and analysing the efficiency of wind plants. The importance of ensuring an optimum energy balance between available energy at a site and electricity generation both during development and operational phases was also underlined.

AEE participated in Wind PowerExpo by organising the technical conferences on both wind plant development and operation.

II) Wind plant operation and maintenance

The operation and maintenance of wind plants was the star topic of the subsequent four round tables, with the first covering "Global Management". The following sub-sections were blade maintenance and replacement, mechanical components and generators, and control systems and electrical components.

III) Repowering

This session covered some of the reasons behind repowering, such as technical and economic factors, the more efficient use of sites, social efficiency, or a reduced environmental impact.

As available sites become saturated, the only alternative to growing and maintaining the wind power industry in Europe is increasingly repowering.

IV) New trends and research and development: cost cutting and improvements in the availability of wind plants

The sixth round table kicked off with a discussion about the role of small wind, a technology that has entered the market in order to competitively make use of wind resources. The main challenges and risks of offshore wind plants were also identified.

The penultimate round table concentrated on the importance of technology in the future development of wind energy. It was stressed that electricity storage technologies still need to be developed by scientists, technologists and industry.

The conferences closed with a final round table on "Structural technological developments".

Finally, it should be mentioned that AEE and Feria de Zaragoza hosted during PowerExpo a space called Search for Jobs in the Wind Industry, which was designed to act as a point to meet and share *employment opportunities* and information on the professional profiles required by all those involved in the sector.

VII.3.4 Occupational risk assessment in the wind sector

A conference on *Occupational Risk Assessment in the wind sector* was held in Pamplona on October 13 covering topics such as risk assessment in wind turbine assembly plants, during transportation, during the assembly phase, during maintenance, during operation, and during dismantling.

This conference formed part of the activities that the Spanish Wind Energy Association and the European Wind Energy Association (EWEA) conduct as members of the Occupational Risk Assessment Campaign carried out by the European Agency for Safety and Health at Work.

This time, leading professionals from the sector met in Pamplona. The conference involved an opening speech and several round tables held after the opening ceremony. Attendees included: José Donoso, AEE Chairman; Imelda Lorea, Director General for Work and Risk Prevention from the Navarre Regional Government; and José Manuel Ayesa, Chairman of the Navarre Business Confederation. The following issues were covered during the round tables:

I) Risk assessment in wind turbine assembly plants

II) Risk assessment during wind plant assembly

III) Risk assessment during the operation of wind plants

Manuel Borrego.

Topics covered included risk assessment in wind turbine assembly plants, during transportation, during the assembly phase, during maintenance, during operation, and during dismantling

VII.4 AEE publications

For yet another year, the **Spanish Wind Energy Association** published its *"Wind Power 09"* annual report. A yearly publication providing all the relevant information on the wind power sector and collating statistics on installed capacity, output, and remuneration of wind energy around the world. It also provides analysis on changes in regulatory frameworks, advances in grid integration, and the outlook for R&D and offshore wind energy.

In November 2009, **AEE** presented a 2008 update of the **Macroeconomic Study of the Impact of the Wind Power Sector in Spain.** This report accurately and exhaustively provides the most pertinent economic data on wind energy development in our country such as the direct and indirect contribution made to GDP in 2008. The **overall contribution amounted to €3,803 MILLION, 0.39% of GDP,** compared to €3,270 MILLION, 0.35% of GDP, in 2007.

VII.4.1 AEE makes its voice heard

One of the main roles of the **Spanish Wind Energy Association** is to inform the media about the most relevant events in the sector.

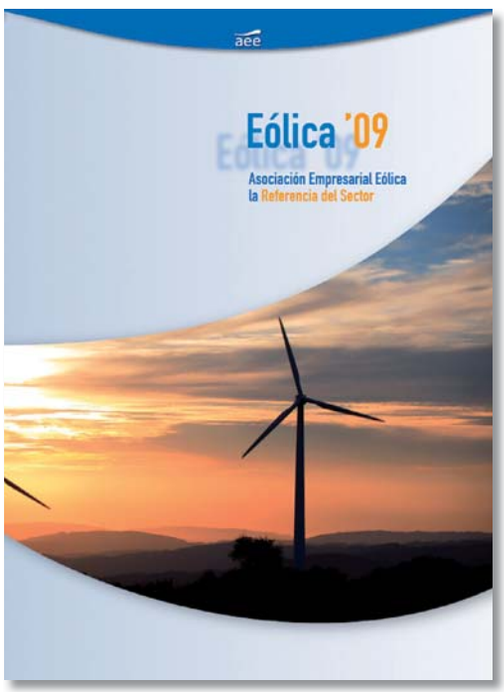
AEE therefore regularly issues press releases that are subsequently reflected in different publications.

