The Spanish Wind Energy Association would like to thank its associates for providing us with the information for the update of the database and photographs. It also acknowledges the National Commission for Energy (CNE), the System Operator Red Eléctrica de España (REE), the European Wind Energy Association (EWEA), The Global Wind Energy Council (GWEC) and the Operator of the Iberian market of Energy –Spanish Pole (OMEL) for their cooperation when elaborating this document.

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Wind Power 2009

Wind Power 2009

Asociación Empresarial Eólica
The Sector's Reference

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President's Address
A commitment to success

On writing this address, months after putting 2008 behind us, the benefits of hindsight reveal that year as one that can be considered the end of a chapter for wind power development. That chapter was one of successes and in which wind power became the most spectacular story among new energy technologies, most particularly among renewable energy technologies. A sector that started with the dream of a group of visionaries managed to put up 8,484 MW last year, giving wind the 'yellow jersey' as the generation technology with most new capacity installed; even ahead of gas, which put up 6,932 MW of new capacity.

In Spain, the volume of new installed wind capacity, at 1,609 MW, was in line with the average over the past few years. The figure brings our cumulative total to 16,740 MW. It also represents the continued consolidation and success of our sector; the best investment that the Spanish economy has made in recent times—as we never tire of reiterating. That is no idle claim but one that is backed by irrefutable facts thanks to the finalisation last November of the '**Macroeconomic Study on the Impact of Wind Energy In Spain'**, which marks a before and after in evaluating the benefits of wind power production incentives. Due to the broad sweeping importance of that study, we have explained the reasons it was carried out and have included its main conclusions in the first part of this yearbook under the telling title: '**Wind power expensive? Debunking the myth**'

On the international stage, wind power has continued growing, with new installed capacity up 27% to 26,963 MW. Against that backdrop, the Spanish wind industry has consolidated its privileged position, among the world leaders, not only due to its own internal development but also because of the presence of Spanish firms in key markets. Our developers and manufacturers continue strengthening their footholds abroad (we are present in some thirty countries). Nearly 8,000 MW of online capacity abroad belongs to Spanish developers while our manufacturers made global exports totalling some €3 billion, by our own estimation.

But just because we have completed a chapter of sector maturity, that does not mean that we have reached our final goal. What it does mean though is that we have arrived at a point of departure to face new challenges on all fronts. Those challenges are further complicated by the current global financial crisis; a temporary situation, but no less harsh for that. But more important than the current financial dip lurks the chronic structural crisis of our energy model (environmental problems, volatile fossil fuel prices, limited resources, etc). The full implications of that energy crisis will return to the fore once the problems of the financial markets are resolved, reinforcing the need for commitment to renewables technologies in general and, as the most efficient among those technologies, to wind power in particular.

As the wind sector starts out on the new challenges ahead with new conditions arising, the Spanish market is faced with a series of regulatory changes that are going to redefine the rules of the game. Those changes include the new European Directive on the Promotion of Energy from Renewable Sources and, at national level, the promised Law of Economic Sustainability. The long-awaited national Renewable Energy Plan 2010-2020 is expected to lay the basis for the sector to reach 40,000 MW of land-based wind capacity (5,000 MW through repowering) and 5,000 MW offshore. And, for the shorter term, the sector awaits a new legal-economic framework to make the renewables plan viable. To help with those arduous tasks, the wind sector is prepared to provide constructive proposals and negotiate agreements, contributing its solidity and the credibility it has built on the back of its strong track record of sustained and sustainable development.

The yearbook finishes with a description of the most important activities carried out by the Spanish Wind Energy Association. Here, the working groups stand out for the number or areas covered and the intensity of their work. Especially relevant is work addressing the future, from intensified efforts in grid integration to research, development and innovation, where the solid bases for the future are established. Today, more than ever, we are aware that maximum effort in R&D&i is the only way to maintain our position among the world leaders and to become increasingly competitive vis-à-vis other technologies, within a market which is more and more a global one every day. We are ready and eagerly set to take on those challenges.

José Donoso
President
Spanish Wind Energy Association

First part:
Wind Power Expensive?
Debunking the myth

Chapter I
Clean, indigenous and . . . profitable

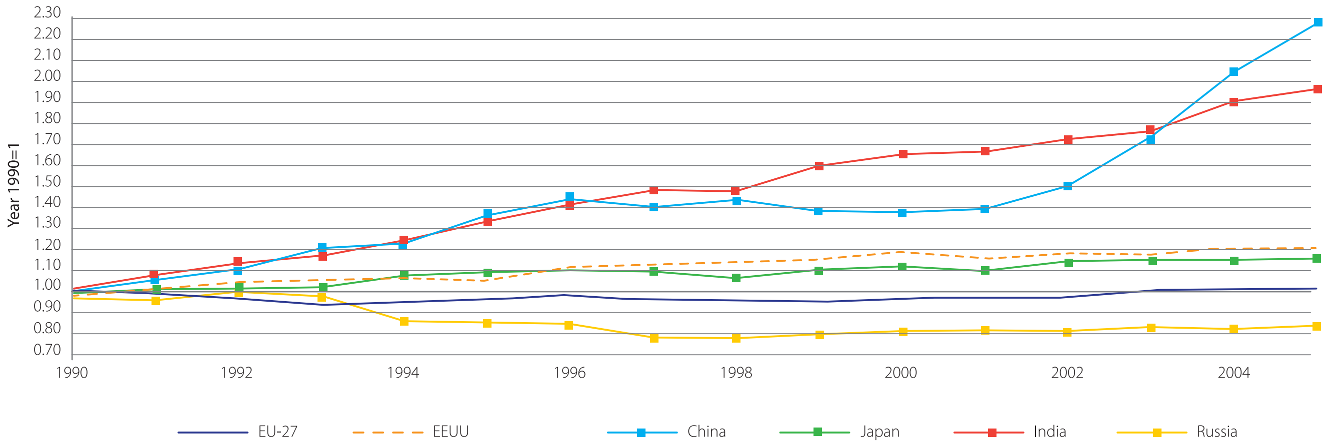
Chapter I
Clean, indigenous and … profitable

The year 2008 marks a milestone for Spanish wind power. That is not just because of the figures confirming the industry's strength and vigour or because of the continued cutting edge strides wind companies have made towards improved grid integration and R&D; all aspects widely, covered in this annual. Beyond those considerable achievements, what stands out above all is the **'Macroeconomic Study on the Impact of Wind Energy in Spain'.** That study debunks once and for all the myth of wind power being expensive. That misconception has been widely propagated—either through disinformation or through the defence of other interests—to discredit this clean energy technology, which has grown from being a secondary alternative to becoming a corner stone of our electricity system.

In the energy model debate, the main error is to focus solely on one aspect, be it economics, technology or strategy. Sometimes, the debate is weakened by oversimplified attempts to demonstrate the superiority of one technology over another. It is obvious that **any energy policy must begin with an exhaustive analysis of the numerous factors** that combine to condition action in the field. There are few sectors with as many aspects that must be taken into account as the energy sector. Everything from geopolitics to domestic comfort is involved in energy issues, through crucial environmental issues, economic, industrial and technological considerations, national competitiveness and employment.

The job of policy makers is to establish in each case, in each moment of history, the priorities. On analysing the suitability of one technology or another, it is important to establish the key challenges that must be met, including the prevailing circumstances at the time and what energy resources are available. Undoubtedly, there are currently two key aspects affecting energy policy today: **environment and security of energy supply.**

Graph I.01. CO2 emissions from energy consumption

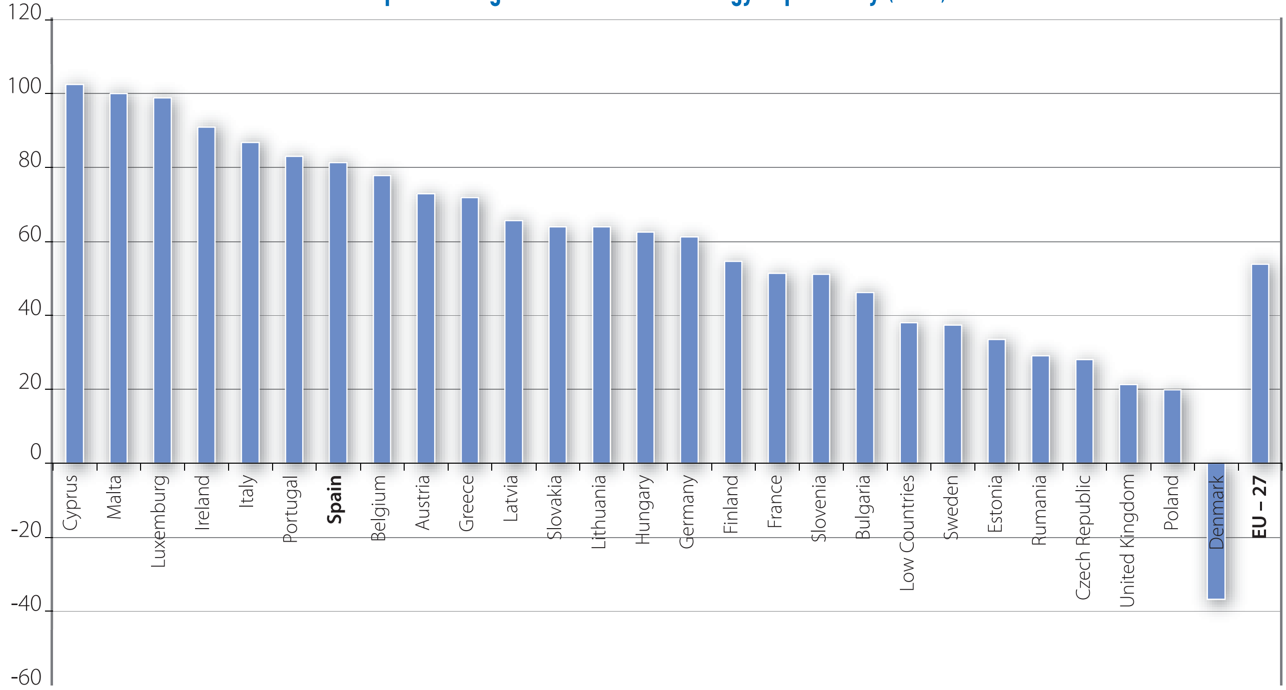


Source: European Commission and OECD

The existing energy model, based on burning fossil fuel resources, is the main producer of the Greenhouse Gas emissions (graph I.01) causing climate change, according to the practically unanimous verdict of the scientific community. We are only just beginning to understand the huge consequences this change will have.

Regarding supply security, clearly the best way to achieve this is by **using indigenous resources.** Other solutions involve leaving too many variables in the hands of others, an aspect which, in some cases, has already been at the heart of the main international conflicts of recent times.

Graph I.02. Degree of EU member energy dependency (2006)



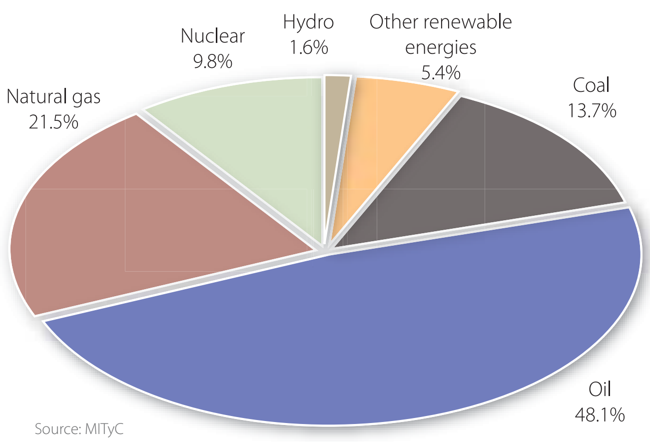
Source: Eurostat

I.1 Clean and indigenous kilowatts …

Successive Spanish governments in recent decades have **opened the doors to different renewable energies** both for strategic and environmental reasons. Regarding strategic motives, renewables provide indigenous resources. Spain does not have natural gas or oil deposits under its surface, and its coal seams are very costly to exploit. That all means Spain has an 82% energy dependency abroad, among the highest rates of external dependency within the European Union, which averages at little over 50% (graph I.02).

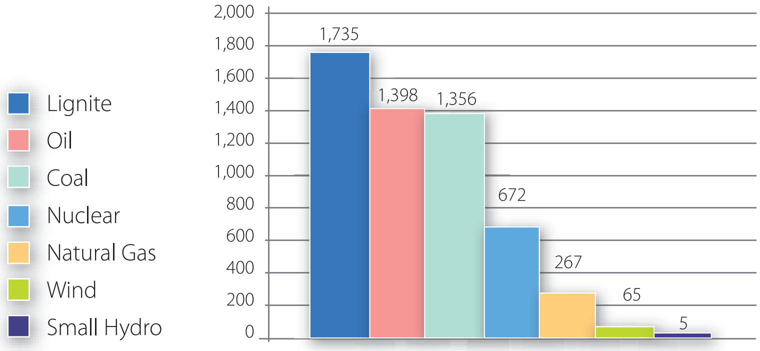
Such a degree of dependency, often dubbed suicidal, implies a serious sap on our economy, which imports €50 billion worth of hydrocarbons a year. Gas and oil alone make up 70% of our primary energy consumption (graph I.03). Furthermore, the volatility of oil and gas prices poses a constant threat to the national economy.

Graph I.03. Spanish primary energy consumption in 2007



Source: MITyC

Graph I.04. Environmental impacts of generating technologies



Source: IDAE and other entities

Strategic and environmental aspects alone justify the use of renewable energies

The renewable energy door opened just a crack in the 1980s as a delayed response to the big oil crises of the 1970s. Through that crack, made by the first reforms to a rigid electricity sector rulebook, slipped the first small hydroelectric installations. Later, following the reforms of the 1990s, the **clean nature** of renewables was introduced as the main justification for supporting that kind of energy. That was because society was beginning to take on environmental concerns, which, not so many years earlier, had been disparaged.

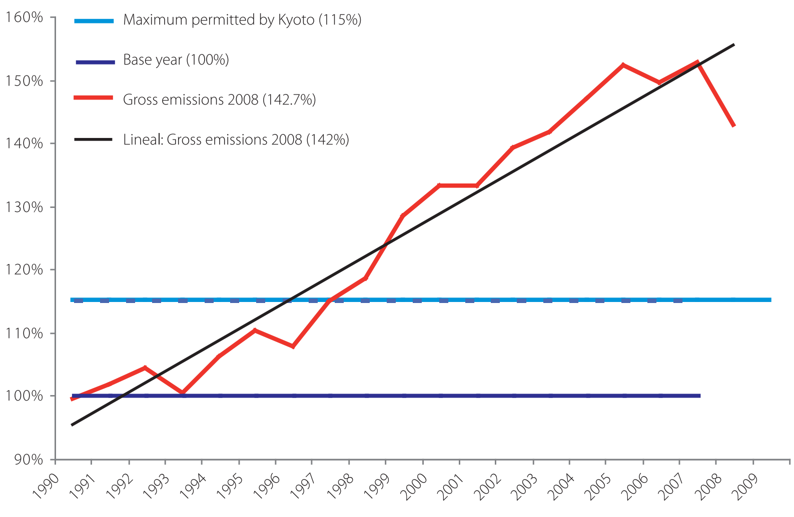
As part of that growing awareness, a study was published in 2000 called "**Environmental Impacts of Eight Electricity Generating Technologies**". The study, instigated by IDAE, CIEMAT and APPA, involved the scientific quantification of the environmental damage and impact of different generation technologies. From the study's irrefutable results, it was concluded that **conventional generation technologies have 31 times or 3100% more impact** than renewable technologies (graph I.04). Wind proved to have 25 times less impact than lignite.

The two key aspects of strategy and environment alone justify the deployment of renewables. In 2008, wind power generated over 31,000 GWh, translating to 11.5% of electricity demand in our country. That means thirty-one thousand kilowatt-hours generated **without emitting Greenhouse Gases** (more than 20 million tons of CO2 emissions avoided), **without producing toxic waste** and **without importing fossil fuels** (wind saved Spain's trade balance over €1.2 billion, a figure which would have been higher if not for the temporary periods of low fuel prices). In short, wind is an effective answer to the key energy policy challenges.

On their own, then, those two key aspects justify the €1.2 billion in incentives paid out to the wind sector over 2008. Any politician could easily explain to society the worthiness of this 'investment' in wind. Wind's achievements are made not through any type of subsidy (subsidies are received by other electricity generation technologies either directly or indirectly) but, rather, through production incentives. The legislature adopted that particular option in order to reward the environmental and strategic benefits of renewables given that the costs of environmental impact by conventional technologies could not be internalised.

Paying €1.2 billion in order to avoid those 20 million tons of CO2—especially as Spain needs to reduce its Greenhouse Gas emissions more than any other European country—is a small price. The country also saves in fossil fuel imports an amount similar to the sum of incentives. Consequently, we firmly believe at the **Spanish Wind Energy Association**

Graph I.05. Emissions of GHGs in Spain 1990-2008



Source: Istas and Worldwatch

(Asociación Empresarial Eólica-AEE), that wind is the best business the Spanish economy has. The term expensive is more appropriate for paying out without receiving added value in return. Contrary to what is so often falsely alleged, the incentives do not make wind power expensive, given that they are an effective and efficient means to advance development of a necessary technology that responds to the two energy policy priorities.

I.2 … and profitable for the country

The term expensive cannot be applied to wind not only because it provides a solution to the main objectives but also because of its socioeconomic spin-offs to the country. For Spain, those spin-offs include, among other aspects, the consolidation of a strong industrial sector and the creation of jobs, not to mention global leadership in a cutting edge field with a brilliant future ahead of it. Ten years ago, as we have seen, the renewables sector set out to scientifically quantify the environmental differences between one generation technology and another. Last year, the Spanish Wind Energy Association considered the moment had arrived to quantify the socioeconomic returns from the wind sector and so commissioned the consultancy firm Deloitte to produce the *'Macroeconomic Study on the Impact of Wind Energy in Spain.'* After months of exhaustive analysis of the numerous areas affected by wind, the work was presented in November 2008. The study offered results that debunked the myth of wind power being expensive. The technology is most definitely not expensive for the country.

Indeed, the strong development growth of wind power in Spain has brought with it the creation of jobs and a **rich industrial fabric enveloping hundreds of companies.** Many of those companies have developed in-house technology with which they have conquered markets in almost thirty countries abroad, including USA. In that country, one of four wind turbines holds a Spanish stamp, either the developer's or the manufacturer's.

Wind power has, then, placed itself in the past decade or so as one of the chief new economic motors. And all indicators point to continued growth, both in Spain and the rest of the world, keeping it high among the top industrial sectors.

In this chapter we will present a summary of the studies conclusions. We believe that, for a proper decision making process, those results must be taken into account by the different public administrations and regulators.

The growth of the wind sector in Spain means that the industry should not only be considered in terms of energy criteria but also in terms of its impact on different levels of economic activity. The study concludes that the sector's direct contribution to Spain's Gross Domestic Product (GDP) over 2007 was just over **€1.9 billion,** translating to over 0.21% of GDP for the year. **For 2012, wind could represent 0.27% of GDP.** In terms of the knock on effect of wind across other sectors of the economy (especially the metallurgic industry, including metal product manufacturing and machine manufacturing) wind generated an indirect contribution to GDP of just over **€1.3 billion**. That contribution is higher than that of such established sectors as shoe and leather goods or fishing; comparisons that perfectly

During the last decades, Wind Power became a cutting edge economical sector

In 2007, wind production avoided fossil fuel imports equivalent to 5.5 million tons of oil

illustrate the scale of the wind sector in our country today.

All indicators point to the future sustainability of wind power in our country in the years to come. Forecasts for installed capacity suggest a **growth of 80.9% worldwide in 2010 while Spain is aiming for 40,000 MW by 2020.** All activities across the value chain (development, building, manufacturing and services) are carried out in Spain and there is a strong presence here of both national and foreign players who have set up shop here after recognising the opportunities available. Spanish companies have also set up affiliates, and have become major sector references, in the world's other key markets—some 30 countries in all.

Another important part of the study involves the trade balance, traditionally one of the Spanish economy's Achilles' heels. Here, wind power **exports** constitute a major positive factor, **exceeding €2.5 billion in 2007,** according to Deloitte. That figure, according to **AEE,** was further exceeded in 2008 (the Association estimates the volume of exports across the sector totalled around €3.0 billion). Once again, we can compare the figure with another strongly rooted Spanish industry, **wine,** which made exports totalling **€1.8 billion** in 2007.

As we pointed out earlier, a key pillar supporting the growth of the wind industry has been the existence of domestic technology thanks to the R&D&i investments carried out by sector companies—some **€174 million** in 2007. The figure grows every year both because of internal technical challenges (production forecasting improvements, adapting turbines to support voltage sags, etc) and because of the need to keep up competitiveness in all markets.

It has already been made clear in this first chapter that wind power deployment is justified by its environmental and strategic benefits. But against the backdrop of the current financial crisis, all aspects affecting employment are also of utmost importance. And while the commitment to renewables in general, and wind in particular, does not form part of a job creation plan (even though there are those who have limited their focus on that area), the sector does make an important contribution. According to the Deloitte study, the wind sector employed directly **20,781 people.** Given the increased activity expected over the coming years, **30,000 people** should find direct employment in Spain's wind industry by 2012. The employment figures further swell taking into account indirect jobs, which Deloitte calculates at 16,949 people in 2007, bringing the combined direct and indirect jobs figure to over **37,000 people,** a figure slightly below **AEE's** own estimate, given the Association's wider criteria for defining indirect jobs. Other studies, like the one made by ISTAS (Union Institute of Work, Environment and Health) of trade union CCOO (Comisiones Obreras), puts the total at **50,681 jobs**, in line with figures provided by the Ministry of Industry, Tourism and Trade or the European Commission itself. **Wind power generates employment with quality, sustainable jobs.**

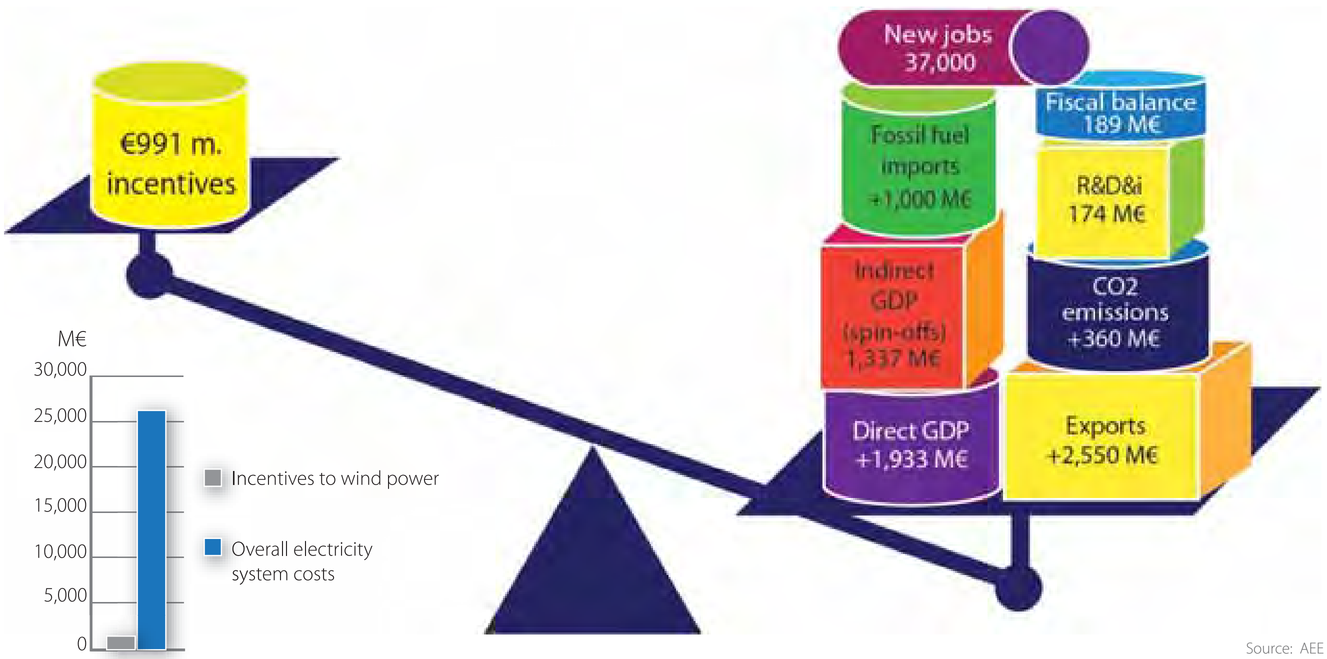
The Deloitte study also shows how wind power generation has substituted a considerable amount of imported fossil-fuel generation, **avoiding a large volume of emissions in 2007,** namely some 18 million tons of CO_2, 11,132 tons of NO_x and 33,817 tons of SO_2.

Moreover, it should not be forgotten that the reduction in imported fossil fuels lowers our energy dependency abroad. In 2007, wind power avoided imports worth the equivalent of **5.5 million tons of oil**, translating to an economic saving of €850 million. In 2008, the saving is estimated at €1.2 billion due to high oil prices.

I.2.1 A good business for Spain

All the figures that the Deloitte study has analysed and processed show that the incentives paid for wind power (991 million in 2007) do not impose a surcharge on the electricity system; far from it, they represent **the best investment for our country.** We have illustrated that reality in a set of scales. On one end of the scales we have placed the incentives paid to wind, so often dubbed expensive, and on the other end we have put the socioeconomic returns. Obviously, not all the concepts on that side can be accurately added as a sum because many of them overlap, but we consider that the image serves to illustrate at a glance the positive effect wind power has for the Spanish economy.

Figure I.01. Incentives against socioeconomic returns of wind power and against overall electricity system



Source: AEE

First part:
Wind Power Expensive?
Debunking the myth

Chapter II
A solid industry

Looking over the past 15 years, it is difficult to find an economic activity with such strong growth as the wind power industry in Spain. Economically, the sector stands out for the turnover generated by its companies, for the creation of value (contribution to GDP) and employment and for its knock on effect on other economic sectors.

Additionally, Spanish sector companies have undergone a high degree of technological and economic development, resulting in considerable technological exports and the creation of affiliates in key overseas markets. That works the other way too, with companies from other countries setting up in Spain, **contribution to our economic growth** and further advancing technological development.

Furthermore, wind power has become an important player in the Spanish electricity system. According to TSO Red Eléctrica de España, 11.5% of all electricity produced in 2008 came from wind power, which became the fourth biggest generation technology.

The wind power industry makes a significant contribution to the country's sustainable development, given that it conforms to the main energy and environmental policy guidelines. Those guidelines are: reduction of Greenhouse Gas emissions and other pollutants; increased renewables penetration and reduced dependency on fossil fuel energy imports.

There are many reasons behind the development of renewables technologies in Spain, especially wind power. Among them lies the model of economic incentives paid to renewables generation. Similarly, technological advances (increased turbine unit capacity, improved grid integration and production forecasting) and reduced kilowatt-hour generation costs.

In December 2008, at the request of the Spanish Wind Energy Association—Asociación Empresarial Eólica (AEE) —asked Deloitte to carry out a ***Macroeconomic Study on the Impact of Wind Energy in Spain.*** As well as illustrating the sector's significance, Deloitte carried out a thorough analysis of the its socioeconomic impact in Spain 2003-2007, together with a medium-term outlook forecast.

II.1 Sector significance: the Spanish case

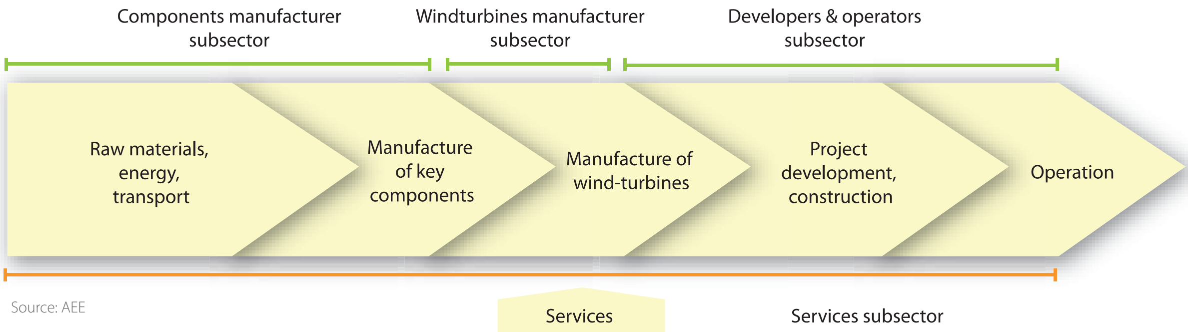
The importance of the wind sector in the world is reflected in installed power growth over the years, reaching a cumulative capacity of 12,700 MW by end-2008, on an average growth rate over the past ten years of nearly 30%. If this trend continues, as predicted, cumulative global wind capacity could reach 170,000 MW in 2010.

In this context, **Spain plays a key role.** With 16,740 MW by end-2008, our country is third in the world in terms of cumulative installed capacity, behind only USA and Germany. The importance of Spain's role, though, is not just its installed capacity but also in terms of power production. Over 2008, the power generated with wind turbines reached 31,130 GWh, making up 11.5% of the total across the electricity system.

Spain´s wind industry is a reference point worldwide, because of its rich business fabric involving all aspects of the value chain

Furthermore, **Spain's wind industry is a reference point worldwide.** The country has a rich business fabric involving all aspects of the value chain (fig. II.01) and geared to serve a global market. That fabric is made up of plant developers and turbine manufacturers, together with a network of component manufacturers and service providers that have evolved on the back of the wind industry's rapid growth. More added value comes both from the strong presence many of those

Diagram II.01. Value chain of the wind power sector



Source: AEE

companies have in the key international wind and the presence of leading international players in the Spanish market.

The sector's sustainable growth is guaranteed by national wind power objectives: 20,155 MW to 2010, as set in the 2005-2010 Renewable Energy Plan (PER), and 29,000 MW to 2016, as set in the Planning for the Electricity and Gas Sectors 2008-2016. **AEE's** proposal to reach 40,000 MW on shore and 5,000 MW offshore by 2020 is generally accepted by the government as a reference for drawing up a new Renewable Energy Plan.