During 2009, the Association published more than 20 press releases, raising public awareness through the media of certain events in the sector.

As would be expected, one of the main issues covered was the publication of **Royal Decree Law 6/2009**, which was of special concern to the Association due to the establishment of the Pre-allocation Register.

In-depth coverage was also provided on the milestones achieved by the wind power industry and on the main sector players (Wind Energy Convention, Wind PowerExpo, etc.).

Other issues covered included the update of the macroeconomic study, the visit made by an influential Brazilian delegation, and the growth of the wind power industry worldwide.



Cover of the 2009 Annual Wind Power Report.

Cover of the Macroeconomic Study of the Impact of the Wind Power Sector in Spain.

VII.5 External projection

www.aeeolica.org, the Spanish Wind Energy Association's website provides a wide and varied selection of information on wind energy in Spain and its industry. Basic data on this energy is provided in the different sections of the website, along with details of the activities performed by AEE to raise awareness of the benefits of wind power in the energy mix.

The website, comprising four main sections (The Association, Wind Power Observatory, Events and Press Room), also include new sub-sections containing more information and offering a better service. The Wind Power Observatory section for example includes *the Truth about green jobs* tab containing a selection of responses to the publication entitled "A study of the Effects of Public Aid to Renewable Energy Sources" which concluded that renewables destroy jobs.

Nonetheless, the wind map continues to remain a key feature of the Wind Power Observatory, showing the location of each wind plant in Spain, and providing details about the respective developer, the municipality in which the wind plant is located, the wind plant's capacity, the model, number and characteristics of the wind turbines, the node to which the wind plant is connected, etc. This section also includes graphs and tables of statistics of installed capacity and wind generation in our country broken down by region, developer and manufacturer.

www.aeeolica.org

Finally, this section provides information on **wind power around the world**, links to daily predictions and monitoring of wind energy output, and wind resource maps.

The **Association** section provides information on the different areas in which **AEE** operates, on the Working Groups, on the events it organises or participates in, and on the **REOLTEC** Technological Platform of the wind energy sector. The **Job Bank section,** jointly manager by the human resources consultancy firma **Ginko** is designed to help search for jobs in the Spanish wind industry. Meanwhile, **AEE Publishes** section gives access to all the Association's publications, including the latest annual reports, or the updated **Macroeconomic Study of the Impact of the Wind Power Sector in Spain**.

The **Events** section can be used to view the programmes of events **AEE** organised annually that directly focus on current affairs in the wind energy sector. It also provides a calendar including all the **events** organised by the Association and those in which it participated. The content of this section is rounded off with a database including the most noteworthy events in the sector.

The **Press Room** includes all the press releases issued by **AEE**, responses to these press releases in the leading media, and a summary of the most recent news on the wind power sector. The opinions of sector experts are also offered under the "Opinion" tab.

This section also provides a selection of photos of wind plants, the Association's activities, and photos taken by the finalists of the Eolo Competition.

New features on the website include the ***Wind news search*** facility, a powerful tool to search for articles on the sector that have appeared in the leading Spanish media, as well as a scrolling window providing the most noteworthy news over the last few days.

Finally, **AEE** members also have access to a **restricted area** of the website where they can obtain information on the Association's various Working Groups, up-to-date institutional documentation, minutes and reports related with board meetings and general meetings, and a summary of the daily press and **AEE Informa** weekly newsletter.

Tres molinos al amanecer
Pedro Salaverría

Chapter VIII
AEE, members and structure

VIII.1 Member list according to activity

Associations

AEPA (The Asturias Wind Energy Association)

APECYL (The Castile and León Association of Wind Power Developers)

APREAN (The Andalusian Association of Renewable Energy Developers and Operators)

APRECAM (The Castile-La Mancha Association of Wind Power Developers)

Component manufacturers

3M ESPAÑA, S.A.