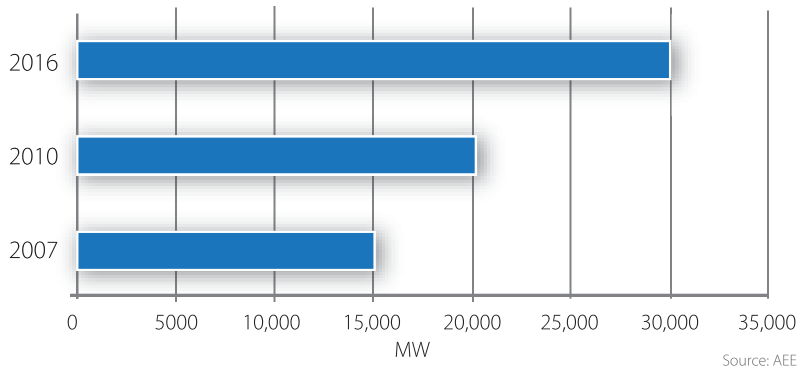
An important contributory factor behind the growth experienced by wind power is that the costs in sites with high wind resources are close to those of other generation technologies. Given the experience and technical and economic expertise gained by the country's wind industry, **Spanish companies should play a key role** in the development of infrastructures.

Table II.01. Companies involved in wind power

Subsector	Number of companies
Turbine manufacturer	19
Component manufacturer	270
Developer-Operator	140
Services	277
TOTAL	706

Source: Deloitte

Graph II.01. Installed wind capacity outlook in Spain



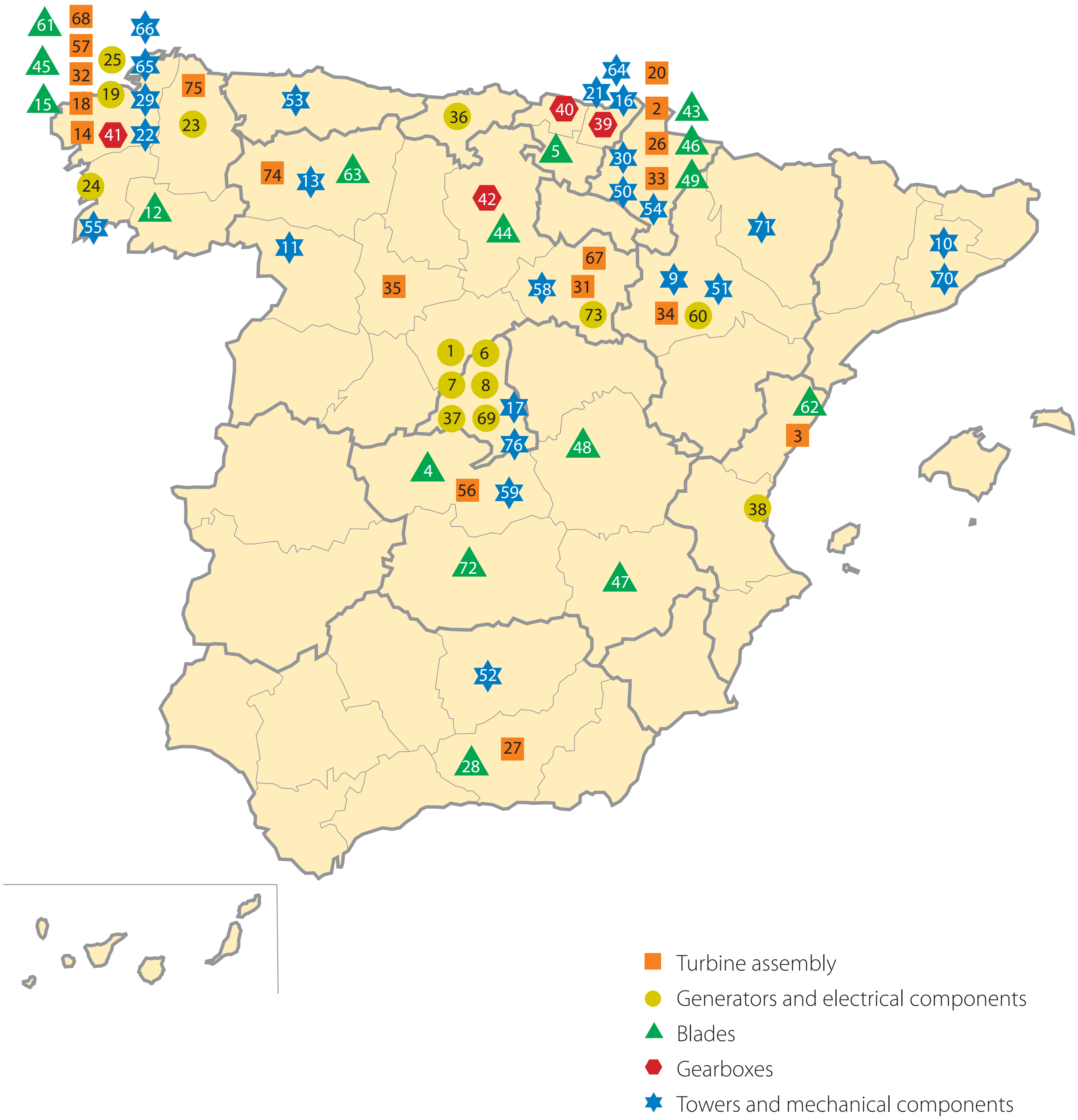
Source: AEE

Table II.02. Location of industrial centres (data from 2008)

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

Source: AEE

Map II.01. Spanish wind sector industrial centres



Source: AEE

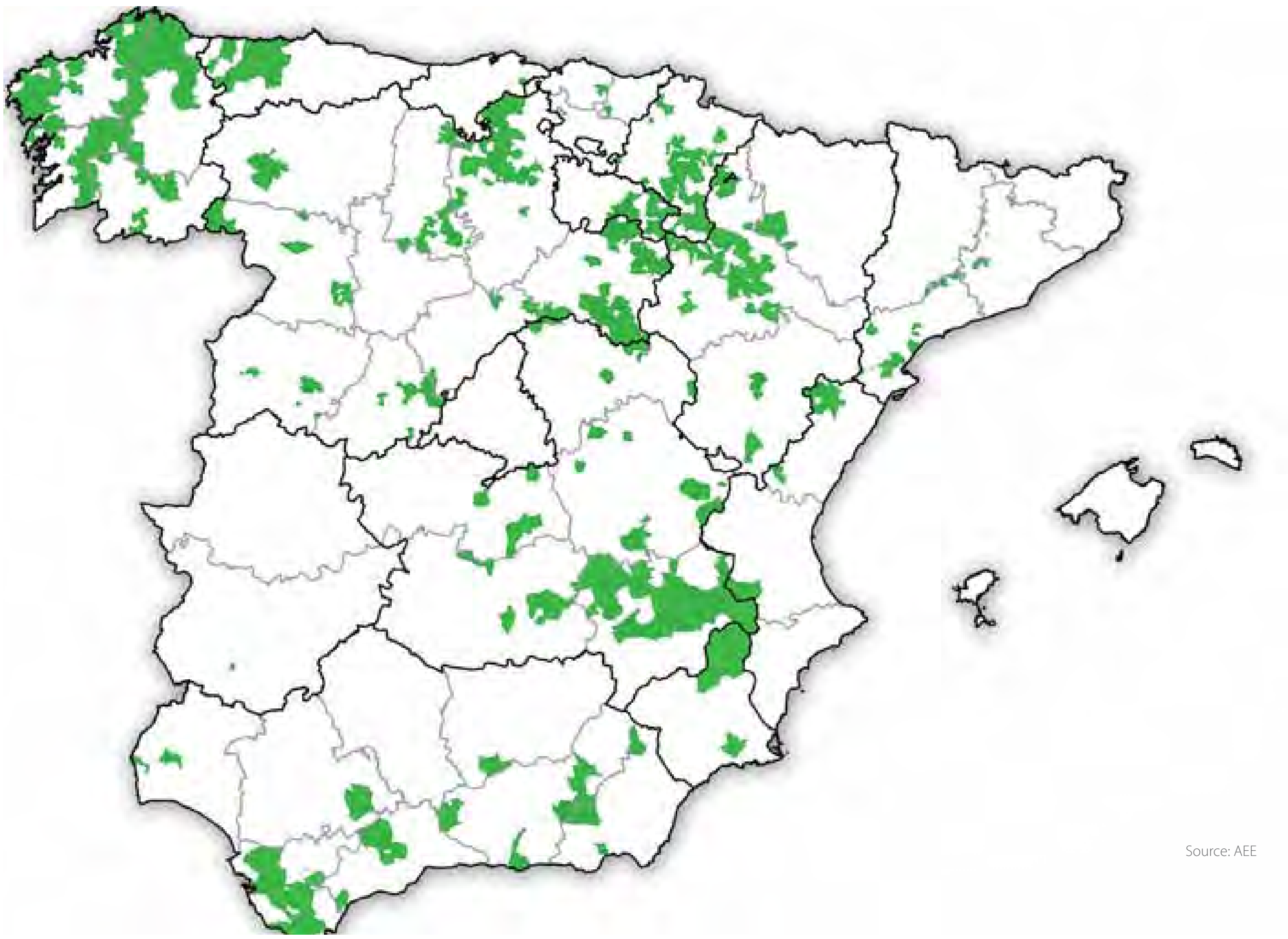
Wind power development is often linked to regional industrial investment plans

As has already been indicated, the growth of the Spanish wind sector is largely thanks to the development of companies that cover the entire value chain in more than half the autonomous regions that make up Spain. Those companies include developer-operators, wind turbine manufacturers, component manufacturers, innovation centres and service companies. As can be seen on the map on the previous page, wind industry factories can be found in many autonomous regions.

If we analyse the wind power capacity across the different autonomous regions we can see that the main ones are Castile La Mancha, Castile and Leon and Galica, each with over 3,000 MW.

The different growth rates experienced across the autonomous regions is not only due to differences in available winds. It is also due to the degree of support given to wind power by the different regional governments. In many cases, wind plant development is linked to strategic industrial investment plans.

Map II.02. Municipalities with operational wind plants



Source: AEE

II.2 International reach

Other indicators of the Spanish wind sector's importance include its international reach. That includes the **strong presence abroad of Spanish companies,** not just developers and manufacturers but also numerous auxiliary companies. It also involves the high volume of Spanish exports.

The volume of wind capacity installed and operated abroad by Spanish companies is around 8,000 MW, spread across 17 countries.

USA is particularly important to Spanish companies, which have installed over 3,460 MW there. Furthermore, the number of Spanish manufacturers and developers in that and other countries is constantly growing.

Spain is a net exporter of equipment, services and technology for the wind power industry. Sector development at home has also attracted foreign investment.

Indeed, according to the latest data compiled by AEE, exports from wind turbine factories based in Spain alone amounted to €2.2 billion over 2008. AEE estimates that if the entire sector is taken into account, the volume of exports would top €3 billion (against €2.6 billion over 2007). That figure is based on estimates across more than 230 component manufacturers, over 280 service companies, and around 140 developer-operators.

Table II.03. Spain's wind power presence abroad

Countries	Net Power (MW)
Germany	287.80
Australia	210.00
Belgium	48.65
Brazil	185.50
Canada	57.99
Chile	18.15
Corea del Sur	46.50
USA	3,460.44
France	509.85
Greece	278.20
Hungary	61.16
India	60.90
Italy	223.40
Mexico	439.50
Poland	186.66
Portugal	1,161.50
United Kingdom	704.00
TOTAL	7,940.21

Source: AEE

Second part: the facts and figures

Chapter III
Installed Capacity

Chapter III
Installed Capacity

National target in sight

The year 2008 can be seen as a transitional year between the extraordinary year 2007—extraordinary for various reasons- and 2009. 2009 is a crucial year because that is when the future course for renewables should be mapped out in the form of the promised Renewable Energy Law and the new Renewable Energy Plan 2011-2020, which will form the base for new specific rules for renewables. In 2007, 3,500 MW were installed after developers pushed to complete plants before the end of that year in order to be eligible for the more favourable regulation, which helped encourage their investment in the first place. Then, over 2008, growth was more in line with the average over previous years (in fact, it was a little below, as expected, due to the 2007 push).

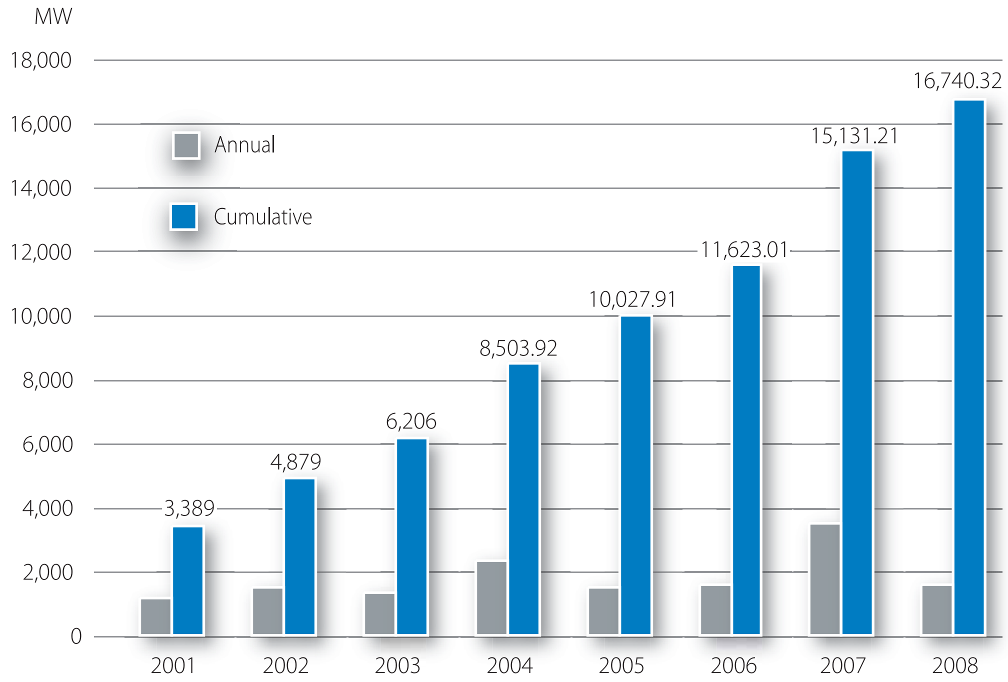
According to the **Wind Power Observatory of Spanish Wind Power Association—Asociación Empresarial Eólica (AEE)**—1,609 MW were installed over 2008, bringing the cumulative total to 16,740 MW. The figure is based on data from developers and manufacturers and is checked against registers made by the regional governments. **AEE** believes Spain will now easily reach its 20,155 MW wind power target as set in the **Renewable Energy Plan 2005-2010.** Although the global financial crisis is toughening financing conditions across the wind sector, which is very capital intensive, for the time being it has only slightly slowed the project development.

Performance last year put **Spain in third place** (behind only USA and Germany). But outside our borders, Spanish manufacturers, developers and other wind companies abroad are keeping Spanish wind power in the lead.

Regarding installed capacity across the autonomous regions, **Castile La Mancha** continues ranking first with a cumulative total of 3,415.61 MW. Nevertheless, Caststile and Leon produced the biggest absolute growth, with 518.69 MW of new capacity, while Valencia produced the biggest year-on-year leap, with a growth of 27.66%.

Iberdrola remains the biggest operator in Spain, with 4,602.35 MW to its name, though, with 321.50 MW of new capacity, Endesa installed more than any other company last year. Regarding turbines, **Gamesa** still dominates the national market with a 49% share.

Graph III.01. Annual installed capacity in Spain 1998-2008



Source: AEE

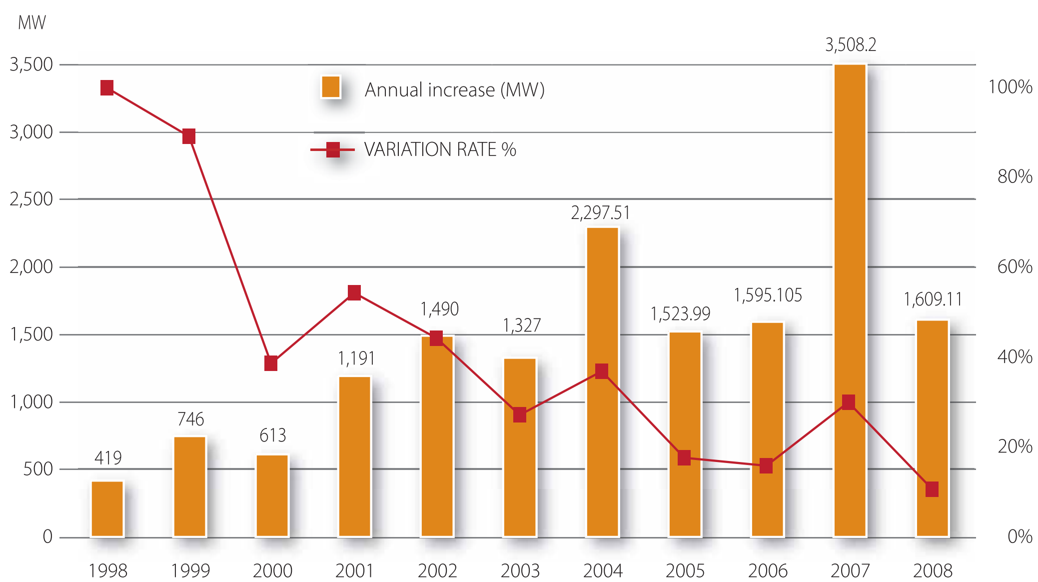
The 1,609.11 MW of new capacity installed in Spain over 2008 brought the cumulative figure to January 1, 2009 to 16,740.32 MW, against the 15,131.21 MW online the same time the previous year. The figures mean that cumulative wind capacity has more than doubled in just over four years. That growth consolidates Spain as the world's third ranked wind market in terms of cumulative capacity (see Chater VII) and keeps the country on track to reach the **20,155 MW target to 2010** as set in the Renewable Energy Plan 2005-2010.

In the past four years installed capacity has doubled

The 1,609.11 MW installed in Spain over 2008 marks a 10.63% capacity increase

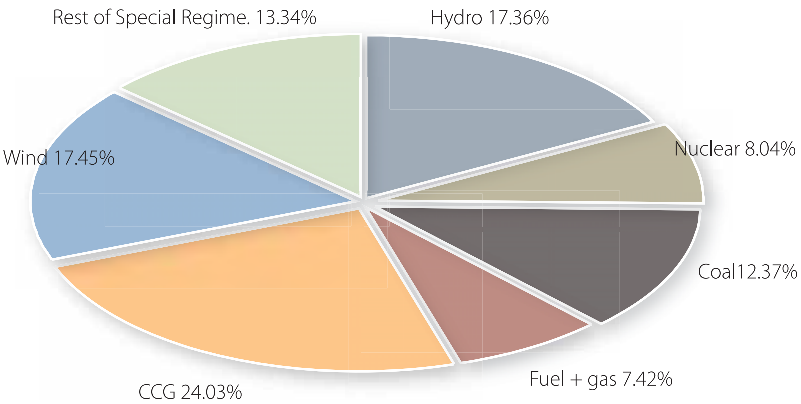
The 1,609.11 MW installed in Spain over 2008 marks a 10.63% increase in the cumulative total. That is the **third biggest increase in absolute terms** in the short history of Spanish wind power, only beaten by performance in 2007 (3,508 MW, and 30%) and 2004 (2,297.51 MW, and 37%). It is important to point out that the annual capacity figures vary mainly due to a variety of factors, such as administrative processing or grid permits and access, but not due to any lag in response to market needs. Nevertheless, there have been two important regulation changes in recent years, namely the Royal Decree 436 in 2004 and the Royal Decree 661 in 2007, both of which brought on installed capacity boosts.

Graph III.02. Annual increase in installed wind capacity and variation rate, 1998-2008



Source: AEE

Graph III.03. National installed capacity shares of Spain´s generation technologies, to end 2008



Source: REE y AEE

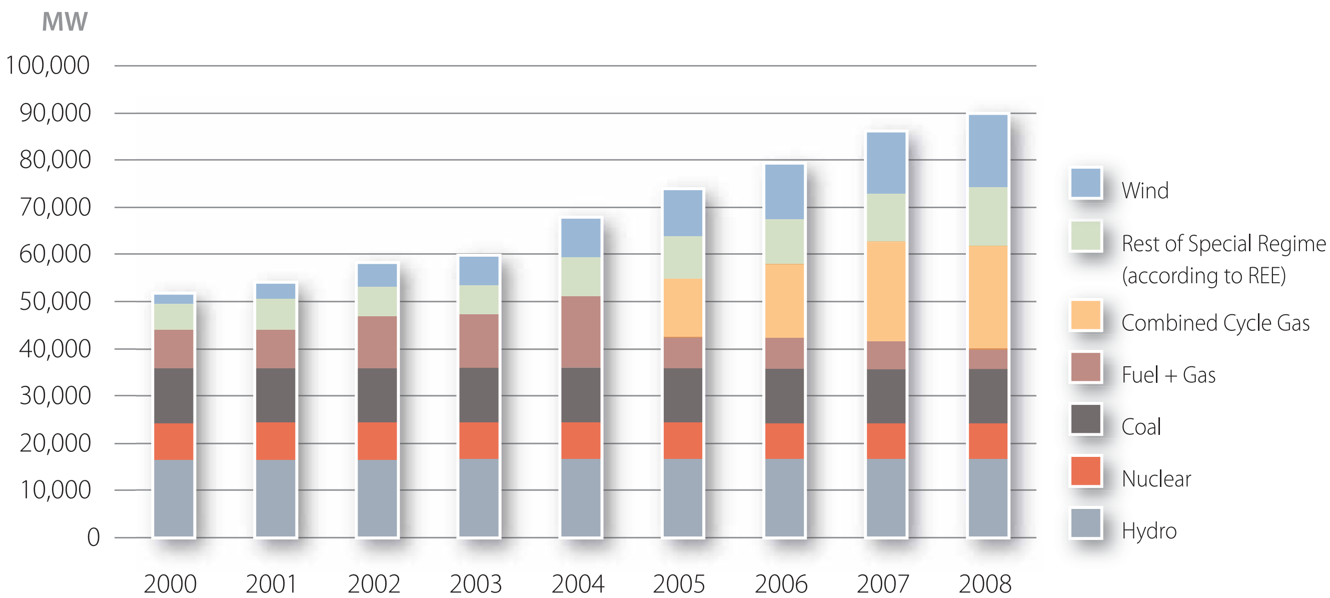
Installed wind capacity represents 18% of the mix in Spain's mainland electricity system. Over the entire national system, including the Canary and Balearic islands, the figure is 17.45%. In the entire mix, that last percentage is behind only combined cycle gas (24.03%) and just ahead of hydro (17.36%). Coal (12.37%), fuel+gas (7.42%) and nuclear 8.94% fall well behind.

Table III.01. Technology capacity shares to end 2008

MW	Mainland Electricity System MW	Share of Mainland Total (%)	Island Electricity System MW	Share of Island Total (%)	TOTAL MW	Share of Total (%)
HYDRO	16,657	18.31%	1	0.02%	16,658	17.36%
NUCLEAR	7,716	8.48%	0	0.00%	7,716	8.04%
COAL	11,359	12.49%	510	10.23%	11,869	12.37%
FUEL+GAS	4,418	4.86%	2,699	54.12%	7,117	7.42%
CCG	21,667	23.82%	1,387	27.81%	23,054	24.03%
WIND POWER	**16,595**	**18.24%**	**145**	**2.91%**	**16,740**	**17.45%**
REST OF S.R.	12,552	13.80%	245	4.91%	12,797	13.34%
TOTAL	**90,964**	**100%**	**4,987**	**100%**	**95,951**	**100%**

Source: REE y AEE

Graph III.04. Annual installed capacity of different technologies 2000-2008



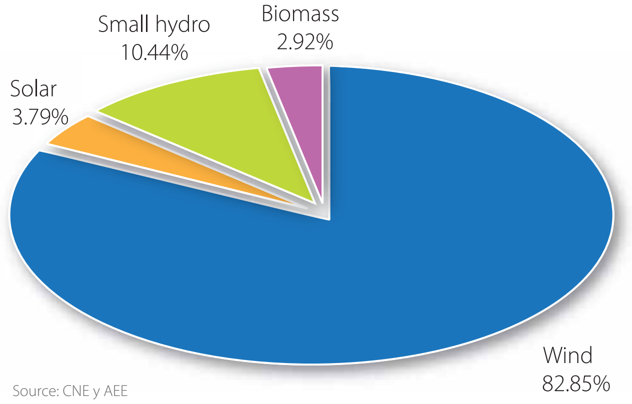
Source: REE y AEE

A chart of installed capacity figures for different generation technologies 2000-2008 illustrates **the strong growth rate of wind power.** That growth rate has put wind power in second place (with hydro capacity at a practical standstill over the period and fuel + gas falling). Combined cycle gas leads the way with over 23,000 MW installed, followed by wind with 16,740 MW and hydro with 16,658 MW.

In Spain´s mainland elctricity system, Wind Power already represents 18% of the energy mix

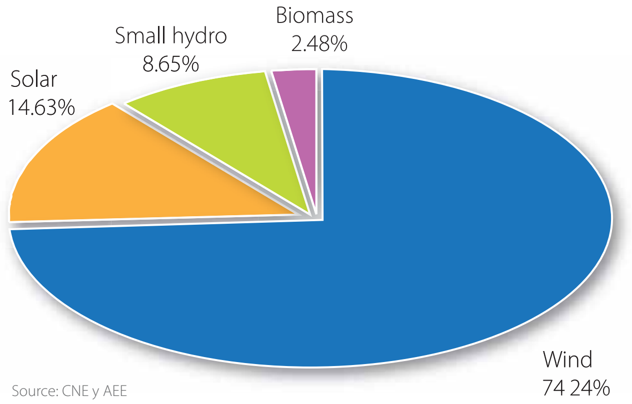
A sharp turn around occurred in the installed capacity weighting of different technologies between 2000 and 2008, as Graph III.04 illustrates. Whereas more than 80% of installed capacity was once made up by fuel+gas, coal, nuclear and hydro power, today those technologies represent only 50% due to the strong consolidation of combined cycle gas, wind power and the rest of Spain's Special Regime generation technologies.

Graph III.05. Capacity share of renewables technologies to end-2007



Source: CNE y AEE

Graph III.06. Capacity share of renewables technologies to end-2008



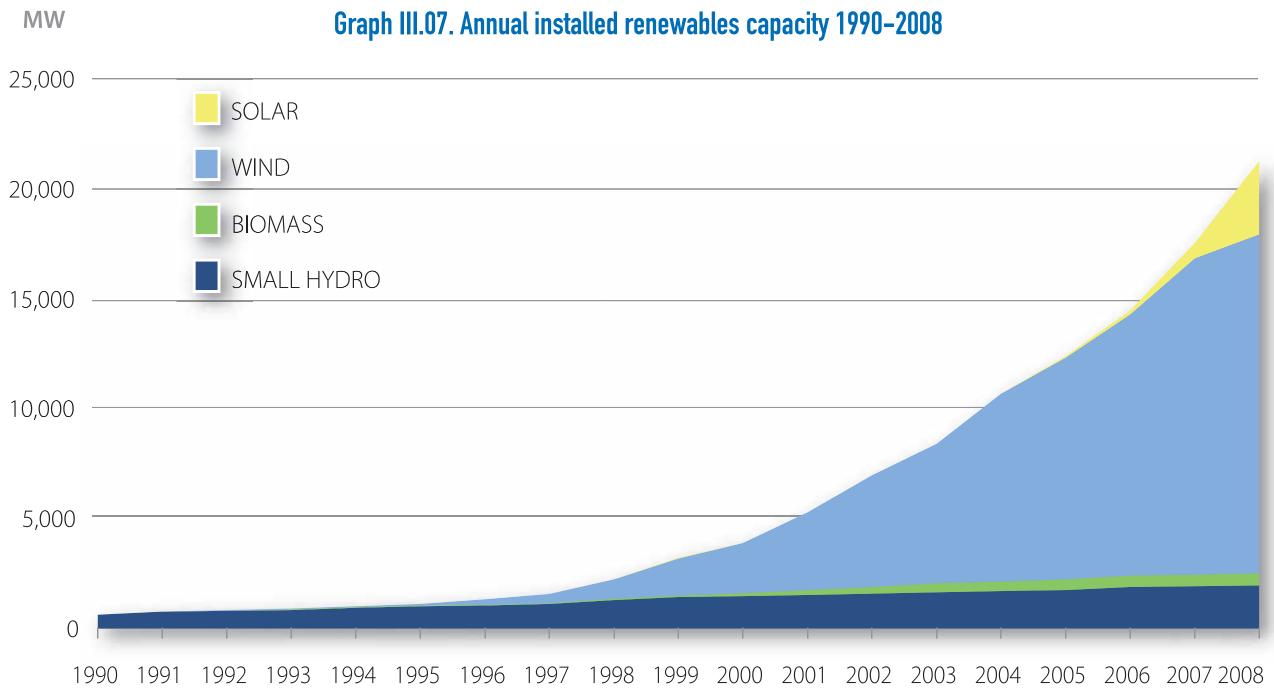
Source: CNE y AEE

Regarding capacity installed accross the different renewables technologies, wind made up 82.85% by end-2007, with 15 GW online. Next came small hydro, with a 10.44% share, solar with 3,7% and then biomass, with 2.92% (according to data from regulator Comisión Nacional de la Energía).

Those figure have altered throughout 2008, especially given the 3,298 MW of new photovoltaic capacity installed, closing the year with a 14.63% share of all installed renewables capacity. Consequently, wind closed the year with a drop in its capacity share to 74.24%.

Even so, wind still accounts for practically three-quarters of renewables capacity installed over the past 18 years (1990-2008).