AEROBLADE, S.A.

AREVA T&D IBÉRICA, S.A.

AVANTI WIND SYSTEMS, S.L.

BASF ESPAÑOLA, S.L.

BOSCH REXROTH, S.L.

C.C JENSEN IBÉRICA, S.L.

CONSOLIS HORMIFUSTE, S.A.

DANOBAT GROUP S. COOP.

DIMECO TÉCNICAS INDUSTRIALES, S.L.

ELEVADORES GOIAN, S.L.

ELTRONIC, A/S

FLUITECNIK, S.A.

GLUAL HIDRÁULICA, S.L.

GREEN POWER TECHNOLOGIES, S.L.

GRUPO ORFEO RENOVABLES, S.L.

GUDGEDA, S.L.

INGETEAM, S.A.

INNEO TORRES, S.L.

JIMÉNEZ BELINCHÓN, S.A.

KINTECH INGENIERÍA, S.L.

LM WINDPOWER, S.A.

MANUFACTURAS ELÉCTRICAS, S.A.

MATZ-ERREKA S. COOP.

MORGANITE ESPAÑOLA, S.A.

PECOL 2 COMPONENTES INDUSTRIAIS, LDA.

RKB EUROPE, S.A.

RÖCHLING PLÁSTICOS TÉCNICOS

ROXTEC SISTEMAS PASAMUROS, S.L.

SANTOS MAQUINARIA ELÉCTRICA, S.L.

SKF ESPAÑOLA, S.A.

TALLERES LANDALUCE, S.A.

TECNOTRANS BONFIGLIOLI, S.A.

TRACTEL IBÉRICA, S.A.

WIND TO POWER SYSTEM, S.L.

ZIGOR CORPORACIÓN

Wind turbine manufacturers

ALSTOM WIND, S.L.

ENERCON GMBH Sucursal en España

EÓLICA DEL ZENETE, S.L. (EOZEN)

GAMESA EÓLICA

GE WIND ENERGY, S.L.

MTORRES OLVEGA INDUSTRIAL, S.A.

NORDEX ENERGY IBÉRICA, S.A.

REPOWER ESPAÑA, S.R.L.

SIEMENS, S.A.

SUZLON WIND ENERGY ESPAÑA, S.L.U.

TECNOARANDA, S.L.

THE SWITCH

VESTAS EÓLICA, S.A.U.

Other entities

CENTRO NACIONAL DE ENERGÍAS RENOVABLES (CENER)

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

SOCIEDAD PARA EL DESARROLLO REGIONAL DE CANTABRIA, S.A. (SODERCAN)

Developers / operators

ABO WIND ESPAÑA, S.A.

ACCIONA GREEN ENERGY, S.L.

AGRUPACIÓ ENERGÍAS RENOVABLES, S.A.U. (AERSA)

ALARDE SOCIEDAD DE ENERGÍA, S.A.

ALDESA ENERGÍAS RENOVABLES, S.A.

ANEMOI RENOVABLES, S.L.

ASTURWIND, S.L.

BANCSABADELL INVERSIÓ I DESENVOLUPAMENT, S.A.

BEAS DE INGENIERÍA, S.L.

CALIDAD ENERGÉTICA, S.A.

CAPITAL ENERGY, S.A.

COPCISA ELÉCTRICA, S.L.U.

DURO FELGUERA, S.A.

EDP RENOVÁVEIS

ENDESA COGENERACIÓN Y RENOVABLES, S.A.

ENEL UNIÓN FENOSA RENOVABLES, S.A.

ENERFÍN SOCIEDAD DE ENERGÍA, S.A.

ENERGÍA Y RECURSOS AMBIENTALES, S.A. (EYRA)

ENERGÍAS RENOVABLES MEDITERRÁNEAS, S.A. (RENOMAR)

ENERGYO RENEWABLE ENERGY, S.A.

ENFINITY SPAIN, S.L.

EOLIA RENOVABLES DE INVERSIONES, SCR, S.A.

EÓLICA DE NAVARRA, S.L.

EÓLICA DEL CIERZO, S.L.

EÓLICA DEL MONTALT, S.L.

EÓLICA DEL SURESTE, S.L.

EÓLICA VALLE DE PERALEDA

E.ON RENOVABLES, S.L.U.

ESBI FACILITY MANAGEMENT ESPAÑA, S.L.

EVELOP SPAIN, S.L.

FERSA ENERGÍAS RENOVABLES, S.A.

FORTUNY ENERGÍA, S.L.

GAMESA ENERGÍA

GECAL, S.A.

GENERA AVANTE, S.L.

GESTAMP EÓLICA, S.L.

GRUPO VI ENERGÍAS RENOVABLES, S.L.U.

GUASCOR WIND, S.L.

IBERDROLA RENOVABLES, S.A.U.

IBEREÓLICA, S.L.

ISOLUX CORSAN CONCESIONES, S.A.

ÍTACA WIND POWER, S.A.

JORGE, S.L.

MAGTEL ENERGÍAS RENOVABLES, S.L.

MONTAÑESA DE RECURSOS ENERGÉTICOS, S.L.

NORVENTO, S.L.

OLIVENTO, S.L.

ORISOL CORPORACIÓN ENERGÉTICA, S.A.

PALENCIA DE ENERGÍA EÓLICA, A.I.E.

PRENEAL, S.A.

RENOVALIA ENERGY, S.A.

RENOVIS ENERGÍAS, S.L.

RP GLOBAL, S.L.

SAN MARTÍN, S.A.

SHELL WINDENERGY, B.V.

SOCIEDAD EÓLICA DE ANDALUCÍA, S.A.

SOTAVENTO GALICIA, S.A.

TAIM WESER

WPD DEVELOPMENT RENOVABLES, S.L.

Services

360 CORPORATE FINANCE, S.A.

AGOSAN, S.L.

ALATEC, S.A.

ALEASOFT (ALEA BUSINESS SOFTWARE, S.L.)

ASCOT INSURANCE SERVICES ESPAÑA

AVANCOS TECHNICAL SERVICES, S.L.

BARLOVENTO RECURSOS NATURALES, S.L.

BERGÉ LOGÍSTICA ENERGÉTICA

BESEL, S.A.

BRUZON & MILLER CORREDURÍA DE SEGUROS Y REASEGUROS, S.A.

CAIXA D´ESTALVIS DE CATALUNYA

CAPITAL SAFETY GROUP

CENTROS PARA LA FORMACIÓN Y LA PREVENCIÓN. CENFORPRE, S.L.

CÉNTRICA ENERGÍA, S.L.U.

CH2MHILL ESPAÑA, S.L.

COMERCIALIZADORA DE SERVICIOS ANTI FUEGO, S.A. (CDAF)

CONTROL Y MONTAJES INDUSTRIALES CYMI, S.A.

DAUNERT MÁQUINAS - HERRAMIENTAS, S.A.

DEWI GMBH

DIAGNÓSTIQA CONSULTORÍA TÉCNICA, S.L.

DIALEC COMUNICACIÓ PER LA SOSTENIBILITAT SCP

EDUINTER, S.A.

EFACEC SISTEMAS DE ESPAÑA, S.L.

ELDU, S.A.

ELECTRIA, S.A.

ELECTRIZITATS-GESELLSCHAFT, S.L.

ELECTRO RAYMA, S.L.

ELSPEC ENGINEERING LTD

ENERGY TO QUALITY, S.L.

EÓLICA INGENIA, S.L.U.

EREDA, S.L.

EUROTHERM – INVENSYS

EXACT SOFTWARE, S.L.

FERIA DE ZARAGOZA

FUNDACIÓN CIRCE – CENTRO DE INVESTIGACIÓN DE RECURSOS Y CONSUMOS ENERGÉTICOS

GALOL, S.A.

GAMESYSTEM ESPAÑA

GARRAD HASSAN ESPAÑA, S.L.U.

GARRIGUES MEDIO AMBIENTE, S.L.

GINKO (ADERLEX IBERIA, S.L.)

GLOBAL ENERGY SERVICES SIEMSA, S.A.

GNERA ENERGÍA Y TECNOLOGÍA, S.L.

GREEN ALLIANCE SGECR, S.A.

IBERDROLA INGENIERÍA Y CONSTRUCCIÓN, S.A.U.

INDOORWIND, S.L.

INDRA SISTEMAS, S.A.