Graph III.07. Annual installed renewables capacity 1990-2008



Source: CNE

Table III.02. Regional installed wind capacity 2007-2008

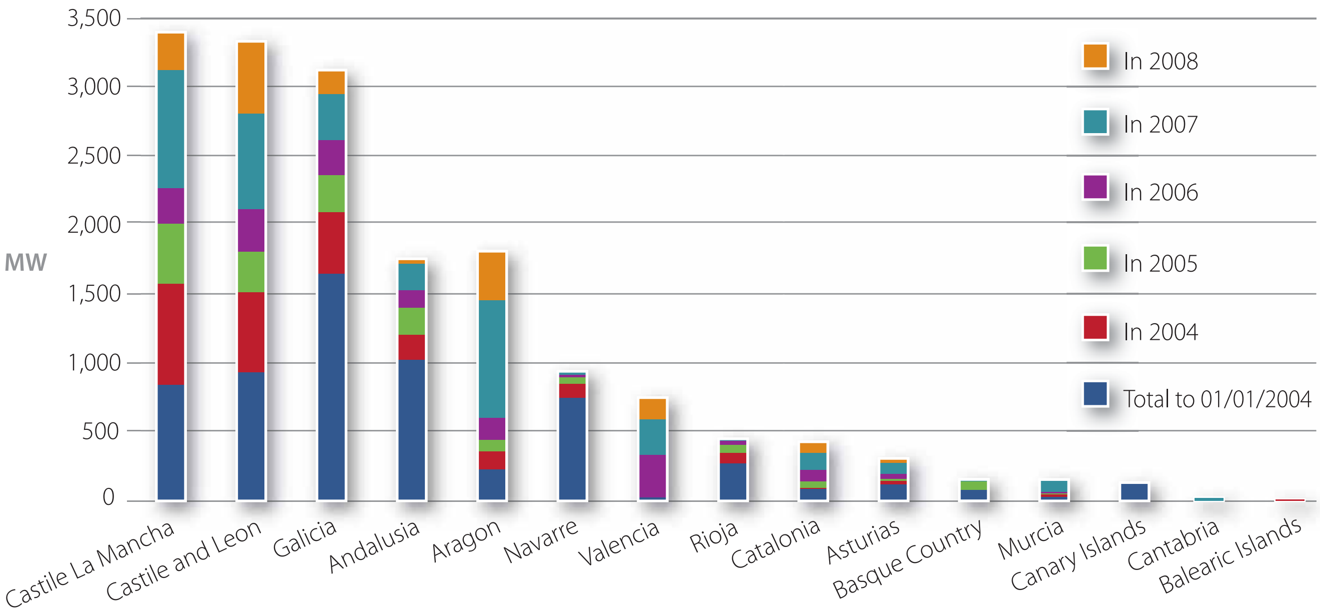
Region	Cumulative Capacity to 01/01/08	New Capacity 2008	Cumulative Capacity to 01/01/08	Rate of Variation
Castile La Mancha	3,142.36	273.25	3,415.61	8.70%
Castile and Leon	2,815.35	518.69	3,334.04	18.42%
Galicia	2,972.79	172.45	3,145.24	5.80%
Andalusia	1,445.54	349.45	1,794.99	24.17%
Aragon	1,719.49	29.82	1,749.31	1.73%
Navarre	952.22	6.55	958.77	0.69%
Valencia	556.44	153.90	710.34	27.66%
Rioja	446.62	0	446.62	0%
Catalonia	343.44	77.00	420.44	22.42%
Asturias	276.30	28.00	304.30	10.13%
Basque Country	152.77	0	152.77	0%
Murcia	152.31	0	152.31	0%
Canary Islands	134.09	0	134.09	0%
Cantabria	17.85	0	17.85	0%
Balearic Islands	3.65	0	3.65	0%
TOTAL	**15,131.21**	**1,609.11**	**16,740.32**	**10.63%**

Source: AEE Wind Power Observatory

Castile La Mancha, Castile and Leon and Galicia make up nearly 10,000 MW, practically 60% of all installed wind capacity across Spain

Of the autonomous regions, **Castile La Mancha** maintained its lead with 3,415.61 MW (273.25 MW of new capacity over 2008). Nevertheless, **Castile and Leon** pulled off the biggest growth in absolute terms, with 518.69 MW of new capacity, putting that region in second place, with 3,334.04 MW, ahead of **Galicia**, which tallied 3,145.24 MW. Capacity across those three autonomous regions totals almost 10,000 MW; practically 60% of Spain's entire installed wind capacity by end-2008. At the other end of the scale lie the regions of the Basque Country, Murcia, Canaries, Cantabria and Baleares, none of which has more than 200 MW of cumulative capacity to its name.

Graph III.08. Regional installed wind capacity 2004-2008



Source: AEE Wind Power Observatory

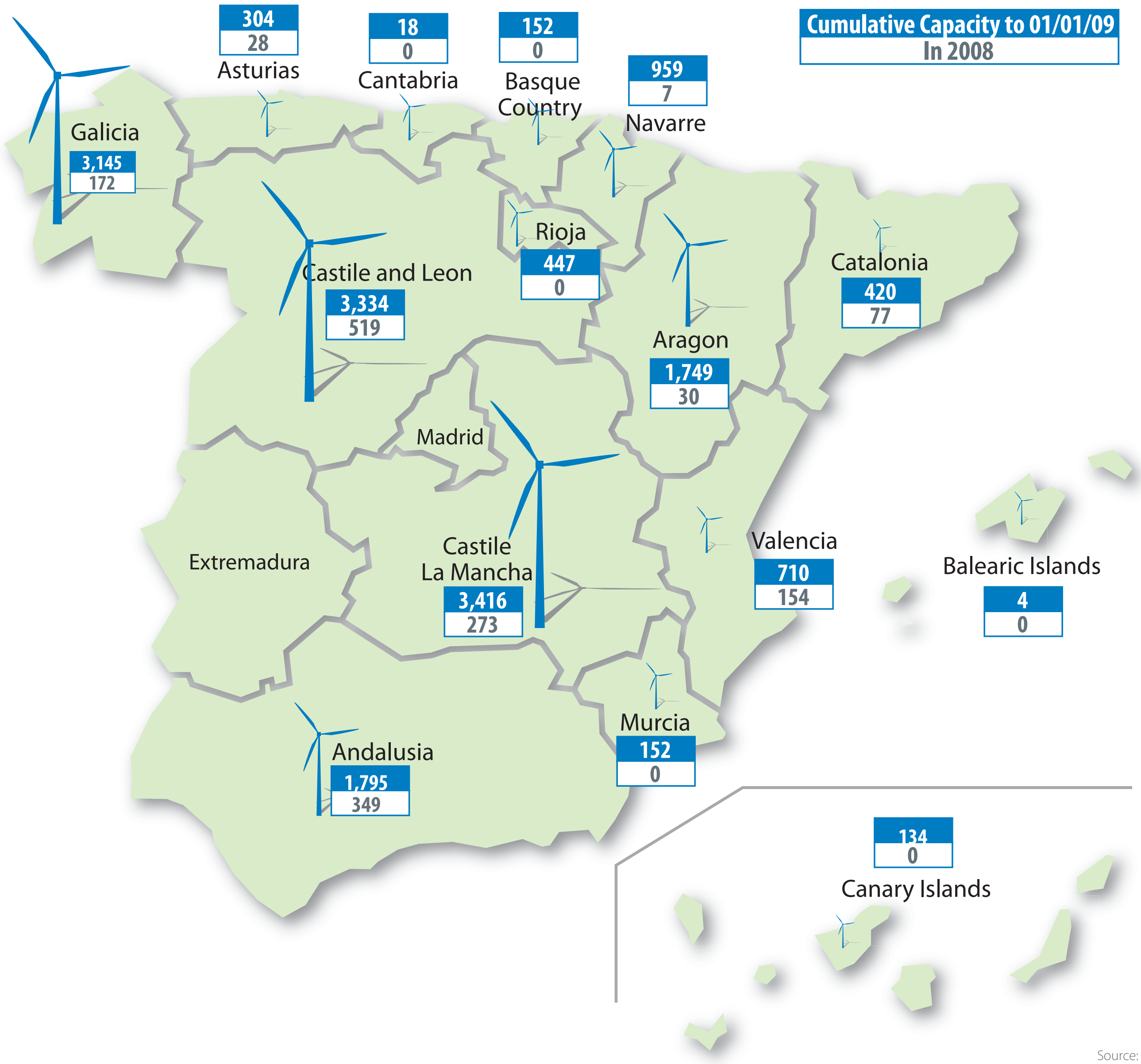
Table III.03. Provincial installed capacity and number of wind plants in 2008

Region	Province	CUMULATIVE CAPACITY TO END-2008 (MW)	TOTAL NUMBER OF WIND PLANTS
	Almeria	244.05	9
	Cadiz	977.36	54
	Granada	309.3	10
Andalusia	Huelva	44.2	3
	Jaen	15.18	1
	Malaga	176.4	13
	Seville	28.5	1
Total Andalusia	**ANDALUSIA**	**1,795.0**	**91**
	Huesca	279.15	8
Aragon	Teruel	177.95	7
	Saragossa	1,292.21	59
Total Aragon	**ARAGON**	**1,749.3**	**74**
Asturias	Asturias	304.3	12
Total Asturias	**ASTURIAS**	**304.3**	**12**
Balearic Islands	Balearic Islands	3.65	3
Total Balearic Islands	**BALEARIC ISLANDS**	**3.7**	**3**
	El Hierro	0	0
	Fuerteventura	11.605	3
	Gran Canaria	71.44	26
Canary Islands	La Gomera	0.36	1
	La Palma	9.93	5
	Lanzarote	8.775	2
	Tenerife	31.98	7
Total Canary Islands	**CANARY ISLANDS**	**134.1**	**44**
Cantabria	Cantabria	17.85	1
Total Cantabria	**CANTABRIA**	**17.9**	**1**
	Albacete	1,879.61	59
	Ciudad Real	202	5
Castile La Mancha	Cuenca	754.1	18
	Guadalajara	496.4	19
	Toledo	83.5	7
Total Castile La Mancha	**CASTILE LA MANCHA**	**3,415.6**	**108**
	Avila	132.13	9
	Burgos	1,165.33	52
	Burgos - Palencia	8.8	1
	Leon	225.75	10
	Palencia	416	19
Castile and Leon	Salamanca	43.14	2
	Segovia	48.52	2
	Segovia - Soria	27.2	1
	Soria	806.13	30
	Valladolid	88.125	2
	Zamora	372.91	21
Total Castile and Leon	**CASTILE AND LEON**	**3,334.0**	**149**
	Barcelona	75	2
Catalonia	Lleida	40.5	1
	Tarragona	260.94	13
Total Catalonia	**CATALONIA**	**420.4**	**18**
Valencia	Valencia	144.4	6
	Castellón	566.0	15
Total Valencia	**VALENCIA**	**710.3**	**21**
	Corunna	978.935	54
	Corruna-Lugo	163.62	6
	Lugo	1,187.43	47
Galicia	Lugo - Pontevedra	43.83	2
	Ourense	180.07	9
	Ourense - Pontevedra	176.2	5
	Pontevedra	374.9	16
Total Galicia	**GALICIA**	**3,145.2**	**142**
Rioja	Logroño	446.62	14
Total Rioja	**RIOJA**	**446.6**	**14**
Murcia	Murcia	152.31	10
Total Murcia	**MURCIA**	**152.3**	**10**
Navarre	Navarre	958.77	43
Total Navarre	**NAVARRE**	**958.8**	**43**
	Álava	81.8	2
Basque Country	Guipúzkoa	26.97	2
	Vizcaya	44	3
Total Basque Country	**BASQUE COUNTRY**	**152.8**	**7**
Grand Total		**16,740.32**	**737**

Note: the number of plants includes extensions and experimental projects

Source: AEE

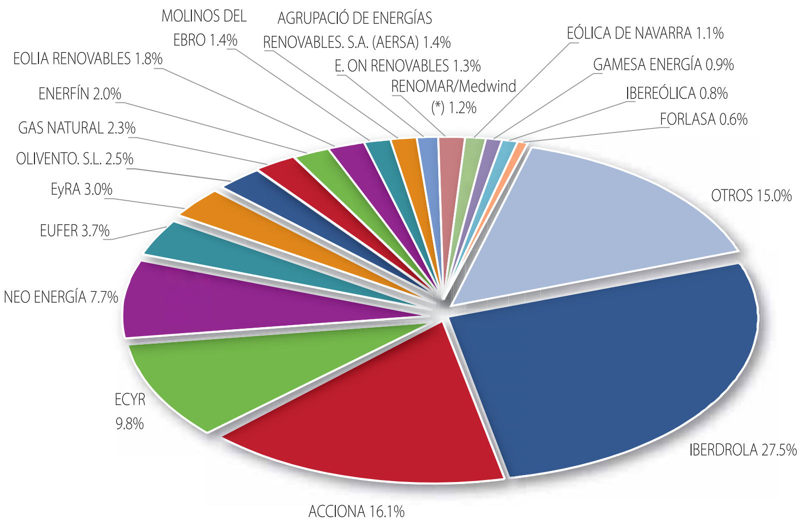
Map III.01. Regional Installed Capacity (MW)



Source: AEE

The highest percentage annual growth last year came from Valencia, which installed 153.90 MW of new capacity to reach 710.34 MW, 27.66% up on the previous year's cumulative total. Next comes **Andalusia,** whose 349.45 MW of new capacity raised the total by 24,17% to reach 1,794.44 MW (making it the fourth region in cumulative terms). **Aragon** now has 1,749.31 MW. Rioja, the Basque Country, Murcia, Cantabria or the Canary and Balearic islands failed to put up a single megawatt in 2008.

Graph III.09. Plant owner share of cumulative wind capacity to end-2008



Source: AEE Wind Power Observatory

In the plant ownership ranking, Iberdrola Renovables retains its lead with a cumulative capacity of 4,602-35 MW to end-2008, thanks to 305.10 MW of new capacity installed over the year. Acciona stays in second place with a cumulative total of 2,698.84 MW, followed by ECYR with 1,640 MW.

* Renomar (Energías Renovables del Mediterráneo has a total of 394.5 MW, but as Acciona owns half of that company, and Medwind the other half, each is attributed its respective share

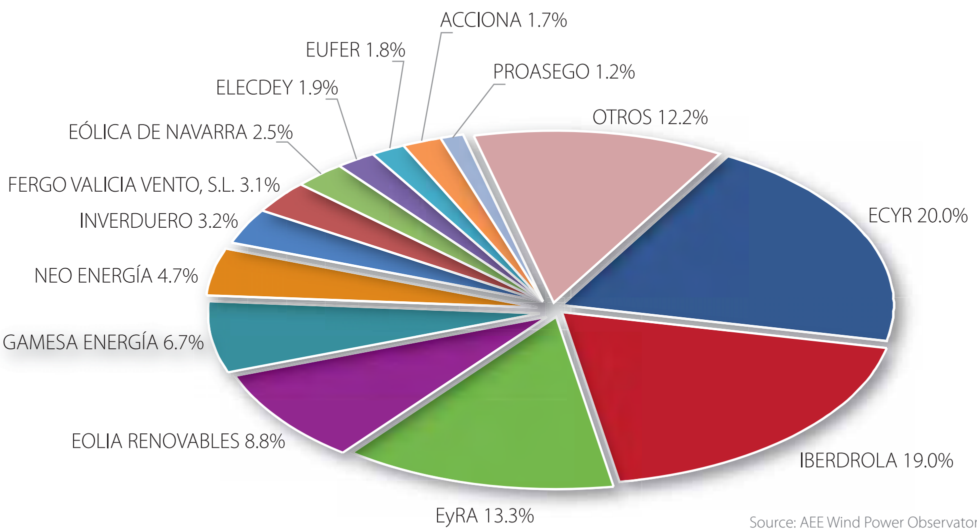
Table III.04. Plant owner share of cumulative wind capacity to end-2008

OPERATING COMPANY	TOTAL CAPACITY (MW)	Share of total (%)
IBERDROLA	4,602.35	27.5%
ACCIONA	2,698.84	16.1%
ECYR	1,640.94	9.8%
NEO ENERGÍA	1,292.60	7.7%
EUFER	613.57	3.7%
EyRA	495.48	3.0%
OLIVENTO. S.L.	421.79	2.5%
GAS NATURAL	382.77	2.3%
ENERFÍN	336.08	2.0%
EOLIA RENOVABLES	296.63	1.8%
MOLINOS DEL EBRO	235.16	1.4%
AGRUPACIÓ DE ENERGÍAS RENOVABLES. S.A. (AERSA)	227.58	1.4%
E. ON RENOVABLES	214.54	1.3%
RENOMAR/Medwind (*)	197.25	1.2%
EÓLICA DE NAVARRA	189.91	1.1%
GAMESA ENERGÍA	144.45	0.9%
IBEREÓLICA	140.90	0.8%
FORLASA	105.00	0.6%
OTHERS	2,504.49	15.0%
TOTAL	**16,740.32**	**100.0%**

Source: AEE Wind Power Observatory

* Renomar (Energías Renovables del Mediterráneo has a total of 394.5 MW, but as Acciona owns half of that company, and Medwind the other half, each is attributed its respective share

Graph III.10. Plant owner share of new wind capacity installed over 2008



Source: AEE Wind Power Observatory

ECYR installed **more new capacity than any other company last year,** namely 321.50 MW, though Iberdrola was close behind with 305.10 MW. Making up the rest of the top five are EyRa, with 213 MW, Eolia Renovables with 141 MW and Gamesa with 107.50 MW.

Table III.05. Plant owner share of new wind capacity installed over 2008
Total in 2008

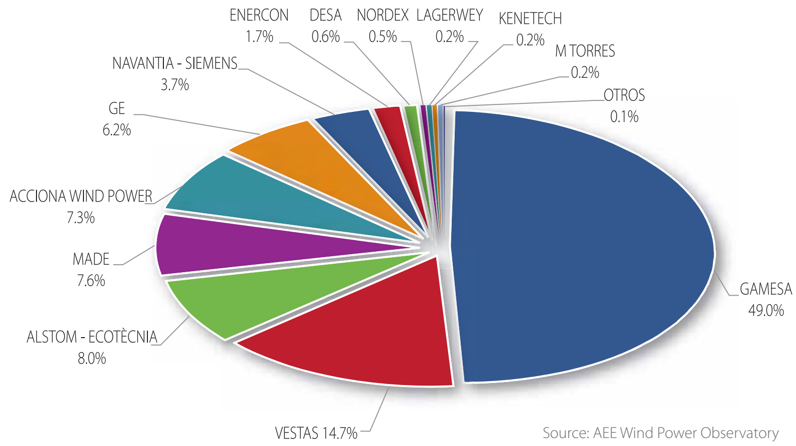
PLANT OWNER	CAPACITY IN 2008 (MW)	% out of total
ECYR	321.50	20%
IBERDROLA	305.10	19%
EyRA	213.68	13%
EOLIA RENOVABLES	141.10	9%
GAMESA ENERGÍA	107.50	7%
NEO ENERGÍA	75.05	5%
INVERDUERO	52.03	3%
FERGO VALICIA VENTO, S.L.	49.40	3%
EÓLICA DE NAVARRA	40.80	3%
ELECDEY	30.40	2%
EUFER	28.80	2%
ACCIONA	27.00	2%
PROASEGO	20.00	1%
OTHERS	196.76	12%
TOTAL IN 2008 (MW)	**1,609.11**	**100%**

Source: AEE Wind Power Observatory

In the plant ownership ranking, Iberdrola Renovables maintains its ead with a cumulative capacity of 4,602-35 MW

An overall slowdown is noticeable in big corporation acquisitions of developers and wind plants to swell portfolios. Still, there were some noticeable transactions, such as **RWE's acquisition of Urvasco** and FCC's entry into the wind sector with the purchase of Babcock & Brown's Spanish wind assets and affiliate, Olivento.

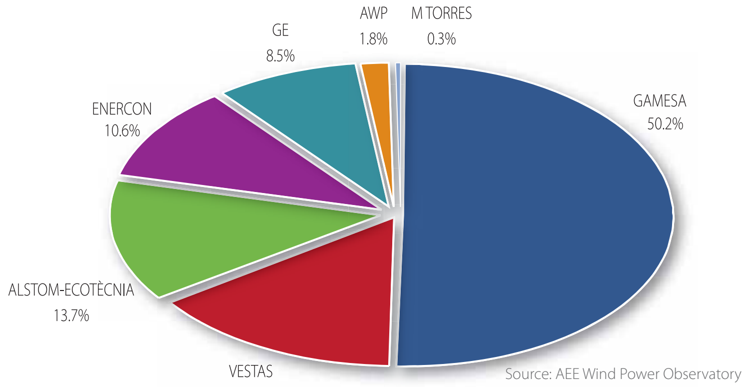
Graph III.11. Manufacturer share of cumulative installed wind capacity to end-2008



Regarding manufacturers, Gamesa retains its national market lead, while Enercon, previously managing only token presence, suddenly picked up last year.

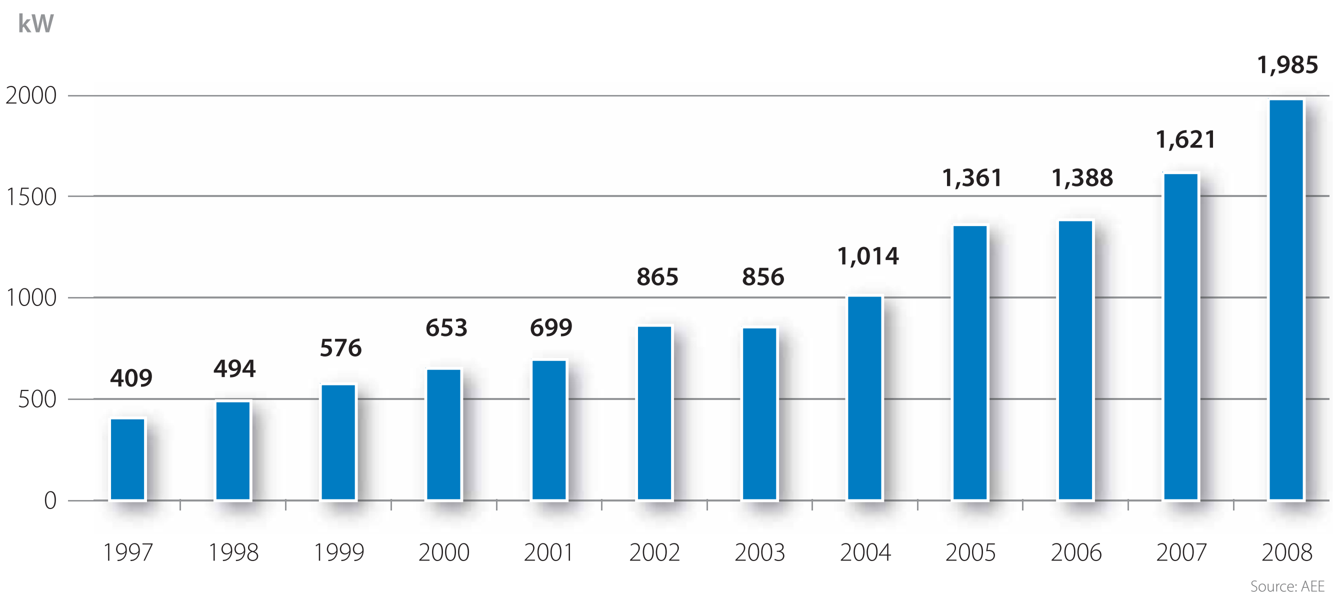
It is important to point out that capacity registered as online is only for plants officially commissioned. Figures from other sources may vary, however, because some manufacturers use different criteria, such as the Provisional Acceptance Certifice (CAP) or simply turbine delivery.

Graph III.12. Manufacturer share of new installed wind capacity over 2008



Gamesa still leads the national market, Enercon´s expansion is to be highlighted

Graph III.13. Average size of wind turbines installed annually 1997-2008

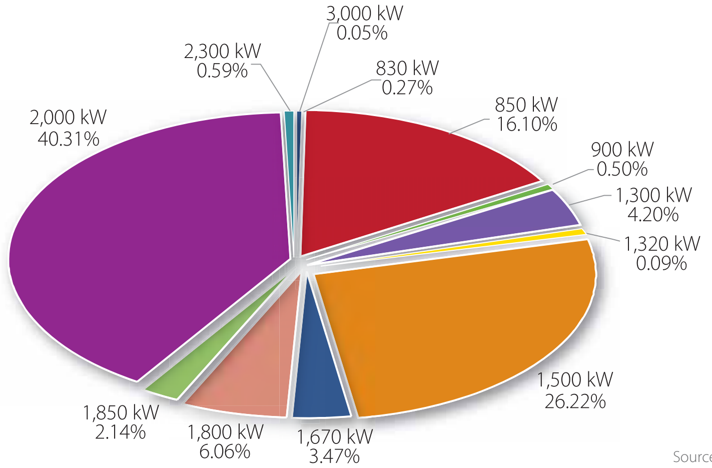


As can be appreciated from the charts, wind turbines installed over 2008 with capacities of 2,000 kW made up 52% of the total, while 3.000 kW machines made up just 3.51%.

The stabilisation of machine size is clearly beneficial from the point of view of product maturity, the optimisation of operational costs and in plant availability.

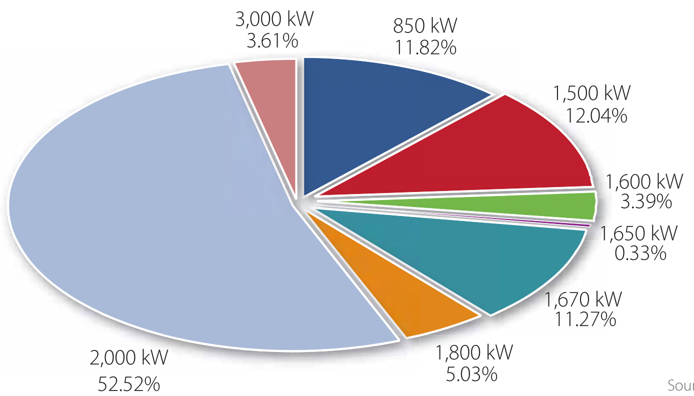
Over 2008, 914 turbines were installed in Spain with an average unit rating of nearly 2 MW (to be exact, 1,985 kW). That is the unit size most traded by those manufacturers with the highest market share. The total number of wind turbines installed by end-2008 was 16,841.

Graph III.14. Size breakdown of wind turbines installed over 2007



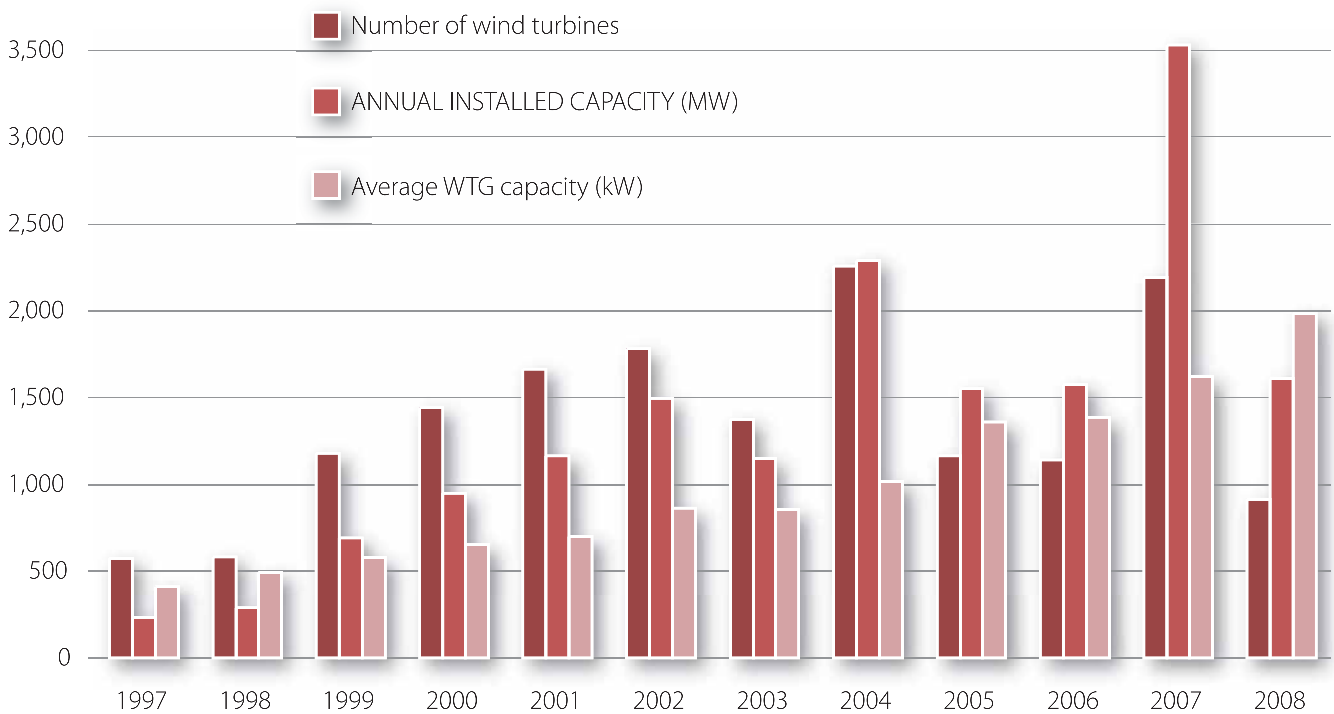
Source: AEE

Graph III.15. Size breakdown of wind turbines installed over 2008



Source: AEE

Graph III.16. Number of wind turbines, average unit capacity and annual installed capacity 1997-2008



Source: AEE Wind Power Observatory

Second part:
the facts and figures

Chapter IV
Generation

Wind now covers 11.5% of demand

In just four years **wind power has doubled its contribution** to covering electricity demand. Against the 16,078 GWh of wind power generation over 2004, last year the figure came in at 31,130 GWh, or 11.5% of mainland electricity demand. That achievement consolidates wind power´s position since 2007 as **Spain's fourth biggest generation technology,** behind only combined cycle gas, coal and nuclear.

The pattern is significant, and especially so given that growth will continue in 2009, not only in absolute terms but also in relative terms. There are two reasons for this: first, production goes up as more capacity is installed and, second, demand is falling, as registered over the first few months of the year (the sag will undoubtedly continue to the end of the year).

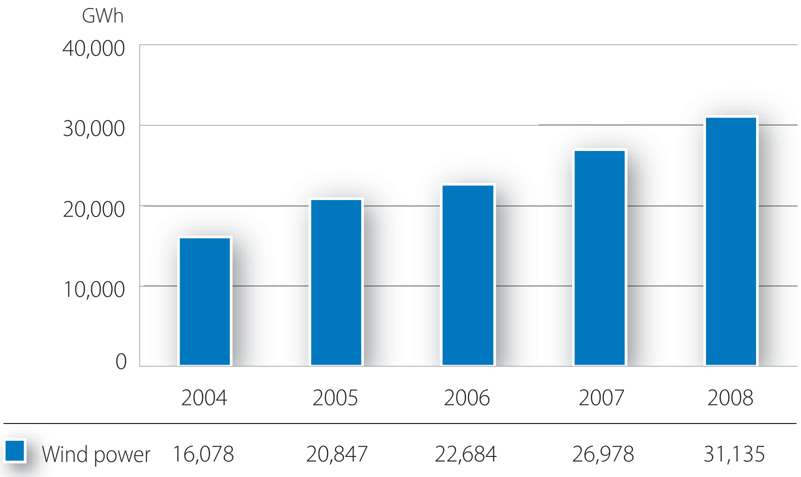
Output over 2008 was 14,6% up on that of 2007. The increase in output was also proportionally higher than the installed capacity growth figure (10.41%). That is because the installed capacity boost in 2007 came mainly in a push during the last few months, meaning plant connection came too late in many cases to make a noticeable difference to overall output for that year.

Regarding **monthly output, April** stands out with nearly 4,000 GWh of production, 140% more than in the previous year. Only for the months of February, May and August did monthly production fall below 2007 figures.

The year 2008 marked **a series of milestones for Spanish wind power.** On March 25, a new record in covering demand was reached, hitting the 40.8% mark, with 9,862 MW in operation. Days before, on the weekend April 21-23, wind power output averaged 28% of demand. The March 23 record was beaten on November 23 when spot wind output reached 43% of demand, with 9,253 MW in operation. Then, on January 22, 2009, a daily output record was reached with 234,060 MWh fed into the system. A maximum spot production record was also reached that day, with 11,159 MW in operation. That record was later beaten when 11,203 MW was reached on March 5.

Cumulative wind output over 2008 was 31,130 GWh, 14.6% up on output over 2007

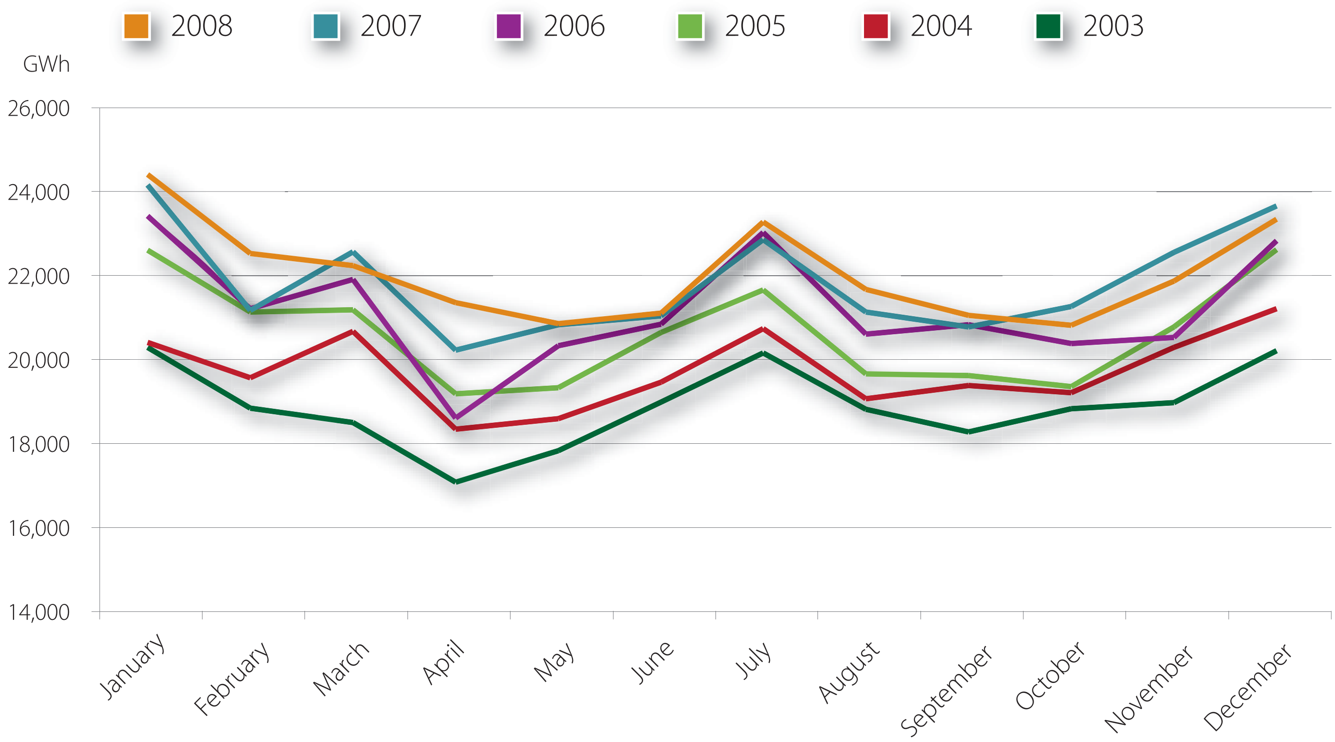
Graph IV.01. Annual wind power production 2004-2008



Source: AEE

Cumulative wind output over 2008 was 31,130 GWh, 14.6% up on output over 2007, while installed capacity was 10.41% up, as indicated in the last chapter. The difference in proportions is undoubtedly due to **the spurt of installed wind capacity towards the end of 2007.** Production from that capacity was only really noted in 2008.

Graph IV.02. Monthly electricity demand in GWh 2003-2008



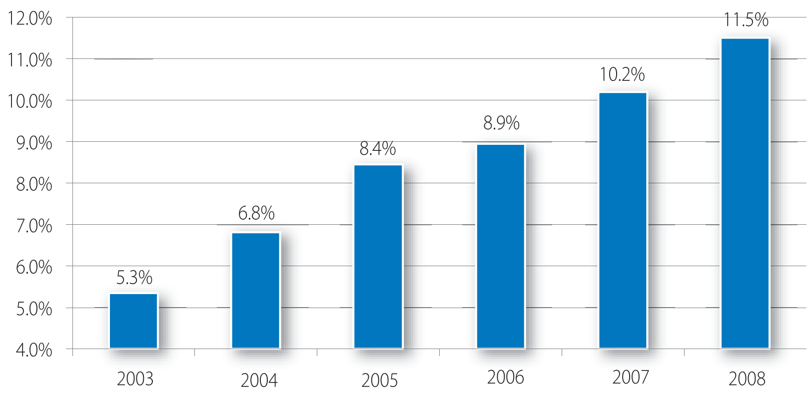
Source: REE

Mainland electricity demand reached **263,961 GWh**, just 1% more than in 2007. Once variables like temperatures and working hours are taken into account, the demand increase is just 0.8%.

Wind power covered 11.5% of electricity demand over 2008. Graph IV.03 illustrates the continuously growing proportion of electricity demand met by wind power over the years. Over 2008, wind power's demand coverage was 1.3% up on the figure for 2007.

Moreover, the proportion of wind power against demand has more than doubled since 2003, growing from 5.3% to 11.5%, as shown in Graph IV.03. That figure underlines the **strong growth** of wind power in the past few years.

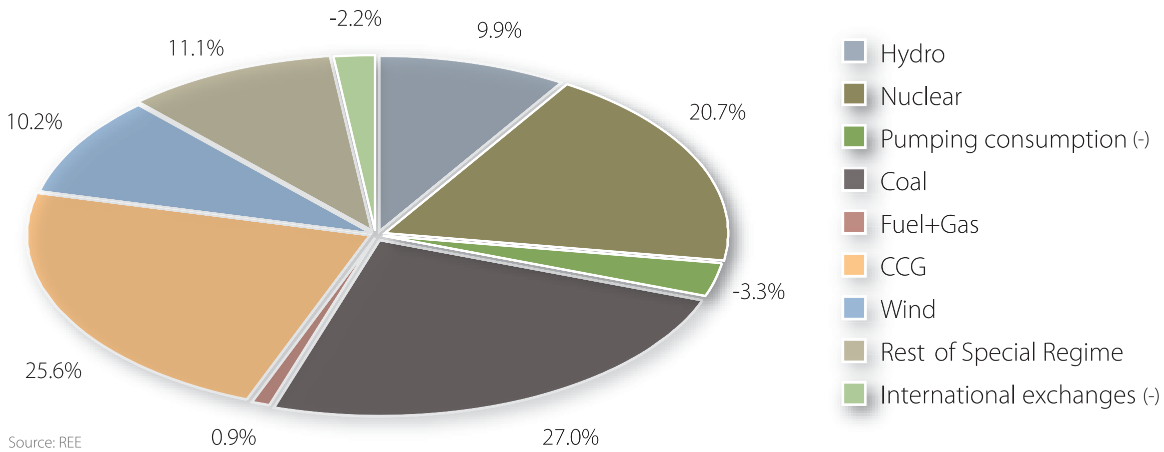
Graph IV.03. Annual wind power production as a proportion of electricity demand 2003-2008



Source: AEE

The proportion of wind power against demand has more than doubled since 2003, growing from 5.3% to 11.5%

Graph IV.04. Penetration of different technologies against demand in 2007



Source: REE

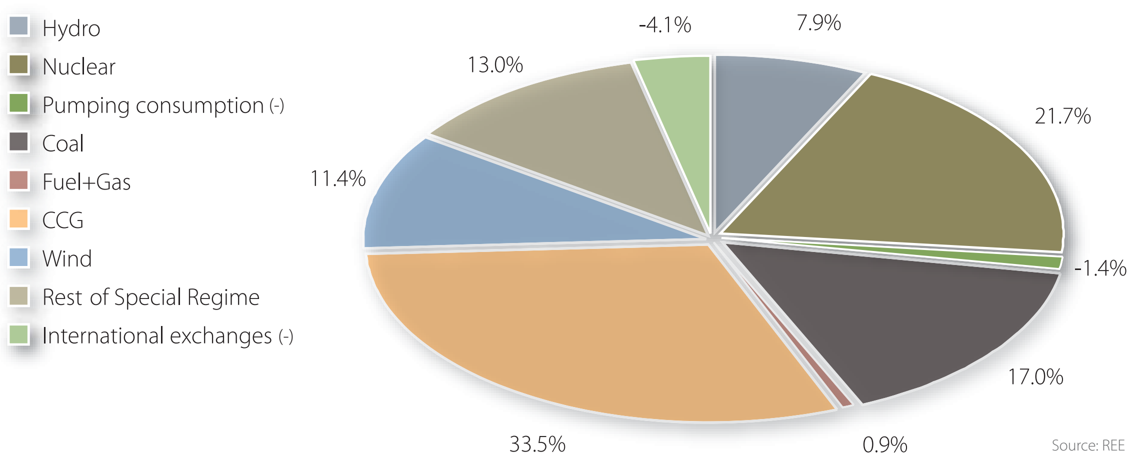
Wind power, the top renewables' generation technology has consolidated its fourth position in Spain's electricity mix

Regarding output from other technologies, combined cycle gas was the top performer covering 33.5% of demand over 2008, up from 25.6% in 2007. Nuclear power comes next meeting 21.7% of demand, 1% up on its coverage over 2007. Coal, the biggest single generator of electricity in 2007, covering 27% of demand in that year, has dropped to third place with just 17% over 2008. The reasons for coal's demise are linked both to its increased costs and to the high prices for emissions, as will be mentioned later.

Wind power, the top renewables' generation technology—has consolidated its fourth position in Spain's electricity mix, with over 11% (in 2007 it reached 10.2%, according to figures from TSO Red Eléctrica de España).

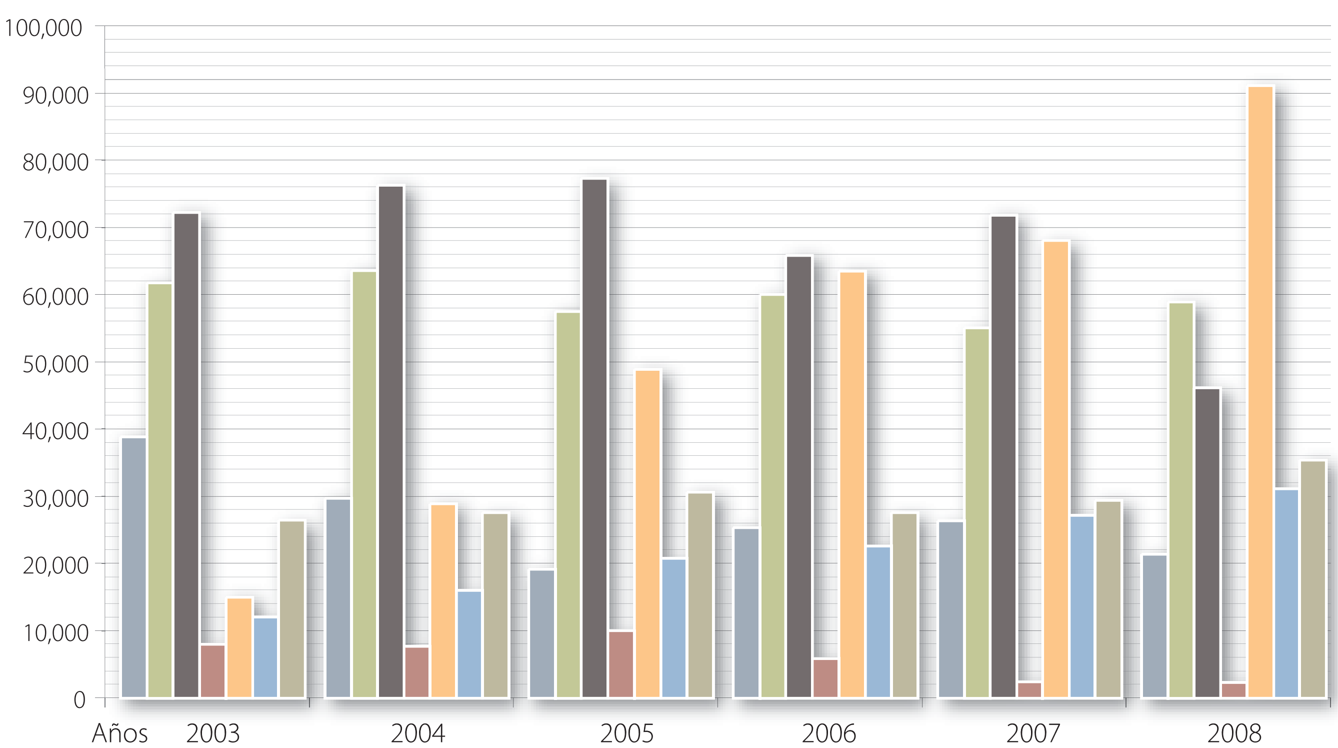
Hydro only covered 7.9% of electricity demand (though water reserves have increased since December 2008), compared with nearly 10% in 2007. Lastly, the contribution of fuel + gas generation to the mix remains low at 0.9% both years.

Graph IV.05. Penetration of different technologies against demand in 2008



Source: REE

Graph IV.06. Annual generation by different technologies 2003-2008

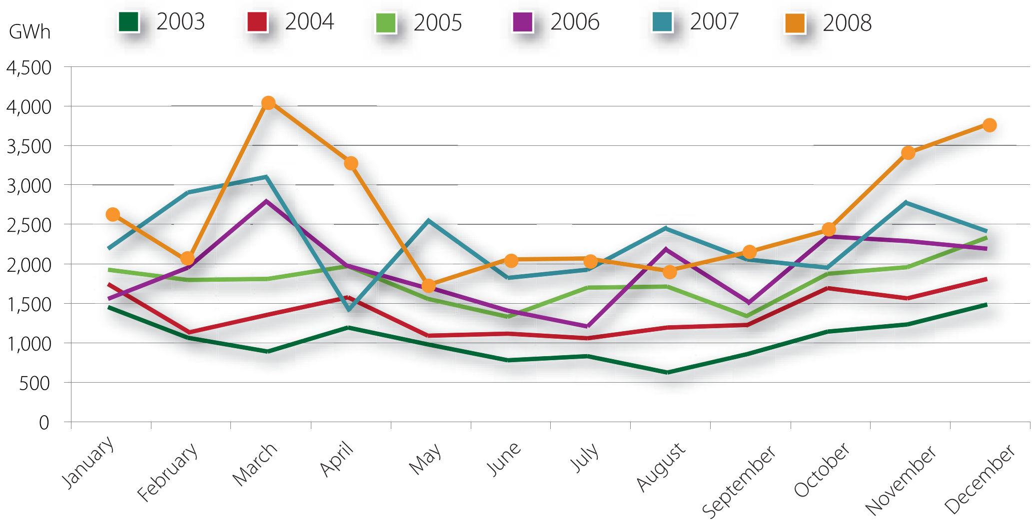


Source: AEE and REE

Regarding annual generation by the different technologies, **combined cycle gas and wind are the ones with the fastest growing penetration. At the other end of the scale, coal-fired generation penetration** has been diminishing since 2005, mainly due to the Kyoto Protocol and the start of a market for emissions' credits, which means coal (the technology producing most Greenhouse Gas emissions) has experimented cost increases. Consequently, coal is increasingly substituted by combined cycle gas, reducing its share in the electricity mix.

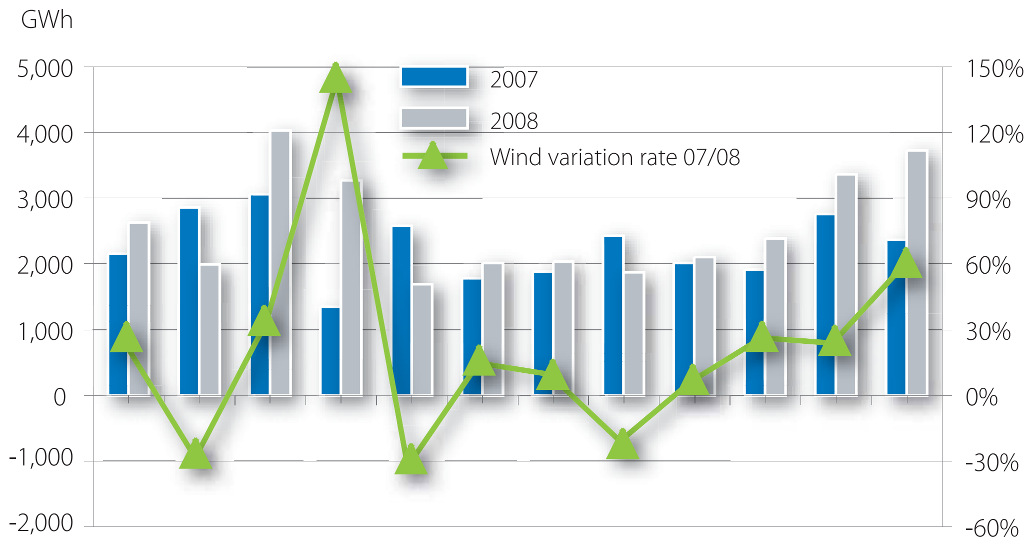
Coal-fired generation has been diminishing since 2005

Graph IV.07. Monthly wind power generation 2003-2008



Source: AEE and REE

Graph IV.08. Monthly wind power generation and variation rate 2007-2008

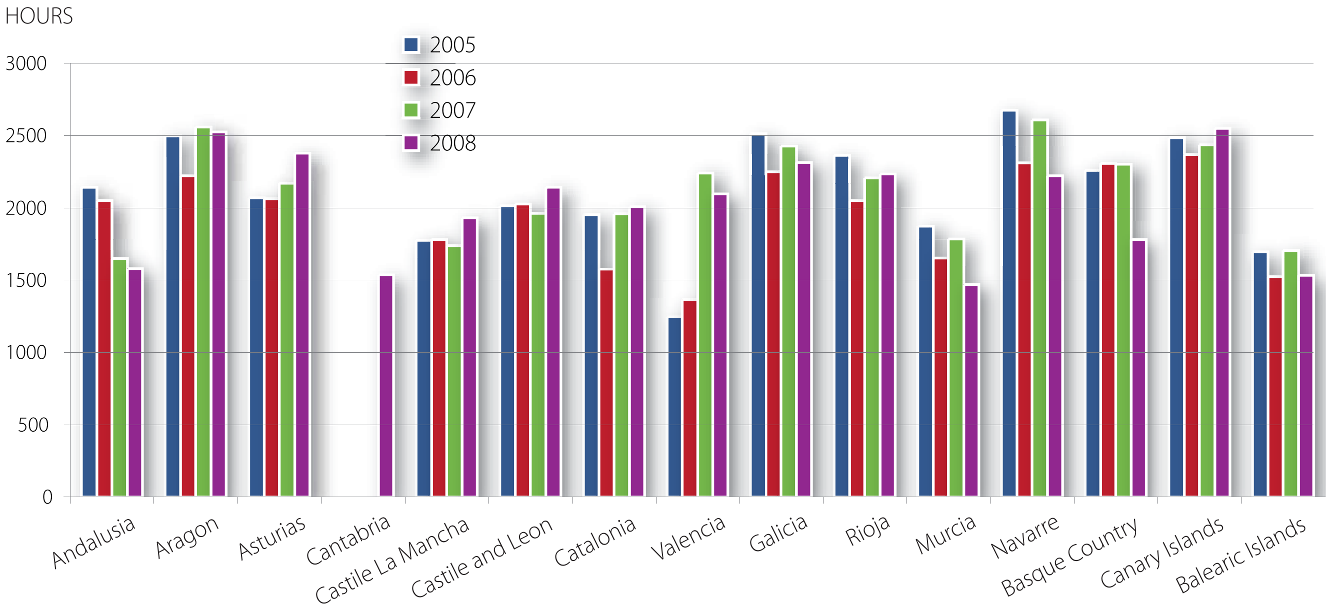


Source: AEE and REE

Analysing the monthly pattern of wind output over 2008, and comparing it with that of the previous year, April stands out as a month of extraordinary production, with a 140% growth against the same month in 2007. Monthly production only fell below 2007 levels in February (partly due to 2007 being a leap year), May and August and while the growth rate was below 6% in September, for the remaining eight months it was above 11%.

April 2008 stands out as a month of extraordinary production, with a 140% growth against the same month in 2007

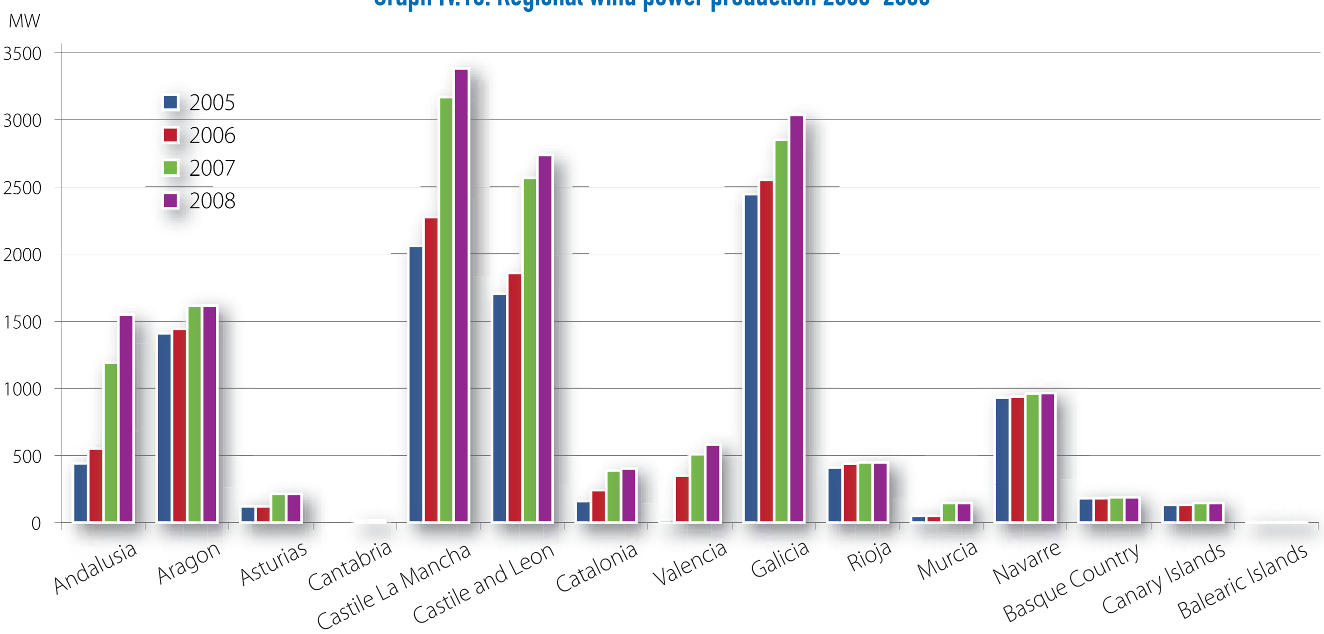
Graph IV.09. Regional running hours 2005–2008



Source: CNE and AEE

Graph IV.09 shows the capacity factor for each region expressed as annual production equivalent to the number of hours wind plants operate at full nominal capacity. Notably, **Andalusia's** capacity factor has fallen in recent years due, mainly, to the significant increase in installed capacity, growing from 550 MW by end-2006 to nearly 1,800 MW by end-2008.

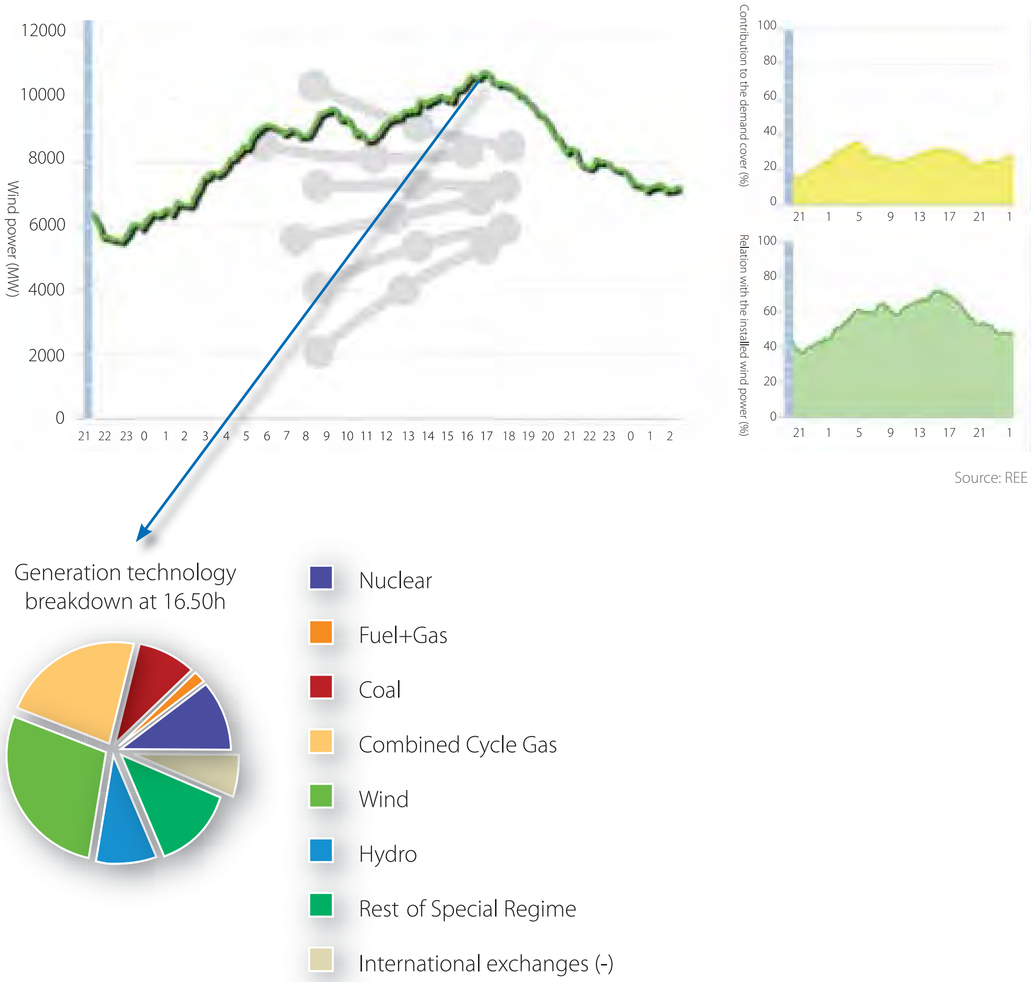
Graph IV.10. Regional wind power production 2005-2008



Source: CNE and AEE

Graph IV.10 shows annual wind power generation in each autonomous region 2005-2008. Output in some regions, like Galicia, Navarre or Rioja, has remained mainly steady. Nevertheless, other regions, like Castile La Mancha and Castile and Leon have practically doubled annual production, with generation touching 6,000 GWh.