INFOPOWER (T & F INFORMANEWS IBERIA, S.A.)

INGENIERÍA DE COMPUESTOS, S.L.

INTEGRAL MANAGEMENT FUTURE RENEWABLES, S.L.

INTORD, S.A.

ISASTUR, S.A.

ISOTROL, S.A.

LA CAIXA, S.A.

LASO ABNORMAL LOADS

LEADERNET SISTEMAS TELECOMUNICACIONES, S.L.

MAECO EÓLICA, S.L.

MARSH, S.A.

MASTER DISTANCIA, S.A.

METEOLÓGICA, S.A.

METEOSIM TRUEWIND, S.L.

METSO MILL SERVICE, S.L.

MLS, S.L.

MOTUSA (MONTAJES Y TUBERÍAS, S.A.)

MS ENERTECH, S.L.

NIKASH SPAIN, S.L.

NORMAWIND, S.L.

OPERACIÓN Y MANTENIMIENTO ENERGY, S.A.

OPEX ENERGY OPERACIÓN Y MANTENIMIENTO, S.L.

ORMAZABAL (WIDEWALL INVESTMENT, S.L.U.)

RONÁUTICA

SAVINO DEL BENE, S.L.

SENERGY ECONNECT LTD

SERVICIOS RENOVABLES DE NAVARRA, S.L.

SG DOCUMENTA, S.L.

SGS TECNOS, S.A.

SSB SERVICIOS EÓLICOS IBERIA, S.L.

TALLERES AZPEITIA, S.L.

TESICNOR, S.L.

TINDAI PREVENCIÓN Y SEGURIDAD, S.L.L.

TRANSPORTES LASARTE, S.A.

TÜV RHEINLAND IBÉRICA INSPECTION, CERTIFICATION & TESTING, S.A.

URKUNDE, S.A.

VERTICAL MULTISERVICIOS

WIND COMPOSITE SERVICE GROUP EUROPE, S.L.

WIND TO MARKET, S.A.

WINDAR RENOVABLES, S.L.

WINDBROKERS ESPAÑA, S.L.

WINDTEST IBÉRICA, S.L.

YNFINITI ENGINEERING SERVICES, S.L.

ZF ESPAÑA, S.A.U.

aee

Spanish Wind Energy Association

VIII.2 Board of Directors

Permanent Committee

President

D. José Donoso Alonso	GAMESA ENERGÍA, S.A.

Vice-presidents

Dª. Concepción Cánovas Del Castillo	ENDESA COGENERACIÓN Y RENOVABLES, S.A. (ECYR)
D. Jorge Corrales Llavona	EDP RENOVÁVEIS, S.L.
D. Santiago Gómez Ramos	ACCIONA EÓLICA CESA, S. L.
D. Rafael González Sánchez	ENEL UNIÓN FENOSA RENOVABLES, S.A.
Dª. Ángeles Santamaría	IBERDROLA RENOVABLES, S.A.
D. Lennart Fagerberg	EON RENOVABLES IBERIA, S.L.U.
D. Miguel Picardo Troyano	VESTAS, S.A.U.