Graph IV.11. Wind power demand coverage and capacity factor
The April 18 2008 milestone: 10,879 MW simultaneous production



Source: REE

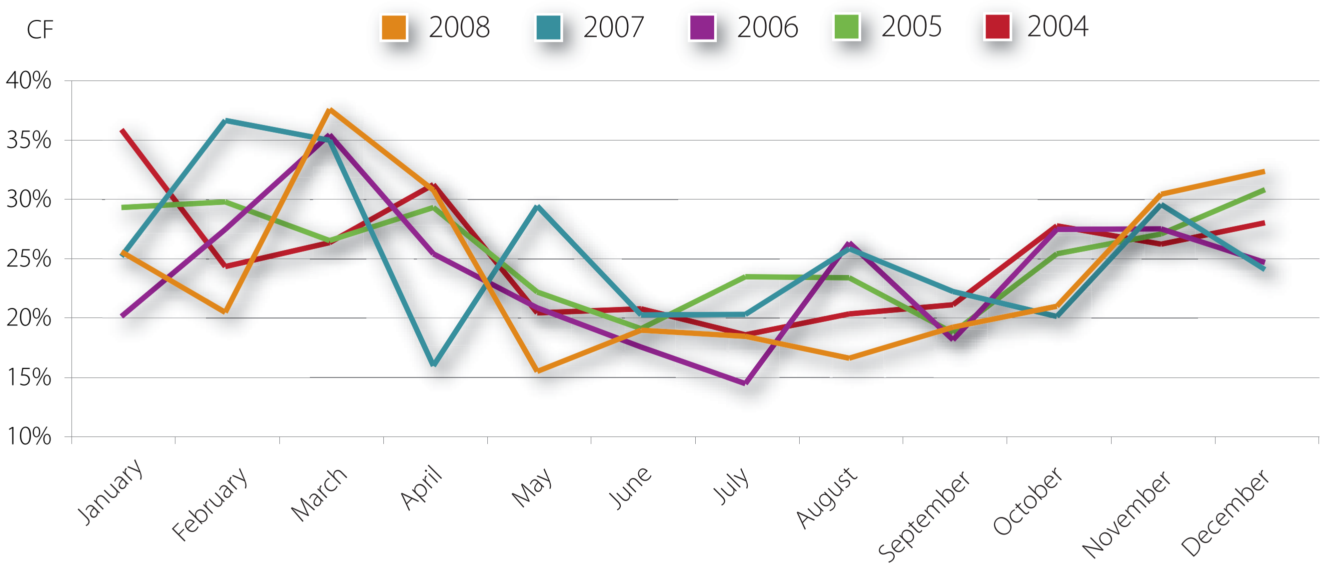
On various occasions throughout 2008, wind power topped its owns **records in simultaneous peak production, maximum hourly production and maximum daily production.** On April 18, a spot peak of 10,879 MW was registered, with 10,879 MW producing simultaneously at 17.00h, covering 32% of demand and marking a spot capacity factor of 72%, according to information from TSO, Red Eléctrica de España. With 213,169 MWh of production, wind covered 28.2% of electricity demand that day.

On 24 November, at 04.47h, 43% of electricity demand was covered by wind power; a penetration level inconceivable just months earlier.

The average capacity factor of wind power dropped slightly over 2008 against the previous year. In accordance with REE's monthly installed capacity figures, wind power's average capacity factor was below 24%, illustrating the increased volume of new installed capacity at sites with lower winds. Nevertheless, the concentration of new plant execution towards the end of the year masked that effect.

On 24 November, at 04.47h, 43% of electricity demand was covered by wind power

Graph IV.12. WIND – Monthly capacity factor 2004-2008

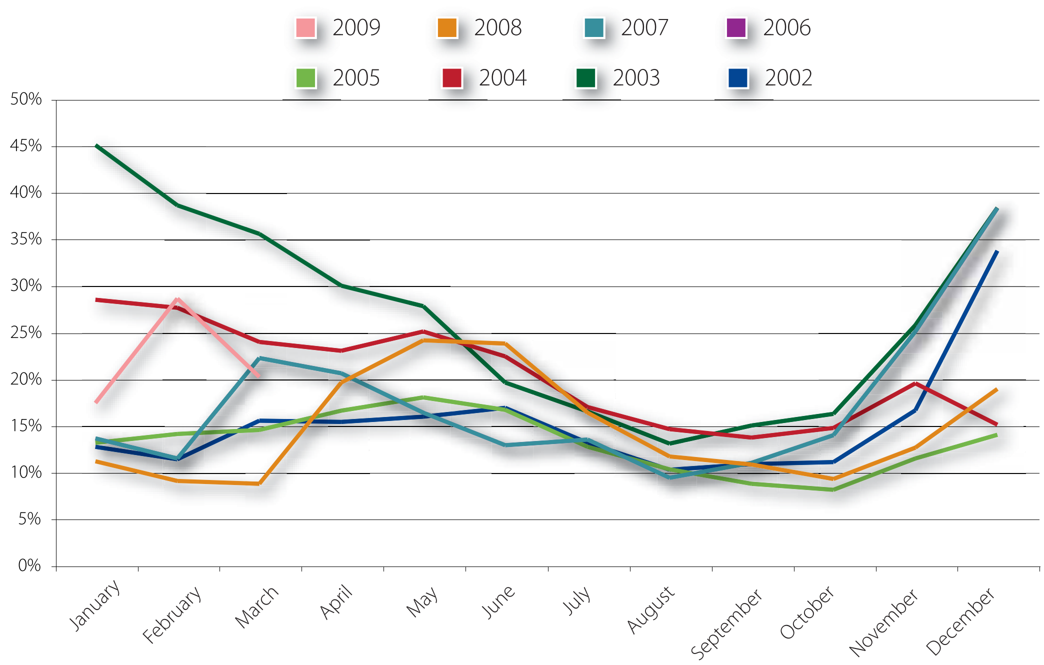


Source: AEE and REE

Graph IV.12 shows the average monthly capacity factor for the last five years. As can be seen, there is a slight reduction during the summer months, when the figure touches around 20%.

Nevertheless, the seasonal variation of wind power is less pronounced than in the case, for example, of hydro power, as can be seen in both graphs (V.12 and IV.13).

Graph IV.13. HYDRO – Monthly capacity factor 2004-2008

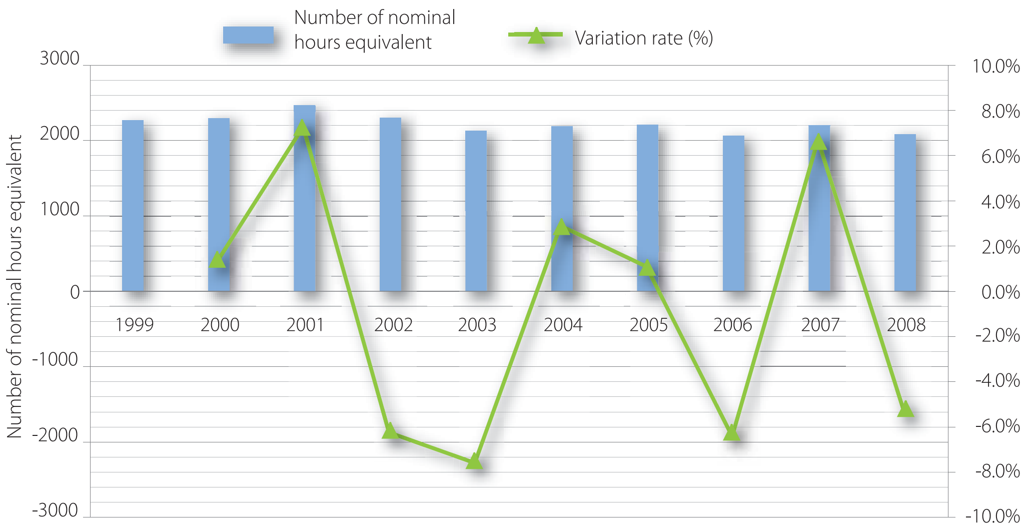


Source: AEE and REE

The graph representing monthly capacity factor of hydro power illustrates the seasonal variation of that technology

The graph representing monthly capacity factor of hydro power illustrates the seasonal variation of that technology. In those years when hydro production is high, such as in 2003, the capacity factor falls in the summer months, producing a higher seasonal variation than in the case of wind power.

Graph IV.14. Average annual production in nominal hours equivalent and variation rate 1999-2008



Source: AEE and REE

Despite the big increase in wind production in the months of March, April, October, November and December, the average number of production hours equivalent to nominal capacity was 2,085, about 5% lower than the previous year. That figure does not completely reflect sector reality, given that it depends very much also on the installed capacity inaugurated in the last months of the year. In other words, the existing installed capacity at the end of the year is divided by the power generated over that year. If a lot of capacity is inaugurated in November and December, that distorts the calculation of operational hours.

Spain´s average number of production hours was 2,085 hours


EURO GRUAS

Second part: the facts and figures

Chapter V
Retribution and returns

Wind power on the market

As stated in the Royal Decree 661/2007, there are **two pay schemes** for wind power. One scheme is the feed-in tariff; in other words a mandated fixed price for wind generation, regardless of programming periods. The other is a market mechanism, whereby the final price is the combination of the pool price, freely negotiated by the operator or broker, with a production incentive that varies in accordance with the pool price.

The price of wind power sold on the wholesale market depends largely on the pool price. Over 2008, **the average daily pool price was €64.43 / MWh,** 64% up on the 2007 price (€39.35 / MWh), the highest registered to date. Monthly prices over 2008 were above **€55 / MWh,** topping all previous average annual prices and matching levels in France, Holland and Germany.

The publication of Order ITC/3860/2007, on December 28, established a consumer price index (IPC in its Spanish acronym) of 360 basis points for adjusting the feed-in tariff and the production incentive, together with the cap and floor across Spain's electricity Special Regime (renewables, cogeneration and other distributed or efficient power sources) placing the **feed-in tariff for 2008 at €75.681 / MWh,** 3.35% higher than in 2007. The base production incentive was €30.272 / MWh. The floor and cap of the final price were set at €73.663 / MWh and €87.790 / MWh, respectively. The mandated purchase price set for the fixed-tariff within Royal Decree 661/2007 is 9.8% below the price envisaged for 2008 in the Royal Decree 436/2004.

Practically all Spanish wind power is traded under the market mechanism. This is because the average annual purchase price achieved on the market under RD 661/2007 (pool price plus incentive) was €85.94 / MWh against €75.68 under the feed-in tariff, a 12% difference. Under the market option, the incentive was close to its upper cap (65.3%) for most production hours.

The 2009 tendency is a 3.30% increase in the 2008 levels. That is in accordance with Order ITC/3801/2008, of December 26, which adjusts electricity tariffs as of January 1, 2009, setting an IPC of 355.6 basis points for the feed-in tariff, production incentive and the floor and cap.

Table V.01. Parameters establishing wind power purchase price under Royal Decree 661/2007 2007-2009

RD 661/2007	Units: €/MWh	2007	2008	2009
	Feed-in tariff	73.228	75.681	78.183
	Reference incentive	29.291	30.272	31.273
	Cap	84.944	87.790	90.692
	Floor	71.275	73.663	76.098
	CPI		3.60%	3.56%
	X Factor		0.25%	0.25%

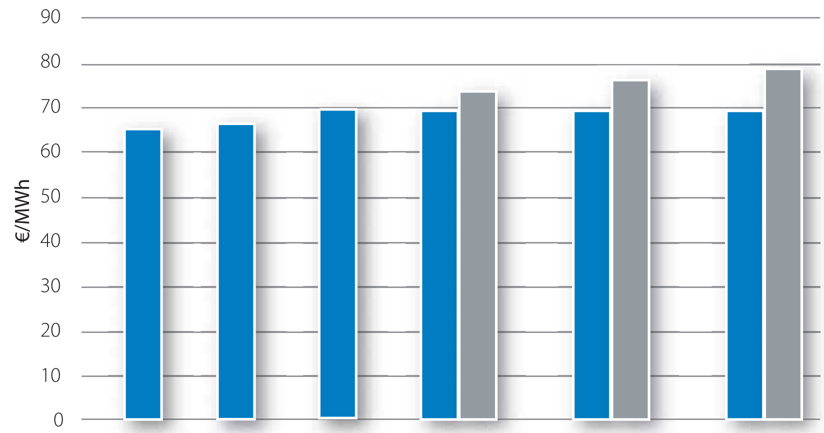
Source: AEE

The First Transitory Disposition of Royal Decree 661/2007 rules that operators of wind plants with the final commissioning certificate issued **before January 1, 2008**, receive transitory status. Then, before January 1, 2009, those operators must choose between one of two options laid out in article 22.1 of Royal Decree 436/2004, with no chance of changing after that.

If an operator chooses the feed-in tariff option (option A), that option will apply for the **remaining life of the plant**. If the market option is chosen (option B), the operator is entitled to the incentives established in RD 436/2004 until December 31, 2012. Any extension to the plant in question will automatically operate under the RD 661/2007 rules.

Nevertheless, plants holding the final commissioning certificate issued before January 1, 2008, were entitled to opt fully for **RD 661/2007** before January 1, 2009. Once switched to the new RD, plants **may not switch back** to the transitory status, as described in the First Transitory Disposition of RD 661/2007.

Graph V.01. Feed-in tariff rates 2004-2008



	2004	2005	2006	2007	2008	2009
Fixed tariff RD 436/2004 (90% of Average Electricity Sector Tariff)	64.86	65.97	68.93	68.93	68.93	68.93
Fixed tariff RD 661/2007				73.228	75.681	78.18

Source: AEE

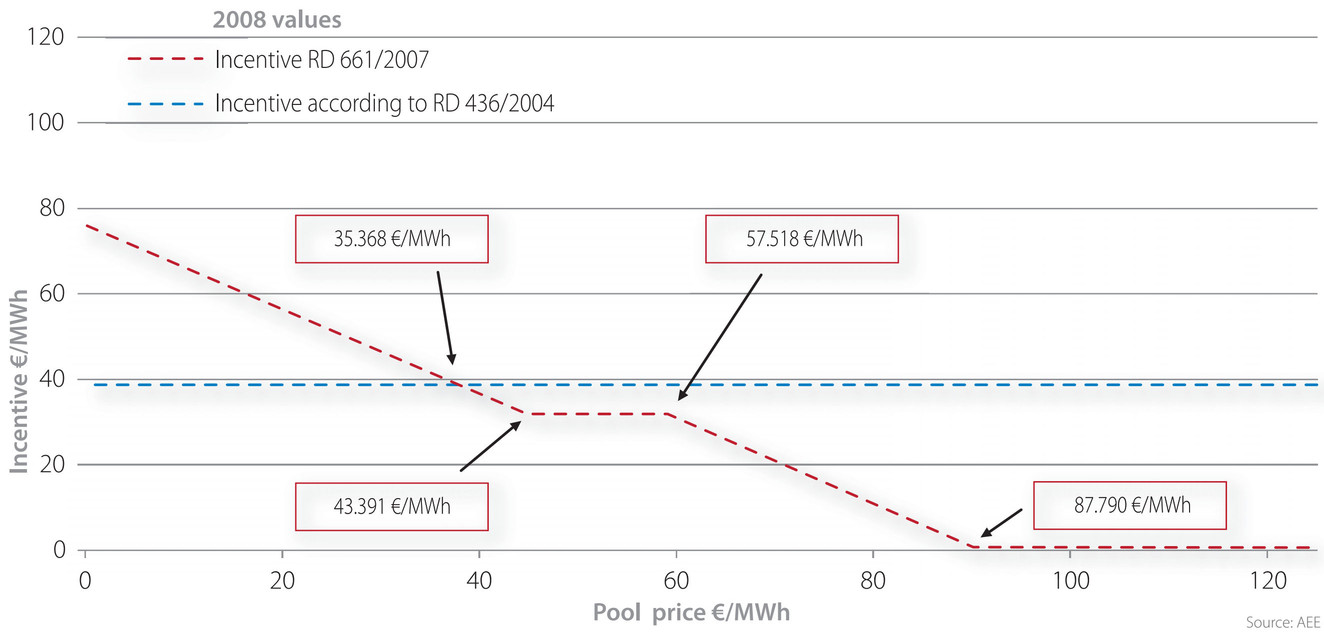
Graph V.01 shows the varying feed-in tariff rates since RD 436/2004 came into force. That tariff was based on a percentage band (80-90%) of the Average Electricity Sector Tariff (TMR in its Spanish acronym). Within that band, the exact percentage also depended on the year of plant commissioning.

Then, in 2007, RD 661/2007 set a feed-in tariff to be **renewed in line with the Consumer Price Index,** with a correction factor of 25 basis points, up to December 31, 2012, and 50 basis points thereafter.

Comparing the fixed tariff during 2008 under RD 436/2004 terms and RD 661/2007 terms, returns under the latter were 9.8% higher. Fixed tariff purchases under RD 436/2004 were at the same prices as in 2006.

Comparing the fixed tariff during 2008 under RD 436/2004 terms and RD 661/2007 terms, returns under the latter were 9.8% higher

Graph V.02. Production incentive relation to market pool price 2004-2009

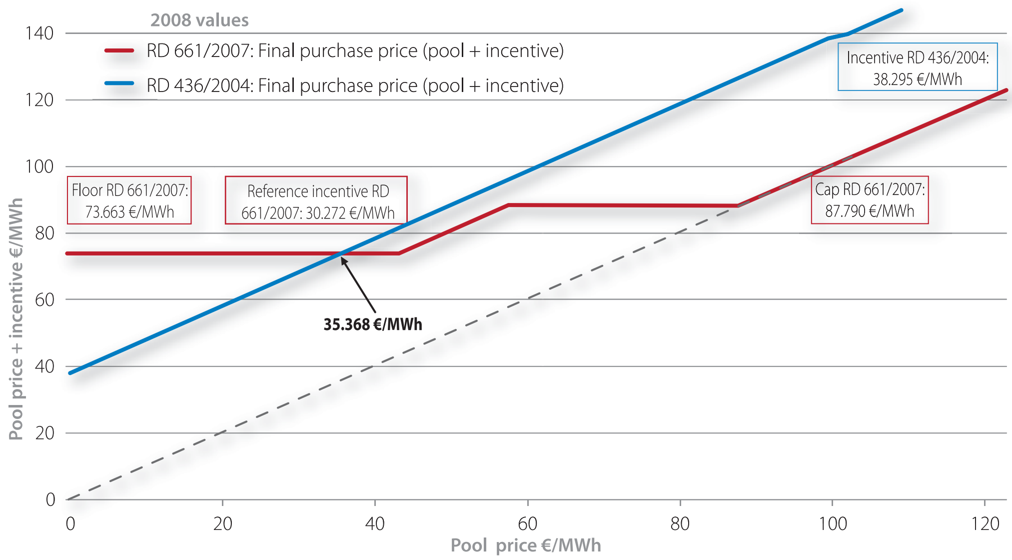


Source: AEE

The production incentive set in Royal Decree 661/2007 varies according to the wholesale electricity market price, or pool price, as illustrated in Graph V.02. The incentive envisioned by the First Transitory Disposition of Royal Decree 661/2007 is constant. If the pool price is below €35.368 / MWh, the incentive set in RD 661/2007 is higher than the one set in the First Transitory Disposition.

In 2008, the daily mean market price was 64.43 € / MWh

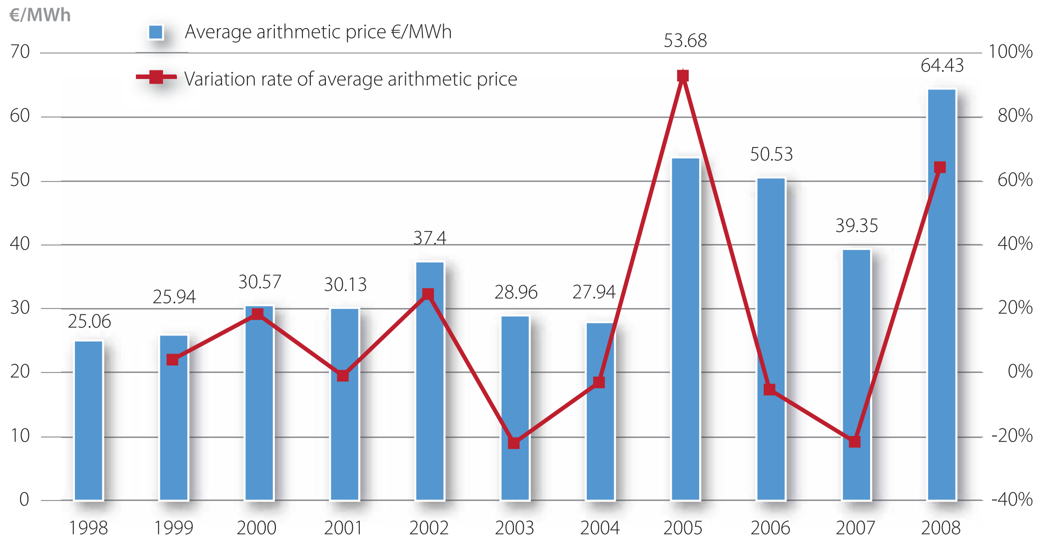
Graph V.03. Final wind power purchase price against pool price 2008



Source: AEE

Wind power purchase prices on the market are illustrated in Graph V.03. As mentioned earlier, in the case of RD 661/2007, that price is the sum of the going price on the daily wholesale electricity market plus the production incentive, within the band of a floor and cap.

Graph V.04. Annual daily electricity pool price and variation rate 1998-2008

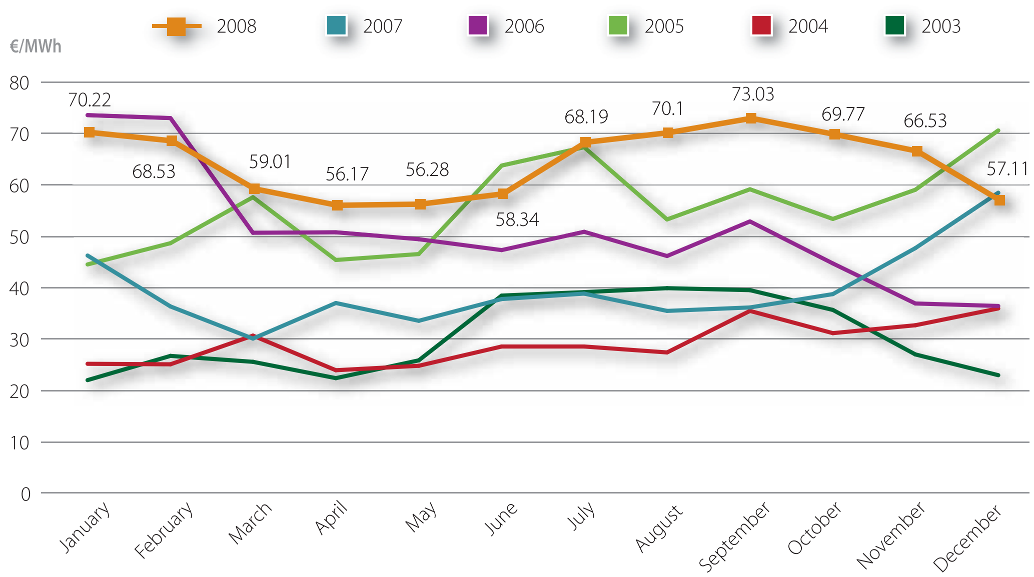


Source: OMEL and AEE

The key factor for operators selling wind power on the wholesale market is the market price itself. The average daily market price over 2008 was €64.43 / MWh, **64% up on 2007** (€39.35 / MWh). While that does not present the market's biggest ever price variation it does mark the highest price registered.

The reason for that price increase is the hike in natural gas costs—generally dictated by combined cycle gas generators—together with the high price of CO_2 emission rights.

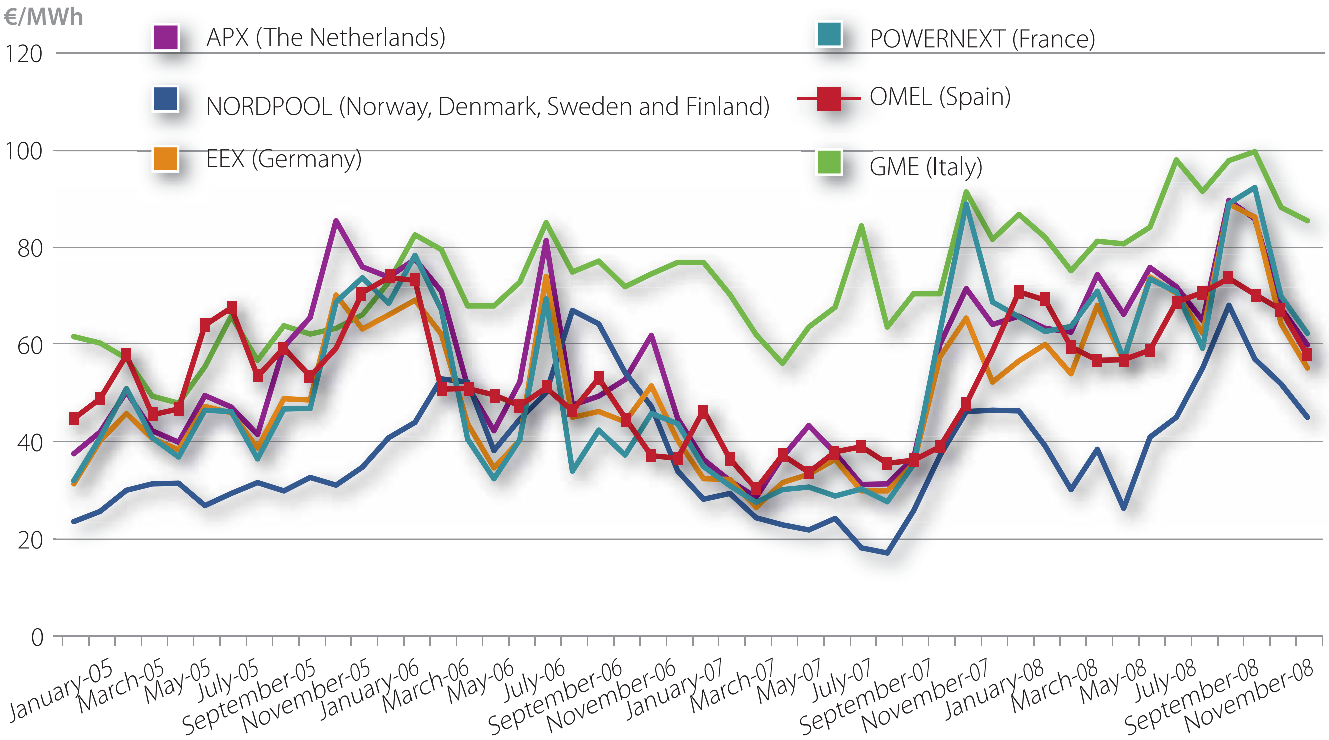
Graph V.05. Daily electricity pool price 2003-2008



Source: OMEL

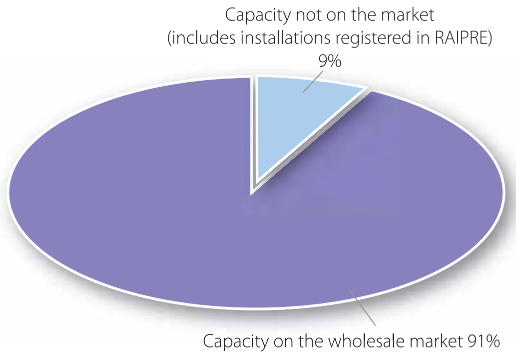
On analysing the daily pool price month by month over 2008, that price is over €55 / MWh for each month. That is a higher figure than the average price achieved over 2007, while prices during the first months of the year were close to 2006 levels, they rose in the final months, reaching levels close to €790 / MWh.

Graph V.06. Price comparison for chief international wholesale electricity markets 2005-2008



Source: OMEL and AEE

Graph V.07. Wind capacity on the wholesale market 2008



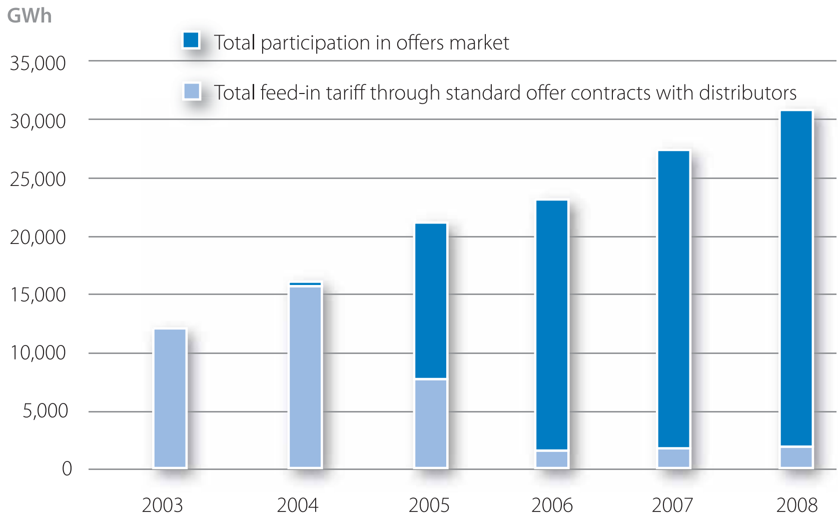
Source: REE

According to REE, only 9% of capacity was operated through the feed-in tariff option

Compared with prices across the chief European wholesale electricity markets, Spanish prices throughout 2008 were at the same level as those of Holland, France and Germany. **Italian prices**, however, were **higher** than the rest.

Currently, all wind power makes offers on the electricity wholesale market de facto. But, according to REE, the national TSO, 9% of capacity was operated through the feed-in tariff option, therefore not affected by the market price. That capacity includes installations with provisional inscription in the Administrative Register of Electricity Production Installations (RAIPRE, in its Spanish form).

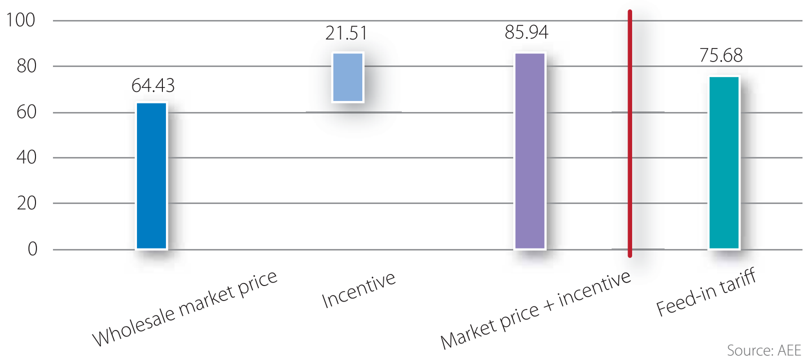
Graph V.08. Chosen pay-scheme options for selling wind power 2003-2008



Source: CNE and AEE

According to data published by regulator CNE, in 2005, operators began selling their wind production through the market offers system—managed by the Operator of the Iberian Energy Market (OMEL)—due to the increase that year in the daily wholesale market price. In 2008, practically all wind power was sold on the wholesale market.

Graph V.09. Comparison between fixed-tariff and market options in 2008, under RD 661/2007



Source: AEE

The incentive of 1st TD (RD 436/2004) was 17 €/KWh higher than under RD 661/2007

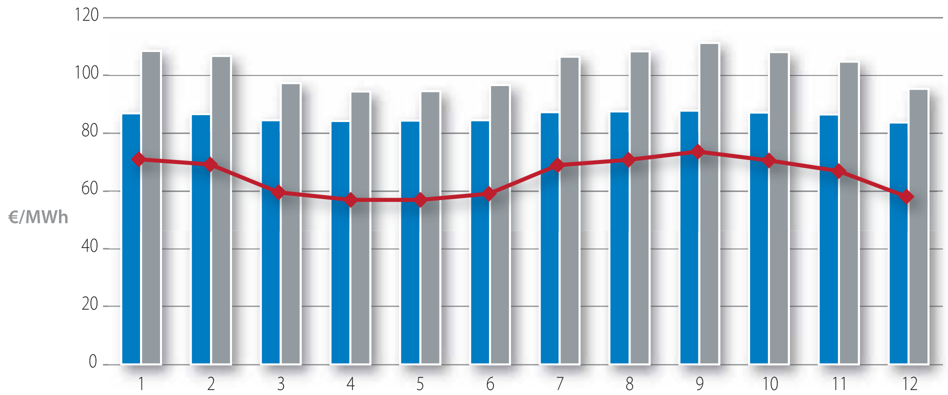
Table V.02. Breakdown of monthly wind power purchase price over 2008 under RD 661/2007 and its 1st Transitory Disposition

Year 2008 (€/MWh)	Average monthly price	Average incentive under RD 661 (monthly calculation)	Average incentive under RD 661 (daily calculation)	POOL + INCENTIVE RD 661/2007	Incentive under RD 436/2004	POOL + INCENTIVE 1ST Transitory Dispostion RD 661/2007	Difference (%)
Jan	70.22	17.57	16.61	86.83	38.29	108.52	-20.0%
Feb	68.53	19.26	18.12	86.64	38.29	106.82	-18.9%
Mar	59.01	28.78	25.55	84.55	38.29	97.30	-13.1%
Apr	56.18	30.27	28.05	84.23	38.29	94.47	-10.8%
May	56.28	30.27	28.14	84.42	38.29	94.58	-10.7%
Jun	58.34	29.45	26.23	84.56	38.29	96.63	-12.5%
Jul	68.19	19.60	19.06	87.25	38.29	106.48	-18.1%
Aug	70.10	17.69	17.47	87.58	38.29	108.40	-19.2%
Sept	73.03	14.76	14.83	87.86	38.29	111.32	-21.1%
Oct	69.77	18.02	17.44	87.21	38.29	108.06	-19.3%
Nov	66.53	21.26	19.92	86.45	38.29	104.83	-17.5%
Dec	57.11	30.27	26.63	83.74	38.29	95.40	-12.2%
2008 period	**64.43**	**23.10**	**21.51**	**85.94**	**38.29**	**102.73**	**-16.3%**

Source: AEE

The purchase price achieved on the market under straight RD 661/2007 conditions was approximately 17% lower than the price achieved under the First Transitory Disposition of that same Royal Decree (which, in effect, are the conditions of RD 436/2004).

Graph V.10. Breakdown of monthly wind power purchase price over 2008 through the market option of RD 661/2007 and its 1st Transitory Disposition



	1	2	3	4	5	6	7	8	9	10	11	12
POOL + INCENTIVE RD 661/2007	86.83	86.64	84.55	84.23	84.42	84.56	87.25	87.58	87.86	87.21	86.45	83.74
POOL + INCENTIVE 1ST TD OF RD 661/2007	108.52	106.82	97.30	94.47	94.58	96.63	106.48	108.40	111.32	108.06	104.83	95.40
Average monthly price	70.22	68.53	59.01	56.18	56.28	58.34	68.19	70.10	73.03	69.77	66.53	57.11

Source: AEE

Graph V.10 further illustrates the preceding table (Table V.02), showing the monthly wind power purchase price achieved under RD 661/2007 and under the 1st Transitory Disposition of that same Royal Decree. Those prices are shown against the average daily wholesale electricity market price.

The crimson line shows **the average monthly price on the daily market.** The difference between that line and the vertical bars is the incentive paid under each payment scheme.

According to the price curve of the wholesale electricity market during 2008, the incentive paid to wind generation on the market under the 1st TD of RD 661/2007 (effectively the rates set in RD 436/2004) was higher, throughout the entire period, than the market incentive paid under RD 661/2007 proper.

Table V.03. Breakdown of returns on market over 2008 under RD 661/2007

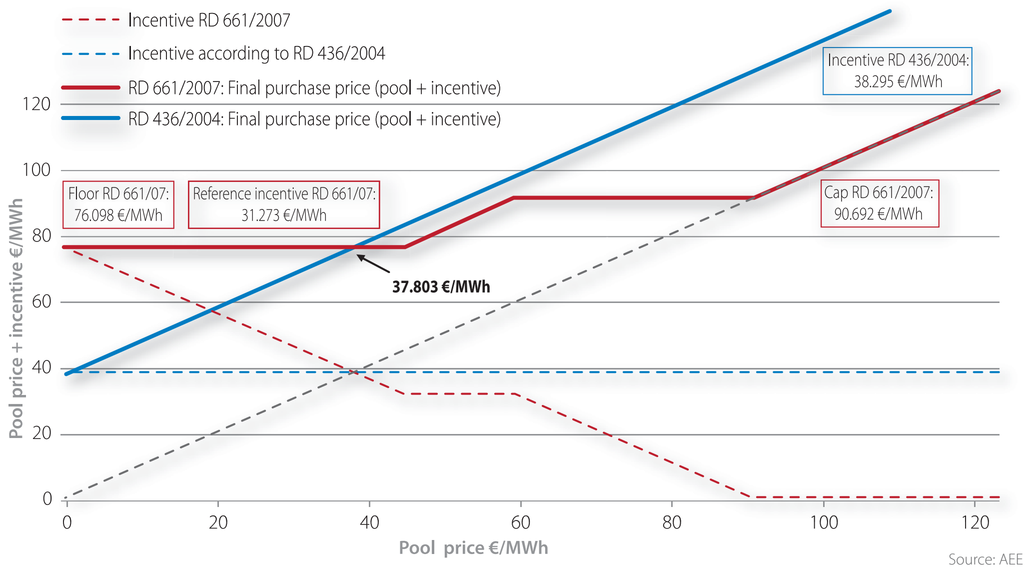
2008	Floor	Incentive constant	Cap	Without incentive
Jan	3.8%	21.4%	64.1%	10.8%
Feb	0.4%	28.3%	62.8%	8.5%
Mar	5.4%	44.5%	49.3%	0.8%
Apr	4.0%	55.3%	40.7%	0.0%
May	3.6%	45.3%	51.1%	0.0%
Jun	4.0%	38.9%	57.1%	0.0%
Jul	0.0%	15.6%	84.0%	0.4%
Aug	0.0%	10.3%	87.9%	1.7%
Sept	0.0%	6.1%	86.4%	7.5%
Oct	2.0%	15.2%	78.3%	4.6%
Nov	4.9%	17.6%	73.8%	3.8%
Dec	13.8%	35.6%	48.1%	2.4%
Average 2008	**3.5%**	**27.8%**	**65.3%**	**3.4%**

Source: AEE

The high wholesale electricity market price meant wind generation only touched the established minimum purchase price floor 3.5% of the time

The average hourly wholesale electricity market price placed the wind power purchase price, for most hours, **at the upper limit, or cap, (65.3% of the time),** while for 27.8% of the number of hours it was within the band of the constant incentive. The high wholesale electricity market price meant wind generation only touched the established minimum purchase price, or floor, for 3.5% of production hours. The zero incentive mark, when the market price is above the wind power price cap—that is to say above €87.79 / MWh—only occurred for 3.4% of the year's operating hours.

Graph V.11. Final wind power purchase price against pool price 2009



Source: AEE

Regarding revised rates as of January 1, 2009, the Order ITC/3801/2008, of December 26 sets a Consumer Price Index (IPC in its Spanish initials) of 355.6 basis points across the feed-in tariff, incentives and floor and cap. The adjustment marks a 3.30% increase on 2008 rates.

Second part: the facts and figures

Chapter VI
Wind power in the world

Germany relinquishes the lead to USA

If wind power has almost doubled its contribution to covering electricity demand in Spain—as mentioned in Chapter IV—we can also state that **world installed wind capacity** has leaped from 47,620 MW in 2004 to **120,798 MW in 2008**; that is 73,178 MW in four years.

Of the 27,051 MW installed across the world in 2008, 87.8% went up in ten countries. **USA** led the way with 8,358 MW of new capacity—22.8% of the total—**a world record for new installed annual wind capacity.**

USA was followed by **China, with 6,300 MW of new capacity**, doubling its cumulative capacity for the fourth year running to reach 12.2 GW by the end 2008. China's lead in Asia is set to continue given that the central government has adopted wind as a key to economic growth. For 2009, cumulative capacity is expected to double again.

In third place came **India**, which installed 1,800 MW of new capacity over 2008, followed by **Germany,** with 1,665 MW. Then comes **Spain,** in fifth place, with 1,609 MW of new wind capacity. In terms of cumulative wind capacity, Spain maintains its second place in Europe and third place in the world, with 16,740 MW up and running by end-2008.

Europe is still the leading world region, with 65,946 MW online, practically **55% of the world's total wind capacity.**

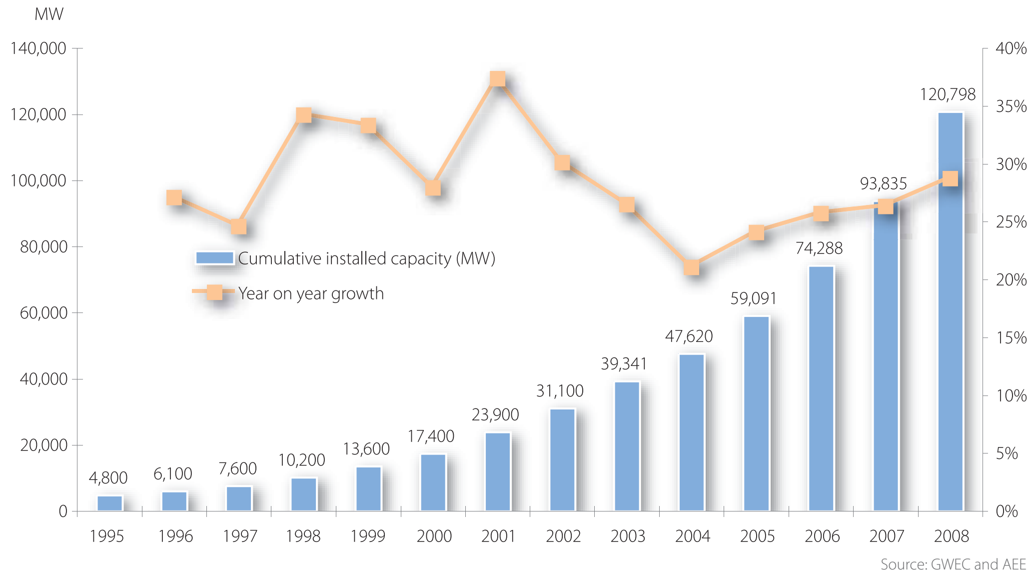
According to data from the European Wind Energy Association (EWEA), wind installed more new capacity than any other generation technology in the European Union over 2008, achieving 8,484 MW over the year, followed by combined cycle gas with 6,932 MW.

Gamesa, Spain's top wind turbine manufacturer, delivered 3,372 MW over 2008, bringing the company's cumulative figure to 16,697 MW. That keeps Gamesa in **third place**, with a 13.7% cumulative share of the world wind turbine market. **Vestas** of Denmark stays in first place with cumulative deliveries totalling 35,000 MW to en-2008. Vestas´ lead is followed by General Electric Wind by **General Electric Wind** (USA), with a cumulative total of 18,218 MW.

Spanish wind developer **Iberdrola Renovables, Acciona Energía and Endesa** are among the world's top operators of wind capacity.

Regarding the **1,471.33 MW of offshore** wind capacity installed in Europe by end-2008, almost 70% went up across Denmark and UK, meaning those two countries maintain their global offshore lead.

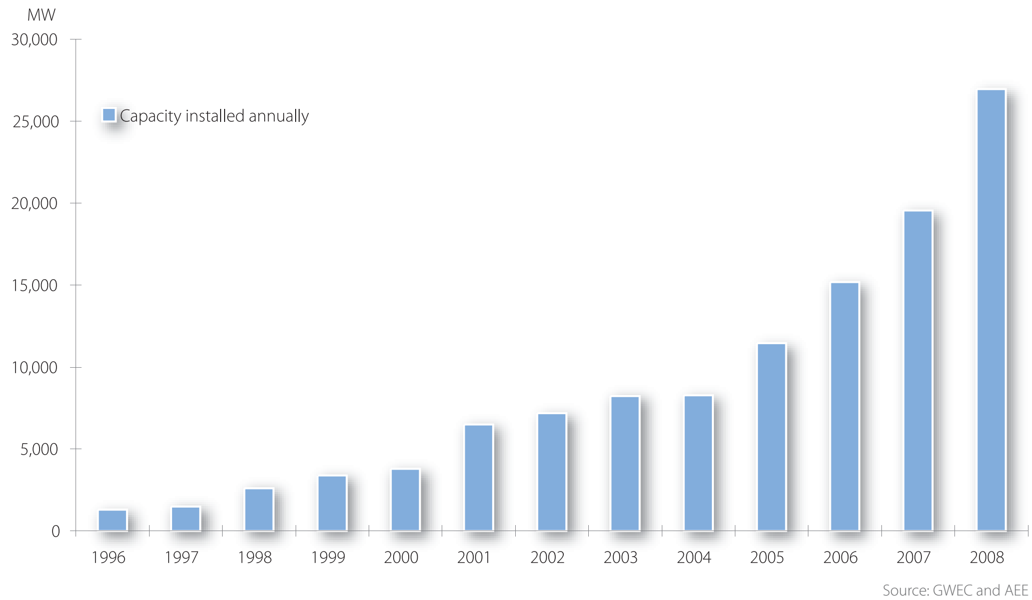
Graph VI.01. Global cumulative capacity and annual growth 1995-2008



Source: GWEC and AEE

Global installed wind capacity reached 120,798 MW by end-2008, according to a report published by the Global Wind Energy Council (GWEC). The figure translates to a **growth rate of 29%,** slightly above the 27% annual growth registered over 2007. That contributed to keeping the growth rate since 2004 on an upward ramp.

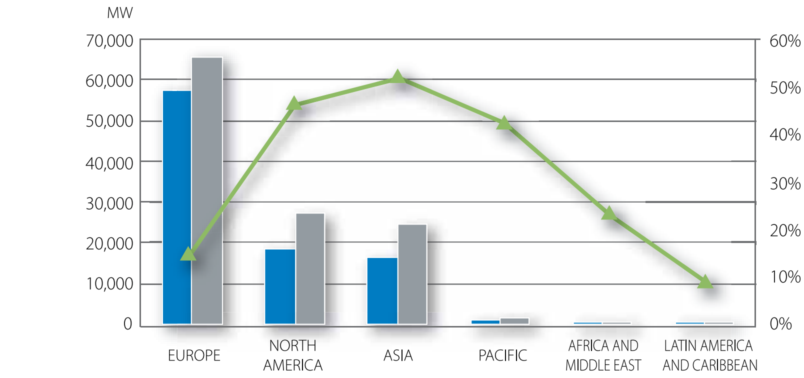
Graph VI.02. Annual global installed capacity 1996-2008



Source: GWEC and AEE

GWEC reports global installed wind capacity reached 120,798 MW by end-2008, a growth rate of 29%

Graph VI.03. Global capacity regionally and growth 2007-2008



	EUROPE	NORTH AMERICA	ASIA	PACIFIC	AFRICA AND MIDDLE EAST	LATIN AMERICA AND CARIBBEAN
To 01/01/2008	57,597	18,670	16,091	1,158	538	578
To 01/01/2009	65,946	27,542	24,368	1,644	669	629
Annual growth	14.5%	47.5%	51.4%	42.0%	24.3%	8.5%

Source: EWEA, GWEC and AEE

Ten countries absorbed 87.8% of new global wind capacity in 2008

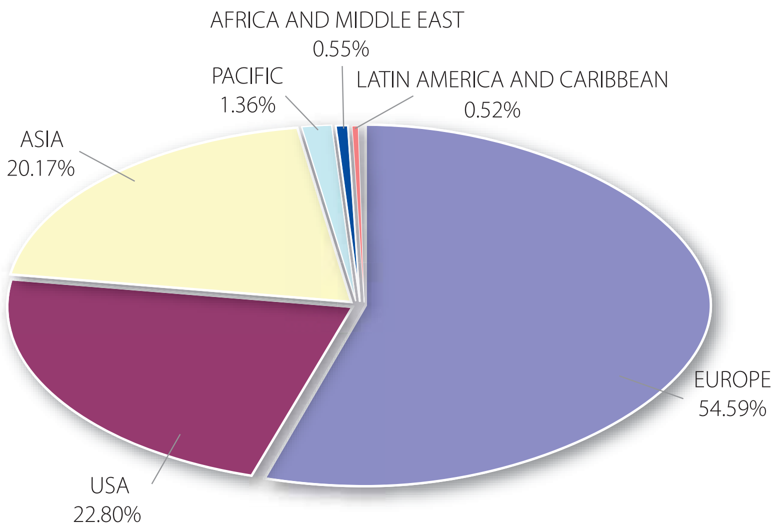
Of the 27,051 MW of new wind capacity over 2008, **87.8 % was installed in just ten countries.** In order of size, starting with the biggest, those markets were: USA (8,358 MW), China (6,300 MW), India (1,800 MW), Germany (1,655 MW), Spain (1,069 MW), Italy (1,010), France (950 MW), UK (836 MW), Portugal (712 MW) and Canada (526 MW).

Globally, **Europe** is still the leading region, with **65,946 MW online**, practically 55% of the world's total installed wind capacity.

USA has broken all annual **world records,** with 8,500 MW of new wind capacity installed over 2008. That brings the country's cumulative total to over 22,000 MW, or 22.8% of the entire world's installed wind capacity.

China doubled its cumulative capacity for the fourth year running, after installing 6,300 MW of new capacity to reach a cumulative total of 12.2 GW by the end 2008. The figures make China the clear leader in the Asia region.

Graph VI.04. Regional breakdown of cumulative global wind capacity to 01/01/2009

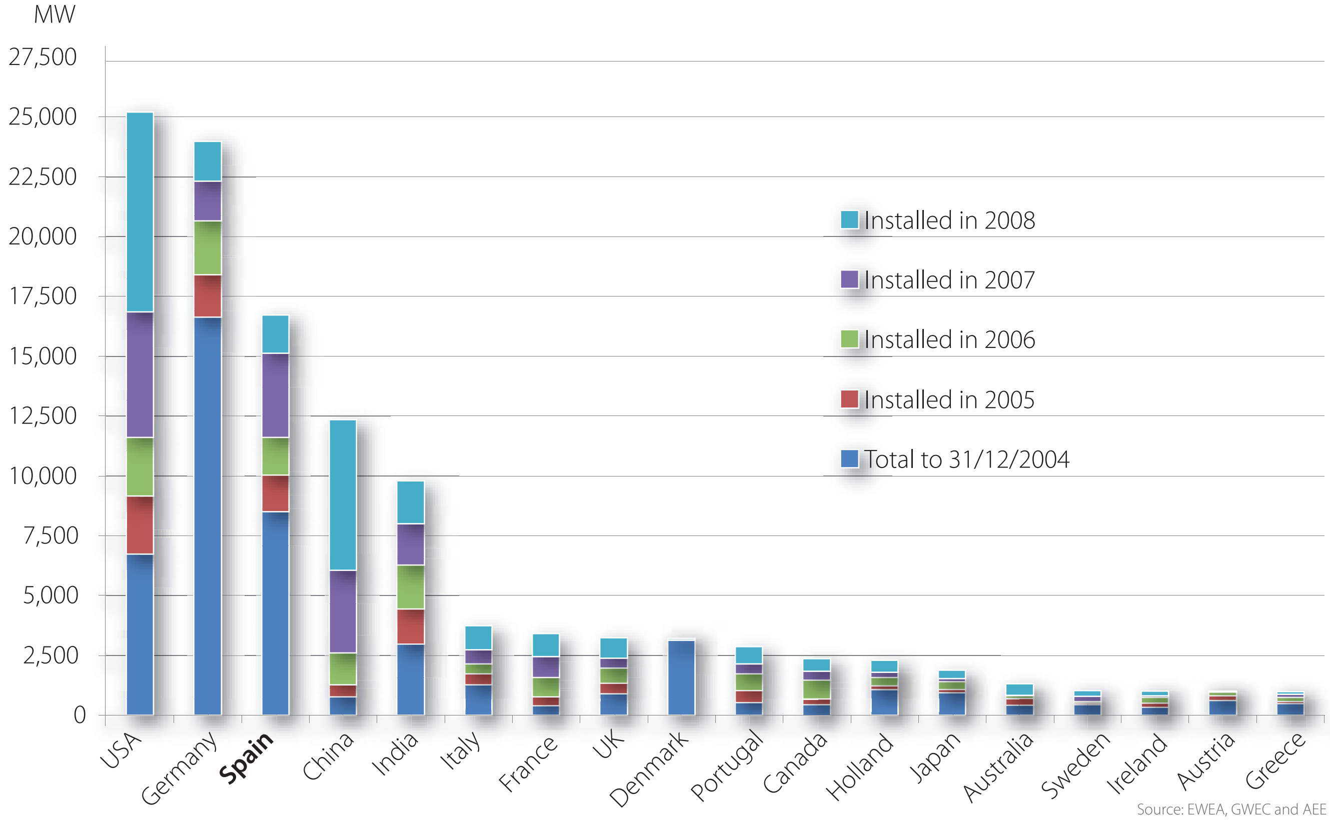


Source: EWEA, GWEC and AEE

In **Latin America, Brazil** was the fastest growing wind market last year with 94 MW of new capacity. At the other end of the scale, Argentina only managed 2 MW, according to GWEC figures.

Africa and the Middle East put up a combined 130 MW last year, 55 MW in **Egypt** and 34 MW in **Tunisia.**

Graph VI.05. Regional breakdown of cumulative global wind capacity 2004-2008



Source: EWEA, GWEC and AEE

Table VI.01. Installed wind capacity in different countries 2007-2008 (MW)

Country	Cumulative to 31/12/2007	Installed in 2008	Cumulative to 31/12/2008	Growth rate 2007/2008	Ranking 31/12/2008
USA	16,824	8,358	25,170	49.6%	1
Germany	22,247	1,665	23,903	7.4%	2
Spain	15,131	1,609	16,740	10.6%	3
China	6,050	6,300	12,210	101.8%	4
India	8,000	1,800	9,645	20.6%	5
Italy	2,726	1,010	3,736	37.1%	6
France	2,454	950	3,404	38.7%	7
UK	2,389	836	3,241	35.7%	8
Denmark	3,125	77	3,180	1.8%	9
Portugal	2,150	712	2,862	33.1%	10
Canada	1,846	526	2,372	28.5%	11
Holland	1,747	500	2,225	27.4%	12
Japan	1,538	356	1,880	22.2%	13
Australia	824	482	1,306	58.5%	14
Sweden	788	236	1,021	29.6%	15
Ireland	805	208	1,002	24.5%	16
Austria	982	14	995	1.3%	17
Greece	871	114	985	13.1%	18

Source: EWEA, GWEC y AEE

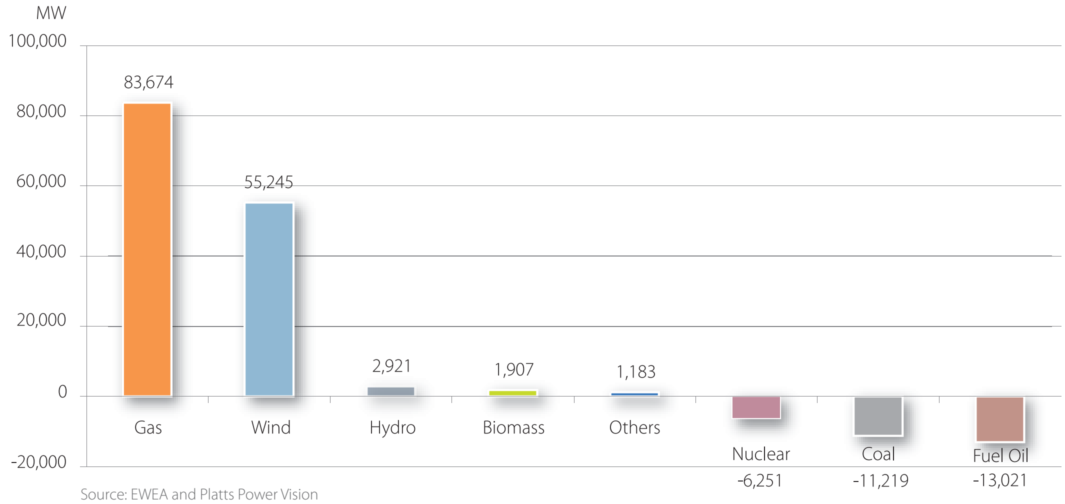
After installing 6,300 MW over 2008, China has surpassed India in installed wind capacity taking fourth place, behind Spain

In terms of national wind markets, **USA ranks first** with 25,170 MW of cumulative capacity after installing 8,358 MW of new capacity in 2008. That achievement relegates Germany to second place, though that country still ranks first in Europe with 23,903 MW online.

With 16,740 MW by end-2008, Spain's online wind market continues ranking second in Europe and third in the world.

After installing 6,300 MW over 2008, China has surpassed India in cumulative installed wind capacity, taking fourth place, behind Spain. **The outlook for the Chinese market is favourable.** Despite the financial crisis, China's central government has declared wind a key to economic growth. For 2009, cumulative capacity is expected to double again.

Graph VI.06. Net installed capacity growth of different technologies in EU 2000-2008

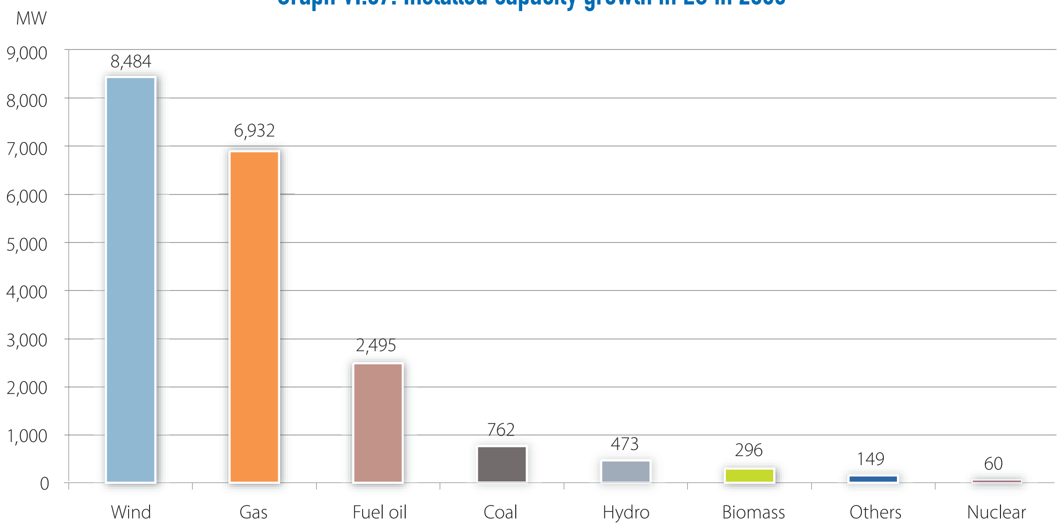


Source: EWEA and Platts Power Vision

Nuclear, coal and fuel have all experienced a cumulative capacity reduction 2000-2008

Among the different European generation technologies, **gas and wind have grown the most** in terms of installed capacity 2000-2008, with 83,674 MW of new gas capacity and 55,245 MW of new wind capacity. In contrast, nuclear, coal and fuel oil are the only three technologies whose installed capacity has fallen over the period.

Graph VI.07. Installed capacity growth in EU in 2008



Source: EWEA and Platts Power Vision

In absolute terms, **wind grew more than any other generation technology across the European Union** in 2008, with 8,484 MW of new installed capacity, according to the European Wind Energy Association (EWEA), followed by gas, with 6,932 MW. Next came fuel oil, with 2,495 MW, even though that technology's capacity has diminished progressively since 2000, as mentioned earlier.

In absolute terms, wind grew more than any other generation technology across the European Union in 2008, with 8,484 MW of new installed capacity

Table VI.02 Country comparative of installed capacity, number of turbines, average size, generation, electricity demand and percentage of demand covered with wind in 2007

COUNTRY	Total Installed wind capacity (MW)	Installed wind capacity offshore (MW)	New annual wind capacity (MW)	Total number of wind turbines (turbines)	Average turbine size (kW)	wind generation (GWh)	Electricity demand (TWh)	Wind power´s coverage of demand* %
Australia	824	0	7	564	2,000	2,526	220.0	1.1%
Austria **	982		17					
Canada	1,845	0	386	1,400	1,320	4,340	***565.0***	0.8%
Denmark	3,124	423	-12	5,212	1,280	7,171	36.0	19.9%
Finland	110	14	24	107	2,160	188	90.0	0.2%
Germany	22,247	7	1,667	19,460	1,888	39,500	617.2	6.4%
Greece	873	0	125	1,118	1,850	2,328	51.0	4.6%
Ireland	803	25	59	686	1,900	1,785	26.0	6.9%
Italy	2,726	2	603	2,943	1,638	4,074	340.0	1.2%
Japan	1,538	11	229	1,331	1,156	2,207	889.4	0.2%
Korea	193	0	18	127	1,417	399	403.1	0.1%
Mexico	85	0	0	0	NA	248	206.7	0.1%
Holland	1,745	108	209	1,847	1,787	3,400	115.6	2.9%
Norway	385	0	60	185	2,727	899	127.0	0.7%
Portugal	2,125	0	427	1,132	1,979	4,036	50.0	8.1%
Spain	15,145	0	3,522	>16.000	1,623	27,026	276.8	9.8%
Suiza	788	133	217	958	1,700	1,429	150.0	1.0%
Switzerland	12	0	0	34	NA	16	58.0	0.0%
UK	2,390	404	427	1,952	2,060	***5,381***	406.0	1.3%
USA	16,904	0	5,329		1,650	48,000	4,800.0	1.0%
Total	**74,844**	**1,127**	**13,315**	**55,056**	**1,773**	**154,953**	**9,428**	**1.64%**

Source: International Energy Agency

Figures in italics and bold are estimates
* *% of national electricity demand from wind = (wind generated electricity/national electricity demand)* * 100
** *Figures from Windpower Monthly*

According to International Energy Agency (IEA) figures, the countries **covering most electricity** demand with wind power during 2007 were **Denmark,** reaching around 20%, and **Spain**, with around 10% (in 2008, the figure was 11,5%), followed by Portugal, with 8.1%, Ireland, with 6.8% and Germany, with 6.4%.