Members

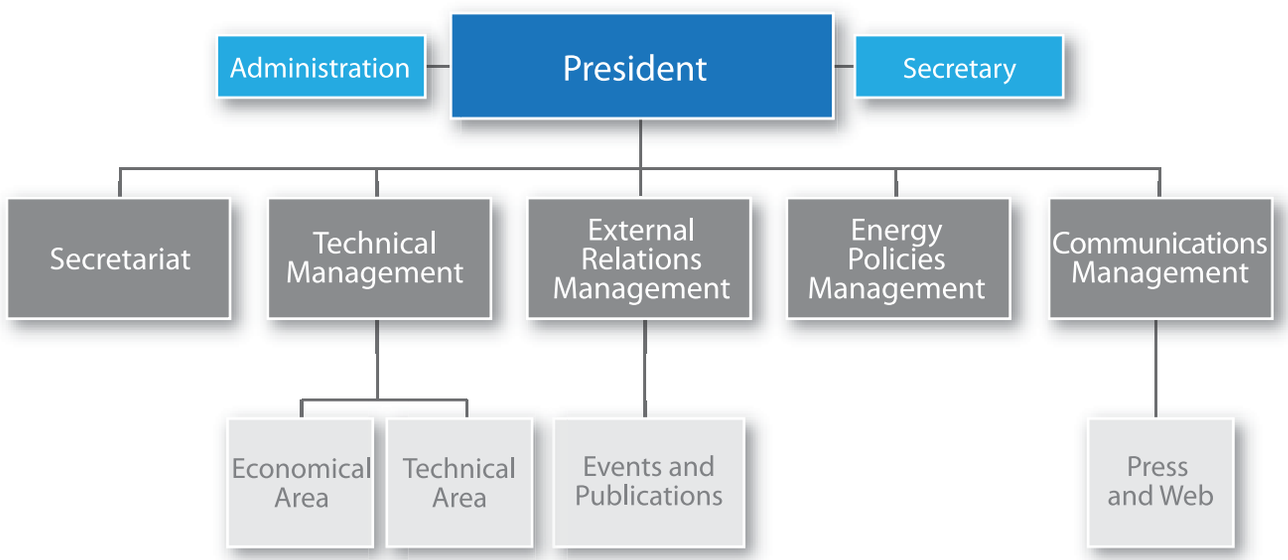
D. Juan Cervigón	OLIVENTO, S. L.
D. Antonio Espíldora García	ASOCIACIÓN DE PROMOTORES DE ENERGÍA EÓLICA DE CASTILLA-LA MANCHA (APRECAM)
D. Casimiro Fernández	ASOCIACIÓN EÓLICA DEL PRINCIPADO DE ASTURIAS (AEPA)
D. Eugenio García Tejerina	ASOCIACIÓN DE PROMOTORES DE ENERGÍA EÓLICA DE CASTILLA Y LEÓN (APECYL)
D. Jesús Losa Fernández	LA CAIXA, S.A.
D. Felipe García-Mina Cabredo	SUZLON WIND ENERGY ESPAÑA, S.L.U.
D. Fermín Matesanz	EOLIA MISTRAL DE INVERSIONES, SCR, S.A.
D. Francesc Roig Munill	FERSA ENERGÍAS RENOVABLES, S.A.
D. Guillermo Planas Roca	ENERFÍN, S.A.
D. Javier Perea Sáenz de Buruaga	GAMESA INNOVATION & TECHNOLOGY, S. L.
D. Jaime De Rábago Marín	CONSOLIS HORMIFUSTE, S.A.
D. Carlos Rojo Jiménez	ASOCIACIÓN DE PROMOTORES Y PRODUCTORES DE ENERGÍAS RENOVABLES DE ANDALUCÍA (APREAN)
D. Juan Ruiz-Jarabo	ENERCON WINDENERGY SPAIN, S.L.
D. Ignacio Soucheiron	BANCSABADELL INVERSIÓ I DESENVOLUPAMENT, S.A.

D. José Manuel Uncio Lacasa	ENERGÍAS RENOVABLES MEDITERRÁNEAS, S.A.
D. Rafael Zubiaur Ruiz	BARLOVENTO RECURSOS NATURALES, S. L.
Dª . Carmen Mateas Moreno	Board of Directors Secretary

The President and the Vicepresidents form parte of the Permanent Committee

VIII.3 Staff

Diagram VIII.01 AEE Staff



José Donoso	President
Alberto Ceña	Technical Director
Sergio de Otto	External Relations Director
Heikki Willstedt	Energy Policies Director
Sonia Franco	Communications Director
Carmen Mateas	Board of Directors Secretary
Ángeles Mora	Technical Department
Emilien Simonot	Technical Department
Mar Morante	Communications Department
Sheila Carbajal	External Relations Department
Ángel Budía	Administration
Paz Mesa	Secretary

Annex

El camino
Laura Castrillejo

Annex
List of graphs, tables, figures, maps and diagrams

CHAPTER II. The figures

CHAPTER III. The Pre-allocation Register: an unnecessary regulation

CHAPTER IV. Grid integration

CHAPTER V. Pay mechanisms and returns

CHAPTER VI. A look to the future

CHAPTER VII. AEE, objectives and action

CHAPTER VIII. AEE, members and structure

aee
Spanish Wind Energy Association

Spanish Wind Energy Association

Serrano 143 2º • 28006 Madrid • Phone: 00 34 91 745 12 76

www.aeeolica.org