According to the International Energy Agency (IEA), the countries covering most electricity demand with wind power during 2007 were Denmark, Spain and Portugal

Regarding wind turbines, **Gamesa, Spain's top manufacturer,** delivered 3,372 MW over 2008, bringing its cumulative total to 16,697 MW by the end of that year. That kept the company in third place with a 13.7% cumulative share of the world wind turbine market.

Vestas of Denmark, with over 35,000 MW of cumulative installed capacity to its name by end 2008, kept its lead with a 28.7% share of the global market. General Electric Wind (USA), with a cumulative total of 18,218 MW, recuperated its second position in the global turbine manufacturer ranking.

Over 2008, Acciona Wind Power installed 1,290 MW, 4.6% of total new capacity in the world, putting the company in eighth place.

Table VI.03. Global installed capacity by main international manufacturers

COMPANY	Cumulative capacity to 01/01/08 (MW)	Installed in 2008 (MW)	Cumulative capacity to 01/01/09 (MW)
VESTAS (DK)	29,508	5,581	35,089
GE WIND (US)	12,979	5,239	18,218
GAMESA (ES)	13,306	3,373	16,679
ENERCON (GE)	13,770	2,806	16,576
SUZLON (IND)	4,724	2,526	7,250
SIEMENS (DK)	7,002	1,947	8,949
SINOVEL (PRC)	746	1,403	2,149
ACCIONA (ES)	1,671	1,290	2,961
GOLDWIND (PRC)	1,457	1,132	2,589
NORDEX (GE)	3,886	1,075	4,961
Others	11,269	4,955	16,224
TOTAL	100,318	31,327	131,645

Source: BTM Consult APS – March 2009

Table VI.04. Global installed capacity by main international wind plant operators

WIND PLANT OPERATOR	Cumulative capacity to end 2006	Cumulative capacity to end 2007	Cumulative capacity to end 2008
Iberdrola Renovables (ES)	4,434	7,362	8,960
FPL Energy (US)	4,300	5,077	6,374
EDP Renovaveis (P)	1,010	3,639	5,052
Acciona Energy (ES)	3,113	3,824	4,566
Long Yuan Electric Power (CN)	850	1,620	2,924
Datang Corporation (CN)	688	1,008	2,154
EDF Energies Nouvelles (FR)	790	1,218	2,031
Endesa (ES)	1,247	1,444	1,925
E,O,N, Climate and Renewables (GE)	524	855	1,890
Eurus Energy Holding (JP)	1,324	1,385	1,722
Babcock Brown Windpartners (AUS)	1,631	1,859	1,530
MidAmerican Energy (US)	460	n,a	1,284
International Power (GB)	361	1,053	1,223
AES (US)	n.a	n.a	1,213
Cielo Wind Power (US)	n.a.	998	1,148
Total (for companies listed)	20,732	31,342	43,996

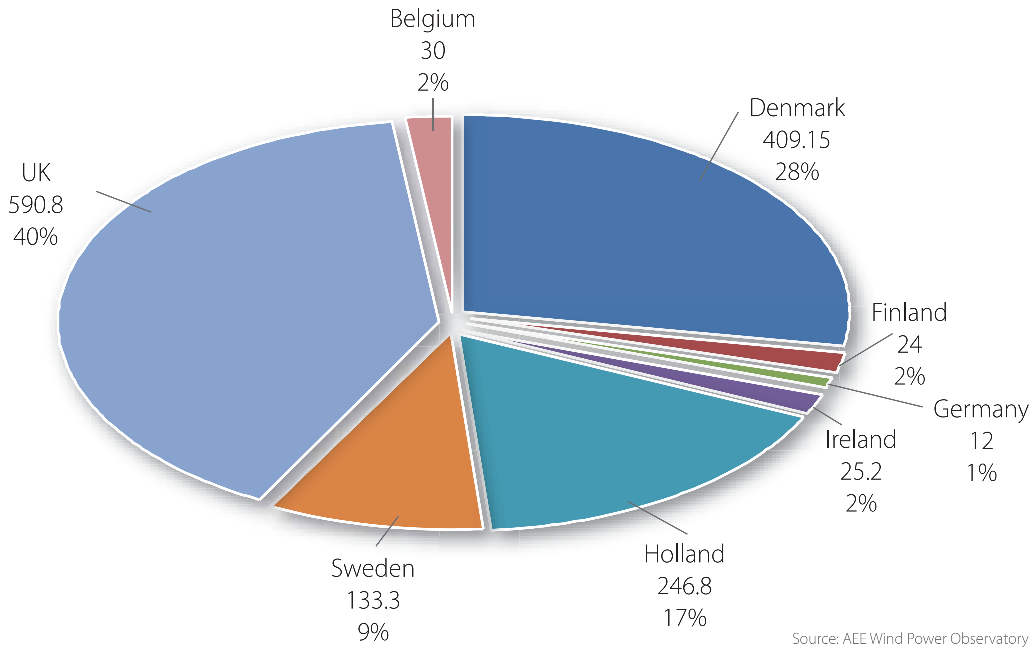
Source: BTM Consult APS – March 2009

Gamesa's global market share continues ranking third at 13,7%

Spanish companies Iberdrola Renovables, Acciona Energía and Endesa are **among the world's top wind plant operators.** With 8,960 MW of cumulative capacity in its ownership by end-2008, Iberdrola Renovables is the world's biggest operator. Acciona Energía, with 4,566 MW, came fourth while Endesa finished the year in eighth position with 1,925 MW.

Iberdrola Renovables, Acciona Energía and Endesa are among the world's top operators

Graph VI.08. Country breakdown of offshore capacity



Source: AEE Wind Power Observatory

Of the 1,471.33 MW of offshore wind capacity installed in Europe by end-2008, almost 70% is in the territorial waters of Denmark and UK, meaning those two countries maintain their global offshore lead. Following that lead, in order of size, come the offshore wind countries of Holland (17%), Sweden (9%), Belgium (2%), Ireland (2%), Finland (2%) and Germany (1%).

Practically, then, the world's entire offshore wind capacity is located in northern Europe.

Currently, in Spain, there are numerous offshore projects by different companies, including Iberdrola and Acciona, though none of these has yet been realised.

Of the 1,471.33 MW of offshore wind capacity installed in Europe to end-2008, almost 70% is in Denmark and UK

Part Three: The Sector Acts

Chapter VII
AEE and the surge of renewable energy support frameworks

Chapter VII
AEE and the surge of renewable energy support frameworks

VII.1 Energy within the EU political context

Wind power is now a priority within the European Union's political agenda. In March 2007, the European Council approved an EU action plan called "An Energy Policy for Europe" proposing a series of energy measures. The document underlined the need for the EU to develop a new energy policy based on a more secure and sustainable economy with heavily reduced CO2 emissions for the good of its citizens.

Within that context, in December 2008, the European Parliament approved **the climate and energy package** as agreed by the EU leaders' summit a week earlier. The package was formally adopted on April 23, 2009, fixing legally binding targets to be achieved by 2020. Across the EU, Greenhouse Gas emissions must be reduced by 20% against 1990 base-year levels, while renewables must meet 20% of EU energy demand. The package measures are also aimed at the EU target of a 20% cut in energy consumption through improved energy efficiency by 2020.

The EU has adopted this initiative as an important contribution to reaching an ambitious international climate agreement at the United Nations climate conference to be celebrated in Copenhagen in December.

VII.1.1 The Directive and the promotion of renewables

The Commission proposed in January 2008 a framework, adopted by the final Directive, for promoting the use and renewable energies, as well as the development of renewables capacity—which includes national objectives to 2020 (as indicated in the renewable energies' route map: http://europa.eu/scadplus/leg/es/lvb/l27065.htm). It also included measures to guarantee the quality of the power and energy produced.

In May 2008, the Spanish Wind Energy Association—*Asociación Empresarial Eólica (AEE)*—made very clear its opinion on the Directive. **AEE hailed the** regulation for establishing, for the first time, a set of binding objectives related to renewable energy consumption for all European Union member states. The **Association** believes the measure will boost wind industry growth. The Directive also has the potential to reinforce Europe's global wind industry leadership at the same time as mitigating the negative impact of climate change and reducing the EU's dependency on energy imports.

AEE hailed the regulation for establishing, for the first time, a set of binding objectives related to renewable energy consumption

AEE considered perfectly achievable the objective of meeting 20% of energy consumption across the EU with renewable energies. Nevertheless, the Association commented that meeting the Directive objectives requires providing member states with adequate control mechanisms to ensure accomplishment. More specifically, AEE said it was vital to maintain the national support mechanisms introduced in Directive 77/2001.

Accordingly, AEE proposed a series of key aspects to include in the Directive:

- As well as **specifying the national objectives as obligatory,** the Directive should also establish as obligatory the milestones on the way. That would ensure a measured and stable development, facilitating the tasks of planning for all economic agents involved.
- In order for the Directive to exercise the desired impact, **penalisations for repeated non-accomplishment of targets** should be set. Penalisations would also apply to non-accomplishment of any subsequent measures adopted by the European Commission (EC) relative to any National Action Plans (NAP).
- The CE should be empowered with instruments to evaluate the suitability of measures adopted en the NAPs and, especially, **to propose and agree on corrective measures in cases of gross deviation.**
- **The function of Guarantee of Origen (GO) should be clarified,** as it was unclear in the

original proposal. The text should specify the ends to be served by GOs, certifying the renewable origin of energy. It should also facilitate the accomplishment of the targets assigned to the member states through GO transfer.

- The national support mechanisms set by the member states should not be affected either by the Directive's enforcement or by the transfer of GOs. In fact, the **transfer of GOs among member states** or companies should only be permitted once the member state hosting the plant in question has accomplished the milestones assigned.

- AEE suggested joint action across the different member Administrations **to alleviate the bureaucratic load** for small renewables installations, which could be processed through one single permitting procedure.

- **AEE** said the renewables industry and plant operators needed to **know in advance** of obtaining permits the technical requirements of the generation equipment to be installed. That would avoid additional costs through subsequent technical adaptation.

- AEE also indicated that **grid access** for **renewables-sourced electricity should be prioritised,** arguing that renewables force system costs down, to the benefit of consumers. Such a rule would also avoid any kind of discrimination against renewables´ grid access.

- Finally, **promoting the physical interior trade of renewables electricity** should be made an EU priority. That would require both prioritised access for producers to interconnections between member-states and a sufficient number of interconnections.

The text finally adopted on December 17, 2008, abandoned the idea of setting up GO transfers as support mechanisms. However, it did uphold the need for those mechanisms and maintained member-state competence in defining them. It also left an open door to member states to jointly coordinate support systems. Parallel to that, it also introduced flexible mechanisms for achieving objectives, namely through inter-member-state transfers and the joint development of projects, either in the member countries in question or in third party countries.

The text finally adopte don December 17, 2008 uphold the need for those mechanisms and maintained member-state competence in defining them

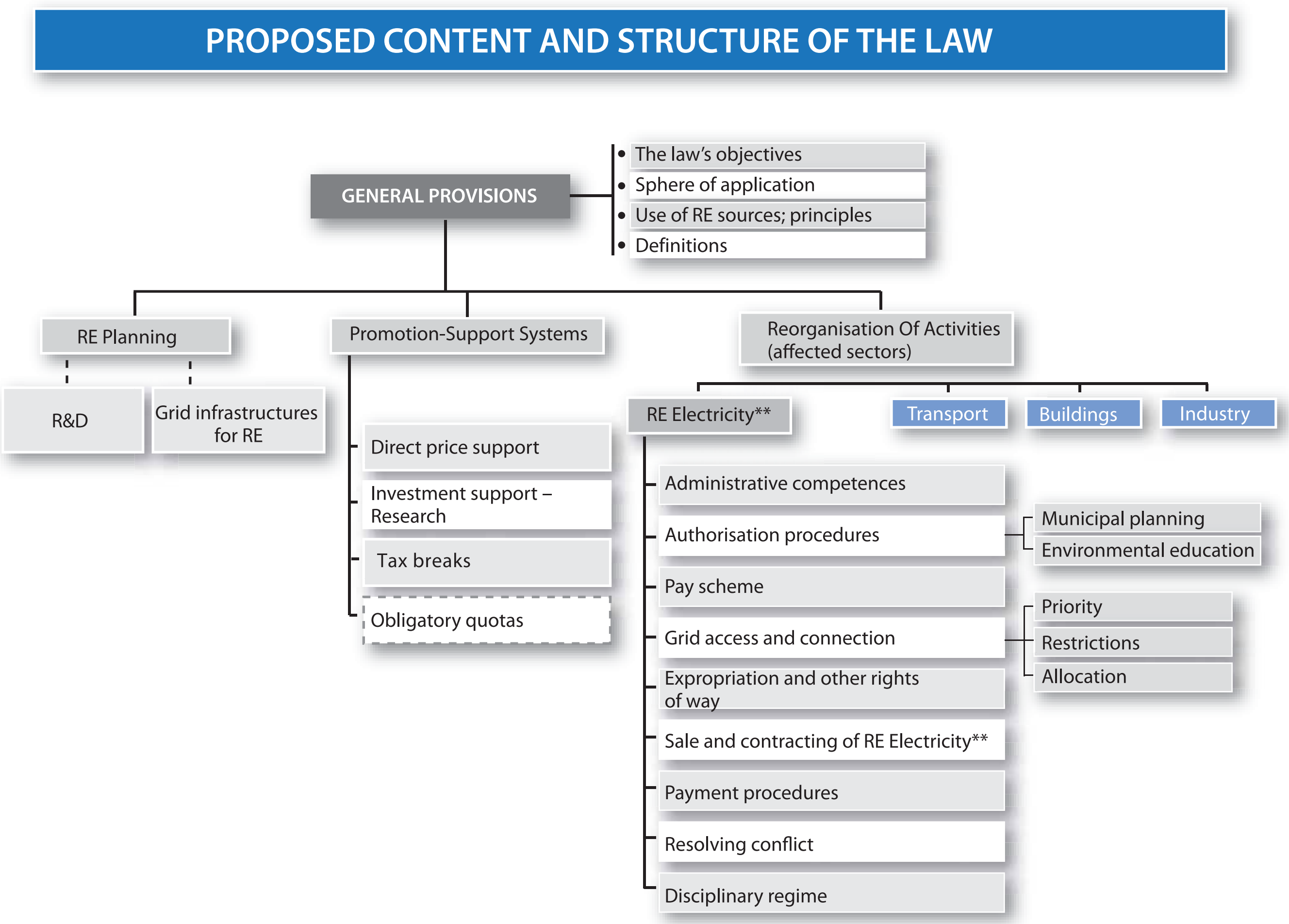
The Directive includes a new support vector for renewable energies involving the promotion of technological development and innovation as well as employment opportunities and regional development

VII.2 Renewable energies within the current national regulation

The Asociation started working in 2008 on a proposal for the content and structure of a Renewable Energy Law, following a government announcement to undertake such an initiative. We announced our support for the initiative as **a clear opportunity to establish a specific, unified and systemic regulation** for renewables. It is also an opportunity for strengthening the legal bases of our activities, contributing to the consolidation of sector growth. Indeed, the importance of a specific law lies, primarily, in the need to ensure the attainment of the new objectives for renewables consumption. That requires the reinforcement of the support systems for different renewable energy technologies, especially those based on direct price support. It also requires the raising of administrative barriers to project development and processing by instigating a careful and systemic ordering of procedures and activities.

We considered that an effective renewable energy law, responding to real sector needs, would not just transpose the new Directive, but would also integrate, perfect and develop the diverse legislation already in force. The proposal was summarised by the following chart:

Diagram VII.01. Proposed content and structure of the Renewable Energy Law



VII.2.1 Basic content proposal for a Renewable Energy Law

A.- Principles and aims

Spanish society wants to evolve away from an energy model based on burning natural fossil resources and towards a less degradable model; one less dependent on energy sources lying outside its frontiers that require processes of extraction, transformation, storage and transportation.

The 2020 objectives require an estimated 40% of electricity production be sourced to renewables. The new law should provide guarantees to achieve that amount of renewables generation without prejudicing other energy vectors also contributing to renewables objectives.

Objectives will not be met without continued political will and action to carry on **promoting sustained investment over time**. That is the way to guarantee investment in renewables projects as a preferential alternative to other generation technologies. It should therefore be included as one of the general principles of the new law.

B.- Support frameworks

The new law should include **detailed regulation of support frameworks,** bearing in mind that they constitute the key tool for promoting renewable electricity generation. The law should therefore define and classify the mechanisms or instruments best suited to integrating the support mechanisms, distinguishing between the following:

- Investment support systems, integrating direct capital subsidies and soft loans, as well as incentives, tax breaks and credits and, in general, ordinary and extraordinary investment stimulus measures.

- Operation support systems, that define the price support mechanisms for electricity generation (production incentives and feed-in tariffs for selling electricity).

The renewable energy act should gather a detailed regulation of the support frames

The new law should also define support-mechanism characteristics in detail in order to avoid references to broad and vague legal concepts open to dubious interpretations and difficult to apply effectively.

It is also important for the new law to include control and feedback mechanisms in order to monitor the efficiency and effectiveness of the support frameworks. This would require a periodic feedback procedure evaluating the degree of attainment of objectives for each technology, enabling institutions (IDAE and CNE) and other energy sector agents to know how far each technology's installed capacity and costs are deviating against those initially planned.

AEE believes consumer information mechanisms should be regulated, in order to facilitate a simple and transparent understanding, by society as a whole, of the effort and results of the support framework for

renewable energy production. The electricity bill should state both the purpose of the support system and, especially, the costs incurred. That would require a kWh breakdown illustrating the proportion of the billed energy covered by each renewable technology.

C.- Taxing renewable energies

The new law presents an excellent opportunity for an improved systematisation of existing regulation. Most importantly, it can be used **to revise tax regulations** applicable to renewables' promotion within the Company Tax Law (Ley de Impuestos de Sociedades), which affect clean energy investments.

AEE believes investments in renewables should not be treated in the same way as those in conventional energy installations, especially concerning direct tax on the capital resources of generation plants. The differentiation between the two types of taxation is particularly necessary at local level, where property tax (Impuestos sobre Bienes, Inmueble, Instalaciones, Construcciones y Obras) and business activity taxes (Actividades Económicas) are a serious burden to investments.

A differentiated taxation treatment for renewables would favour investment in clean energy against conventional energy investments. It would also end the unfairness of taxing both types of energy in the same way.

D.- Planning

The importance of planning renewables deployment as a means to furthering their development is indisputable. Indeed, the **Association** considers the national renewable energy plan a renewables promotion plan. Furthermore, existing electricity sector law requires the government to modify the national renewables plan in accordance with EU objectives. The new law should also hold that same obligation and spirit.

Without any doubt, renewable energy planification is a significant tecnic that contribute efectively to their own development

AEE thinks the new law should determine much of the content of the renewed national Renewable Energy Promotion Plan. The Association therefore proposes it contain the following:

- **The procedure for drawing up the Plan** and the different stages of its processing (i.e. draft bill and bill), together with the period needed for approving it. Drawing up the plan should also require the decisive involvement of a mixed committee of central and regional government officials and economic agents.

- **Final objectives,** assigned to each renewable technology to the end of the period covered in accordance with energy and economic efficiency criteria and also based on proven industrial capacity.

- **Intermediate objectives,** for shorter stretches of time, in order to facilitate periodical monitoring of progress and to provide feedback on requirements, especially regarding grid connections.

- **Financial measures:** the renewables promotion plan should include a breakdown of the costs of each technology together with the financing methods proposed for each one.

- **Technical measures:** the new law should establish that one purpose of the renewable energy plan is to identify and define the necessary grid infrastructures for meeting targets.

- **Grid infrastructures** and other installations necessary for meeting the renewable energy plan targets, in accordance with the provisions mentioned earlier, and including cross-border interconnections, should be considered of exceptional public interest, in line with the tenth additional Disposition of Royal Decree-Law 2/2008, which amends the Land Law.

- The new law should make provisions for the **participation of the autonomous regional authorities in drawing up the renewable energies plan.** Most importantly, those provisions will integrate municipal and regional planning and land use provisions, together with regional industrial development plans. In this way, the new law should facilitate a transparent and objective delimitation of the land uses and activities to be developed coherent with the renewable energies plan.

E.- Grid access and connection

Current rules governing grid access and connection rights are disperse, scattered across different regulations and legal provisions. They have also undergone innumerable modifications, considerably restricting rights laid down in the Electricity Sector Law 54/1997. The new Renewable Energy Law will provide a unique opportunity to modify and unify the rules within a specific law.

AEE recommends the new law include an exceptional provision for denying a grid connection point if the applicant's project exceeds the objectives set in the renewable energy plan or if it exceeds grid absorption capacity. But AEE also suggests the new law demand that any project affected in that way be provided with a connection point in the following renewable energy plan revision. Under no circumstances should the point of connection be denied if there is available grid capacity and the planned installed capacity for the technology in question had not been reached in the previous planned period.

The mixed committee should have **full and specific knowledge of electricity system loads** and of the allocated connection capacity within the renewable energy plan. To this end, the system operator (S.O.) should facilitate the appropriate information. That includes indicating corrective measures to be taken when it establishes limits to the capacity to be connected. The S.O. should also indicate the time period the restrictions will last in a given zone and indicate the reinforcements or improvements necessary to reduce or eliminate those restrictions.

The renewable energy plan should integrate municipal and regional planning and land use provisions, together with regional industrial development plans

Regarding access rights, the priority given to renewable energy production is subject by law to conditions related to supply guarantees. But any restrictions in this regard are not only an undesirable obstacle but also reveal insufficient development of grid infrastructure causing economic inefficiencies and unfairly affecting renewables producers.

The renewables law should therefore require the S.O to set specific measures towards eradicating any restrictions. Such a provision would contribute largely both to providing legal security to renewables investments and, as a consequence, to reaching planned objectives.

F.- Administration and authorisation

I.- Administrative competences:

The renewables law should **modify the administrative competences** in renewables assigned to the central and regional governments in the 1997 Electricity Sector Law.

The new law should assign to the central

Administration competences for authorising renewable plant projects when those installations are located in autonomous regions that have not established their own specific regulation.

The new law should assign to the national electricity regulator, Comisión Nacional de la Energía (CNE), exclusive competence for resolving conflicts involving grid access and connection. CNE should instruct the TSO and electricity distributors on assigning connection capacity.

II.- Authorisation procedure:

The **Association's** proposal incorporates numerous improvements in the regulation of authorisation procedures and holds the future renewable energy law as a good opportunity to bring down administrative barriers.

On July 28, 2008, AEE sent CNE its observations on the "Proposed Royal Decree for a **pay scheme for electricity generation** from photovoltaic technology for new installations after the deadline for eligibility to Royal Decree 661/2007."

On September 15, 2008, AEE sent CNE its comment on the "Draft Royal Decree for **Special Regime grid access and connection.**"

On November 7, 2008, AEE sent CNE its considered view on the "Proposed modification of **operation procedure (i.e grid code) 12.1** – transport grid access and connection applications for new installations."

On November 25, 2008, AEE sent CNE its observations on the "Proposed Royal Decree regulating the start up of **last resort supply** in the energy sector."

The Sapnish Wind Energy Association believe that future law will offer a good oportunity to overcome administrative barriers

Part Three:
The Sector Acts

Chapter VIII
Grid integration

One of the main challenges facing wind energy is grid integration. It would be safe to say that major advances have been made thanks to coordination between the **operator of the Spanish electricity system (Spanish acronym REE)** and the sector through the **Spanish Wind Energy Association (Spanish acronym AEE)**. Adapting turbines and wind plants to voltage dips is probably the aspect requiring the greatest effort.

VIII.1 The importance of assessing the effective access of wind generation to the grid

Penetration studies

2008 clearly showed that one of the most important issues is the **effective connection to the grid** of electricity generated by wind plants. Wind capacity growth is held back by grid limitations and affected by specific factors linked to the operation of the system such as unforeseen variation slopes in wind production or potential risk situations affecting system stability.

In order to assess the volume of wind power which can actually be integrated into the grid, REE conducted a preliminary study on the electricity system's technical capacity reaching the conclusion that the **41,000 MW** envisaged by the sum of Autonomous Regional plans and objectives (see Table VIII.01) can be absorbed by the system.

This output is further supplemented by **offshore wind plants** which, according to the estimates of the **Spanish Wind Energy Association** would add approximately 5,000 MW.

Table VIII.01. Autonomous Region Plans

Autonomous Regions	Installed capacity 01/01/2009 (MW)	Capacity out to tender (MW)	Zone study limits (MW)	Online and authorised CCAA (MW)	Regional Plans (MW) (1)
Andalusia	1,795	500	3,754	3,487	6,284
Aragon (2)	1,749		2,400	1,951	4,000
Asturias	304		918	819	1,100
Balearic Islands (2)	4		50	210	210
Canary Islands	134	440	344	440	1,025
Cantabria	18	1,600	400	32	300
Castile-Leon	3,334		4,375	6,488	6,625
Castile-La Mancha	3,416		3,990	3,324	4,100
Catalonia	420		1,460	1,248	3,500
Extremadura (2)	0	470	225	501	400
Galicia	3,145	2,325	3,438	2,950	6,500
Madrid (2)	0		50	0	200
Murcia	152		538	411	850
Navarre (2)	959		1,400	922	1,536
La Rioja (2)	447		500	448	665
Valencia (2)	710	250	1,600	2,300	3,500
Basque Country (2)	153	256	250	145	624
TOTAL	**16,740**	**5,841**	**25,692**	**25,676**	**41,419**

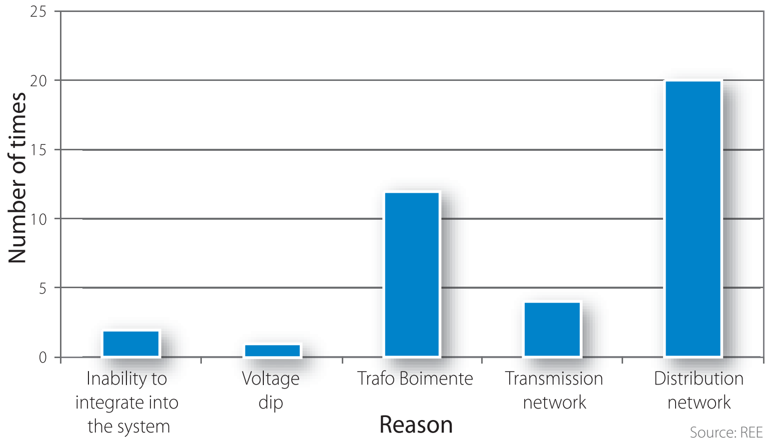
(1) Installed wind capacity envisaged by the Autonomous Regions. Each Region has a different deadline.
(2) The Renewable Energy Plan criterion is applied where there is no zone study.

Source: AEE. Zone studies. Regional Plans

REE holds that the 41,000 MW envisaged by the Autonomous Regions can be integrated into the grid

An important issue being actively addressed is that of potential curtailment of wind generation for reasons of grid security. Experience in 2008 has shown that curtailments were mainly due to insufficient electrical infrastructure rather than grid stability problems or a decline in demand.

Graph VIII.01. Reasons for curtailment (Q4/2008)



We also encounter the new issue of possible conflicts with other forms of renewable generation, especially solar photovoltaic power and solar thermoelectric power.

In order to learn more about grid access developments and the sensitivity of the different nodes, in December 2008 the AEE commissioned Deloitte to conduct the Wind penetration study which analyses the current and future level of wind energy penetration in the Spanish Electricity System.

The objectives of the project currently under way are to study, under different scenarios, wind penetration capacity in the transmission network nodes of the different zones of the Spanish Mainland Electricity System for a number of planning horizons (2011, 2016 and 2020) and to evaluate the potential for increasing this type of generation.

The study is structured in accordance with the following outline:

- To complete the current model of the Spanish Electricity System based on the information available regarding conventional and Special Regime generation and demand and grid infrastructure for the different planning horizons.
- To analyse the wind penetration potential at the different nodes of the Spanish Electricity System without compromising grid security. The study will give due consideration to peak and trough load.
- To model and simulate wind's contribution in meeting demand.
- To analyse the impact of wind power on the overall security of the Electricity System in order to identify, in different demand scenarios, situations in which production should be curtailed.

Map VIII.01. Grouping of wind and solar energy (forecast for 2020)

Source: REE

REFERENCE: Autonomous Region Plans

■	Total wind installed	~ 41,000 MW
■	Total solar installed	~ 4,500 MW

Map VIII.02. Zoning of the Mainland Electricity System

Source: REE

VIII.1.1 Study for the year 2011

Node demand forecasts for 2011 were made based on the node load for 2008, as well as the demand forecasts in the different Autonomous Regions as featured in the **infrastructure plan for 2011,** together with the grid development outlook for that same planning horizon.

VIII.1.2 Calculation methodology

The study is conducted for each demand level based on **40%** wind generation at each of the generation centres in service in 2011.

If the resulting scenario is acceptable and meets safety criteria, wind production is increased by 10% and the analysis is repeated.

These increments are repeated until a situation is reached where safety criteria cannot be met.

Combined cycle generation is decreased to offset the increase in wind generation.

VIII.1.3 Generation scenarios and demand

- Globally established demand of 22,998 MW + 3,188 MW of demand from pump generation units using 40%, 50%, 60% and 70% of installed wind capacity, supposing that the latter plays no role in voltage control.
- Globally established demand of 30,823 MW + 3,188 MW of demand from pump generation units using 90% of installed wind capacity supposing both voltage control scenarios, i.e. wind playing and not playing a role.
- Globally established demand of 30,823 MW + 3,188 MW of demand from pump generation units using 100% of installed wind capacity, supposing that the latter plays no role in voltage control.
- Globally established demand of 41,214 MW using 100% of installed wind capacity, supposing that the latter plays no role in voltage control.

The Deloitte study is conducted for each demand level, based on 40% wind generation at all of the generation centres in service in 2011

Table VIII.02. Generation structure at the beginning of 2011

	Installed capacity (MW)
Wind	20,515
Nuclear	7,070
Coal	10,694
Hydro	7,809
Pump storage	3,188
Combined cycle	41,960
TOTAL	91,236

Source: Deloite

VIII.1.4 Maximum estimate of wind power penetration in the system

A model is built showing an hour-by-hour comparison of demand level with the system's wind profile and the maximum use factor calculated for the said load.

The anticipated wind profile is compared with the maximum wind energy allowed by the system each hour in accordance with demand level (application of Table VIII.02). If the anticipated wind generation profile is greater than that admissible at any given hour, reductions are applied curtailing production in accordance with the use factor.

Initial results show that the 41,000 MW do not put any limitations on the grid, i.e. they do not exceed the limits established under regulations currently in force and therefore, put no pressure on the nodes.

The study will be extended throughout 2009 in order to determine, in accordance with expected scenarios, energy growth forecasts, infrastructure development plans and wind-generated electricity that can be earmarked to effectively cover demand.

In any case, there is a growing interest in the incorporation of new pump storage, the reinforcement of interconnections with neighbouring electricity systems and the use of manageable loads such as the electrically powered vehicles mentioned in the chapter focusing on technologies. Given fast growing interest in such load management aspects, the study also takes them into consideration.

VIII.2 The verification procedure: validation and certification (VVC) of O.P. 12.3 and the current situation concerning wind plant certification

Royal Decree 661/2007 provides that new wind plants, i.e. those permanently registered at the Registry of Special Regime Generation Installations (Spanish acronym RIPRE) after 1 January 2008, failing to comply with the grid code know as Operating Procedure (O.P.) 12.3 are not permitted to charge the Special Regime production incentive.

Wind plants registered at the RIPRE prior to that date must adapt to the grid code before 1 January 2010, unless exempt from this obligation, and to that end must make their intentions known at the Ministry of Industry, Tourism and Trade before 1 January 2009 which will issue the requisite acceptance or rejection report subsequent to consultation with REE. Adapted wind plants may charge the full production incentive during a maximum period of five years.

In all cases, failure to adapt precludes charging the Special Regime production incentive although these wind plants may connect and are given access to the grid.

The procedure to verify turbine compliance, validate turbine and wind plant models and certify compliance with the aforementioned Verification, Validation and Certification (VVC) of O.P. 12.3 was drafted and approved in 2006.

The VVC was compiled by a specific Working Group comprised of wind plant owners, turbine manufacturers and FACTS, as well as laboratories and certifying agencies along with the active participation of REE. Both the National Energy Commission and the Ministry of Industry, Tourism and Trade were invited to take part and were periodically informed about progress made.

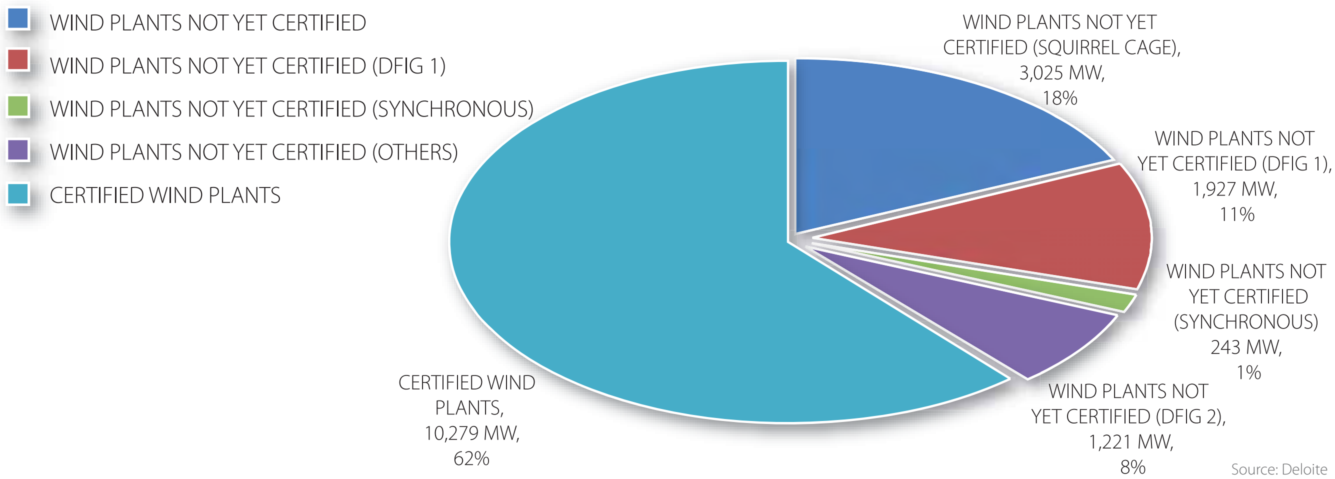
This Working Group was subsequently appointed as the Technical Verification Committee envisaged in the VVC which, through scheduled meetings, monitors adherence to the Procedure.

Royal Decree 661/2007 provides that new wind plants failing to comply with grid code O.P. 12.3 are not permitted to charge the Special Regime production incentive

VIII.2.1 Current state of the certification and adaptation process to comply with the requirements laid down in O.P. 12.3.

The following graph represents a synthesis of the current situation as concerns wind plant certification and includes both new plants and those permanently registered in the RIPRE prior to 31 December 2008.

Graph VIII.02. Situation as of May 2009 with 16,740 MW installed.
(Installed capacity data from the AEE through 31 December 2008)



Source: Deloite

VIII.2.2 Certified wind plants

In accordance with the terms of the Verification, Validation and Certification (VVC) Procedure, there are two ways in which wind plants can become certified:

- **Individual process** (also known as the **individual procedure)** whereby compliance of the turbine (and, by extension, of the wind plant itself) with O.P. 12.3 is checked.

- **General process** (also known as the **general procedure**) where a dynamic compensation or FACTS system (Flexible AC Transmission System) is used, requiring simulation of the entire wind plant once the turbine tests have been conducted.

- The incorporation of FACTS in the process allows for the application of the individual process/procedure, the criterion for the certifying agency being acceptance of the required accredited reports.

As of May 2009, of the total of **365 certified wind plants (10,279 MW),** 353 were certified through the individual procedure (10,003 MW) and three with the FACTS system (80 MW). One plant used the FACTS connected in series to the generator thus isolating it from interference and the other two in parallel to the turbine's electric generator. The remaining 12 plants were certified via the general procedure with the FACTS solution in series (276 MW).

All wind plant certifications using the FACTS solution focused on the turbine.

VIII.2.3 Simplified turbine models

A specific working group was formed within the Technical Verification Committee to define simplified models for both squirrel cage and double fed turbines with a view to validating the model in accordance with the terms of the general procedure and avoiding field trials to the degree possible.

The parameters of the models were included in the new version of the of Verification, Validation and Certification Process (VVC-5).

Part Three:
The Sector Acts

Chapter IX
Wind plant operation

Exchanging information and finding solutions

Among the key areas of work of the **Spanish Wind Energy Association—Asociación Empresarial Eólica (AEE)—** is that carried out by the **Wind Plant Operations Working Group,** created in February 2008. That group was born with one highly defined objective: to exchange information and find solutions to all aspects related to the operation and maintenance of wind plants, including the best ways to optimise operational costs, new preventative maintenance plans and assessing ways to increase availability.

The first year's **results** from this Group have been **very positive** with respect to information exchange and the search for solutions to the main operation and maintenance (O&M) problems. Nevertheless, the complexity of certain wind turbine elements required the creation of specific Sub Working Groups (SWG) for more detailed treatment.

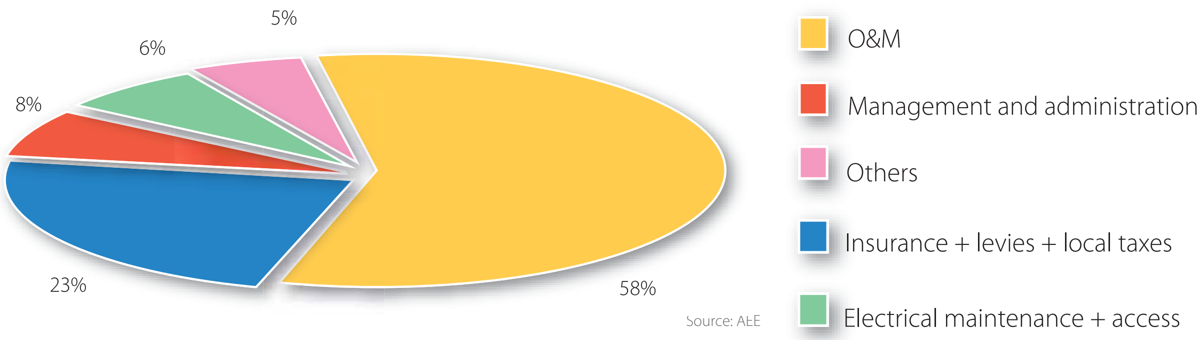
Each of those Subgroups, to be coordinated by **AEE,** will comprise a specific coordinator and a series of members committed to maintaining active participation. The **first Subgroup created was the Blade Maintenance SWG.** The final subgroup structure of the Wind Plant Operations Working Group is expected to be as follows:

- MECHANICS SWG
- BLADE SWG
- GEARBOX SWG
- ELECTRICAL SWG
- PLANT OPERATIONS SWG
- AVAILABILITY SWG

IX.1 Importance of operations

According to the study ***Analysis and Diagnosis of Wind Power Generation in Spain***, which **AEE** commissioned to Intermoney, operational costs could be at around €18 / MWh. Those costs could amount to 50% of investment present-value across the lifespan of a wind plant. The remaining 50% is linked to replacement of large components: blades, gearboxes and generators.

Graph IX.01. Cost structure



Source: AEE

The preservation of wind turbine blades is fast growing in importance

IX.1.1 The Blade Maintenance Subgroup

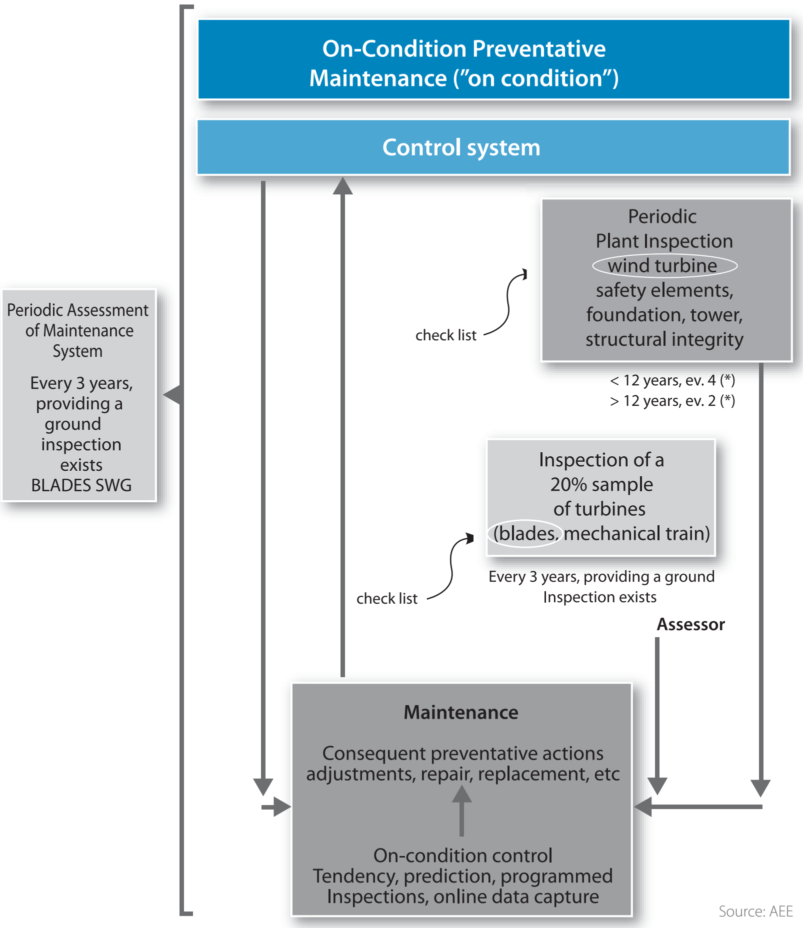
As mentioned earlier, the first Subgroup to arise was that of **Blade Maintenance.** That is because one of the fastest growing areas of concern within the field of wind plant maintenance, both from a technical and management viewpoint, is preserving turbine blades.

The Sub Working Group's task is to produce a document setting a series of **applied criteria for blade maintenance and preservation**, based on Wind Turbine On-condition Maintenance principles. The idea is eventually to produce a general document applicable to all wind turbine elements.

Following three working group meetings, the document is now entering its final stage prior to completion. Its objectives are as follows:

- Creation of a **guide for periodical inspection** of main wind turbine component based on specific milestones and/or prefixed periods.
- Defining the **responsibilities** of internal and external technicians and agents involved.
- Proposed minimum **qualification** of inspection and maintenance companies.
- Establishing **technical report templates** for completion by maintenance technicians.
- Set a series of **suggestions** for efficient, agile and quality Maintenance Planning.
- Establish a set of **recommendations** on how to carry out periodic assessment of both the Maintenance System and plant condition, aimed at guaranteeing secure and integral operations through periodic inspections.

Diagram IX.01. On-condition based preventative blade maintenance



Source: AEE

The Sub Working Group's task is to produce a document setting a series of applied criteria for blade maintenance and preservation

IX.1.2 Application to blades of the database for wind turbine component failure

In the Sub Working Group for Plant Operation, the Spanish Wind Energy Association—*Asociación Empresarial Eólica (AEE)*—proposed the creation of a database collating the number of wind turbine component failures and their causes, together with duration of down times. That database will be applied to blade maintenance within the Sub Working Group and results will be contrasted against the databases of other international organisations similar to AEE.

Image IX.01. Example of a component failure register on the database

IX.2 Prevention

The Spanish wind sector has undergone strong growth over recent years, becoming an important source of generation and employment, with over **45,000 cumulative jobs** to end-2008. By end-2007 there existed over 17,700 direct jobs through O&M, manufacturing and assembly, installation and R&D, according to the "**Macroeconomic Study on the Impact of Wind Energy in Spain**". The same source cites indirect jobs at over 27,000, mainly related to supply of components and grid interconnection equipment. Other studies estimate those figures to be 10-20% higher. In any

The Association proposed the creation of a database collating the number of wind turbine component failures and their causes, together with duration of down times

case, the figures grew significantly over 2008.

In Spain, there are 636 companies involved in the wind power sector, as mentioned in Chapter II. Of those, some 60% are small and medium-sized companies and self-employed run businesses.

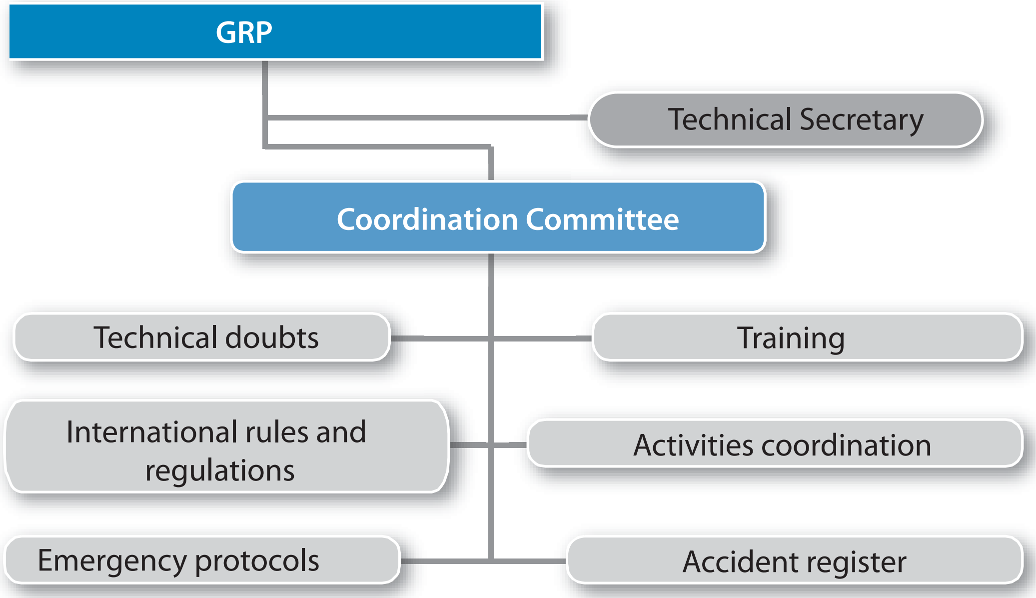
Among other members, **AEE encompasses most of the Spanish sector's economic agents**: component and equipment manufacturers; developers; operators and O&M companies; construction companies; service, transport and distribution companies and companies providing training and risk prevention courses. The special characteristics of work in this sector (working at heights, with high voltages, with heavy loads, etc), together with its constant growth, are regulated in accordance with the Law for the Prevention of Risks at Work and the Law of Industrial Safety.

AEE in tune

AEE members are in tune with the Law for the Prevention of Risks at Work and fully committed to complying with it and to promoting safety and risk prevention in the work place. Accordingly, in July 2007, the Association decided to create a **Working Group for Preventing Risks at Work (PRW).** That group analyses **sector strengths, weakness and threats** in the field of risk prevention. Furthermore, the group is responsible for disseminating risk prevention awareness and culture and **reducing risks at work.** It also represents the sector before the appropriate institutions in the field. In short, it has become a sector reference point in the sphere of health and safety. The working group is structured in the following way:

The special characteristics of work in this are regulated in accordance with the Law for the Prevention of Risks at Work and the Law of Industrial Safety

Diagram IX.02. Structure of the Working Group on Risks at Work



Souce: AEE

The Working Group for Preventing Risks at Work analyses sector strengths, weakness and threats in the field of risk prevention

According to analysis already carried out by the Working Group for Preventing Risks at Work, the sector is still subject to specific shortcomings in risk prevention, despite technological advances and modern information and training mechanisms. Those deficiencies are mainly due to the sector's relative youth.

IX.2.1 Sub Working Group for Technical Doubts in PRW

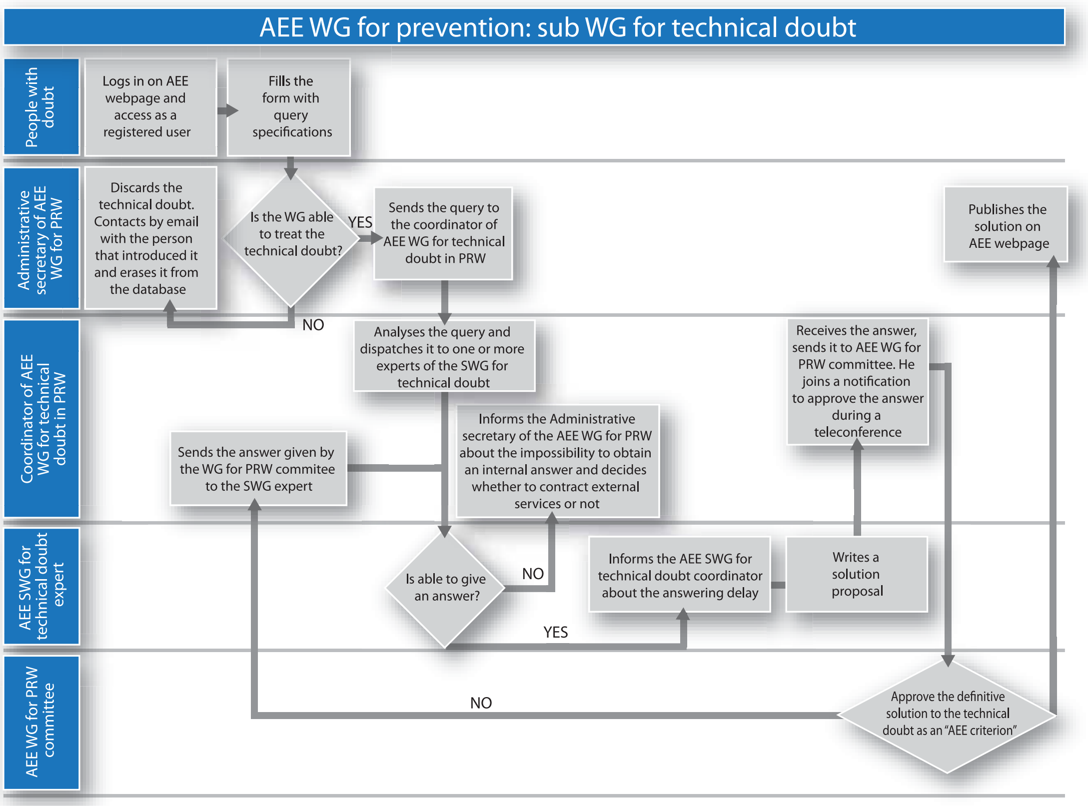
There are discrepancies in the application and interpretation of risk prevention rules. For that reason, Sub Working Group for Technical Doubts in PRW has made available to the entire sector a database that can be consulted on the **AEE** website. Answers to those doubts are either agreed upon by a team specially charged with that task or via external consultation with specialist companies or institutions. As part of the answer provided, the regulations applicable to the question in hand are indicated, together with notes on experiences or documents of interest. The service thus also acts as a forum for sharing experiences.

This subgroup addresses the **doubts presented by any AEE associate member** concerning health and safety at work. Consultations may involve national or international activities related to wind plants and wind turbines and components, including any stage of design, manufacturing, construction, maintenance or dismantlement. Technical doubts may affect aspects ranging from training to documentation, passing through coordination of business activities, accidents at work, technological advances or certification.

The SWG for Technical Doubts in the Prevention of Risks at Work addresses the doubts presented by any AEE associate member concerning health and safety at work

The diagram below describes the established procedure to create a new technical doubt record, its potential solutions and the approval by **AEE** of an official criterion

Diagram IX.03. Technical doubt resolution procedures in PRW



Source: Working Group for Prevention of Risks at Work, AEE

IX.2.2 Sub Working Group for PRW Training

The absence of risk prevention culture in the workplace leaves some safety issues unattended with negative affects on many areas of business activity, especially in the growing number of accidents at work. Consequently, **training** in risk prevention has an **important role to play** in creating a risk prevention culture and so in reducing risks.

The concepts of 'training', 'prevention' and 'health and safety at work' cover an innumerable range of issues. It is therefore necessary to define and focus these issues within the context of the wind power sector. The first step is to inform staff about risks and about prevention measures. Training should focus on enabling workers to recognise and prevent risks for themselves.

AEE's PRW Subgroup has analysed the different **training procedures** and risk prevention dissemination measures the wind sector has implemented to facilitate preventative work among small and medium-sized companies and the self-employed. One of the conclusions was that training should focus on the specific work post or function of each employee. It should also cover all phases of a project from beginning to end: manufacture of turbine components and parts, plant development, construction and operation, O&M and dismantlement.

IX.2.3 Sub Working Group for International Regulations in PRW

All companies are subject to a **series of obligations** in the field of Prevention of Risks at Work under the national rules and regulations belonging to the countries they operate in. Such rules incur time and money costs and can compromise the growth and competitiveness of a company.

With the Spanish wind industry experiencing such high-growth internationally, within an increasingly globalised market, sector players need access to information regarding the broad range of health and safety regulations across different countries. With an extensive document base, companies could reduce time and costs in this field, so improving productivity and competitiveness.

In that context, the Subgroup's work involves analysing legal requirements in PRW in different countries. After consulting companies participating in the Subgroup regarding their interest in the countries targeted by the study, the Subgroup has produced a cross-section of the most representative countries, selecting USA, France, Germany and Japan.

After selecting those countries, the Subgroup's work continues with the compilation of appropriate **documents and regulations** in each one, sometimes soliciting information on existing rules from the respective wind associations of the different countries. That provides a comparative analysis and a guide to the administrative procedures that companies have to follow in those other countries.

IX.2.4 Sub Working Group for Coordinating Company Activities

The outsourcing and subcontracting of companies and services often results in the convergence of a diversity of company activities in the same workplace. That can only increase the chances of common health and safety problems arising among workers from different companies using the installations and equipment belonging to a third party company (the contracting company).

So far the wind sector has made a great effort to meet the demands of the new regulation. That is the case across the board, from primary companies to businesses run by the self-employed, through contractors and subcontractors, all of which have carried out extensive preparations.

Nevertheless, after analysing the situation, the Subgroup concluded that a disparity of criteria exists among the primary companies regarding demands. The disparity continues when it comes to obtaining the right documentation for the small and medium sized companies and the self-employed in the field of wind plant construction and maintenance.

Accordingly, this AEE Sub Working Group has a double task. Firstly, it works to harmonise the coordination procedures among different companies, identifying and evaluating the stronger points of formulas used by different primary companies. Secondly, it works to simplify and unify the minimum requirements for coordination, which benefits small companies that work for a number of primary contracting wind sector companies.

The Subgroup is charged with producing a written guide for the practical application of the legislation and which can be used as a default reference to resolve doubts or conflicts concerning the application of the different regulations. The guide will cover all company activities throughout the lifecycle of a wind plant: development and construction, operation, O&M and dismantlement.

The SWG is charged with producing a written guide that can be used as a default reference for resolving doubts or conflicts concerning the application of the different regulations

IX.2.5 Sub Working Group for Emergency Protocols

By articles 20 and 21 of Law 31/1995 for the Prevention of Risks at Work, the employer must assess the potential emergency situations and adopt the appropriate measures regarding first aid, evacuation and other anti incendiary methods and procedures. The assessment takes into account the company's size and activity, together with the possible presence of non-staff people at the work place.

Royal Decree 407/1992 (April 24), which establishes the Basic Norm for Civil Protection, states "the obligation of the public authorities to guarantee the right to life and physical safety as the primary and most important of the fundamental rights". It also demands guarantees for "the principles of national unity and territorial solidarity and administrative efficiency and coordination". The public authorities must also guarantee "the mechanisms enabling the mobilisation of the necessary human resources and materials for protecting people and property in the case of grave collective risk, catastrophe or public calamity".

Following that brief legal summary, it should be pointed out that the idiosyncratic nature of wind plants—geographic distribution, tower height, reduced spaces, etc—means that any emergency procedures must be totally specific and standard traditional methods cannot be applied.

IX.2.6 Sub Working Group for Registering Accidents at Work

As mentioned earlier, the absence of a risk prevention culture in the workplace negatively

AEE and EWEA have become official members of the Healthy Workplaces campaign on "Risk Assessment", organised by the European Agency for Safety and Health at Work

affects different aspects of company activity, especially in corporate accident rates. Awareness of **the cause of accidents and the ways to prevent them** is an important step towards establishing that culture and in reducing accidents themselves. It is important to assess, differentiate and disseminate preventive and corrective measures specifically for the constantly growing wind sector, which is creating more and more specialist jobs.

The first measure any company should take, with respect to its employees, is to inform them regarding the existing risks and the procedures to adopt to prevent accidents. Currently, no information specific to the wind sector regarding accidents and rates exists (any information is part of the general electricity sector registers and includes all technologies). Accordingly, the Sub Working Group for Registering Accidents at Work analyses the **communication procedures** for incidents, accidents and occupational illnesses in order to assess accidents and the accident rate in absolute and comparative terms.

Having analysed those communication procedures, the Subgroup is now working on a **computer programme** to facilitate the communication both of accidents and occupational illnesses in the wind sector. The Subgroup is also carrying out **international comparative studies** with other countries' wind sectors in order to analyse and quantify accidents at work and accident rates.

Furthermore, the Subgroup monitors and identifies the causes of accidents and illness at work, in order to propose corrective measures through the publication of information pamphlets. The Subgroup needs as much information as possible in order to guide optimally the companies' prevention programmes.

IX.3 Other commitments

In order to promote health and safety at work, AEE and the European Wind Energy Association (EWEA) have joined, as official members, the Healthy Workplaces campaign on "Risk Assessment", organised by the European Agency for Safety and Health at Work (EU-OSHA) in which thirty international organisations and companies already participate. That initiative's aim is to reduce the number of accidents and occupational illnesses by promoting the assessment of risks as the first step towards establishing a **sustainable culture of risk prevention.**

AEE has signed the **European Road Safety Charter.** That charter was promoted by the European Commission (EC), which invited organisations to implement concrete measures, to evaluate the results and to continue informing society of the need to reduce the number of victims of road accidents. The **AEE** Working Group's commitment is to promote and disseminate road safety among its members. As part of that task, the Association will distribute good driving practices cards once every month.

IX.4 Work done

I. **First European Meeting on Risks Prevention in the Wind Power Sector** (see Chapter XII). The event, held in Navarre region 21-22 May, 2008, was organised by AEE with the collaboration of the Regional Government of Navarre and the Confederation of Navarra Businesses. It brought together over 150 experts.

II. As part of its commitments within the European Agency for Safety and Health at Work (EU-OSHA), and as an official member of the "Risk Assessment", campaign, the **Association** organised on April 29, a technical seminar on "Risk Assessment at Design Stage", at the Institute for Machine Verification, part of the National Institute for Work Safety and Hygiene (INSHT in its Spanish initials) in Bilbao.

Part Three:
The Sector Acts

Chapter X
The future of wind energy

REOLTEC, REVE and offshore wind

The success of wind power has been internationally acknowledged but the sector is well aware of the fact that today's world leadership can only be maintained through constant effort in research, development and innovation; in other words, it must be forward-thinking. One of the main initiatives towards this end is the wind sector Technological Platform (REOLTEC), which, among other tasks, is paving the way for the development of offshore wind generation and the REVE project (wind power regulation by means of electric vehicles) recently launched in 2008.

The Spanish Wind Sector Technological Platform, **REOLTEC**, was launched in July 2005. Its main objective is to define the sector's R&D priorities and to integrate and coordinate scientific and technological development. Already in 2008 one of its main concerns was that of monitoring the activities of the **European TPWind Platform** mostly with the aim of establishing lines of collaboration in order to participate in European projects. Representatives of REOLTEC's Managing Body have also been in contact with members of the Ministry of Science and Innovation (which currently holds the vice-chairmanship at meetings of the TPWind Mirror Group) to foster the incorporation of REOLTEC's wind sector R&D and Innovation priorities and positions in the different meetings and strategic documents.

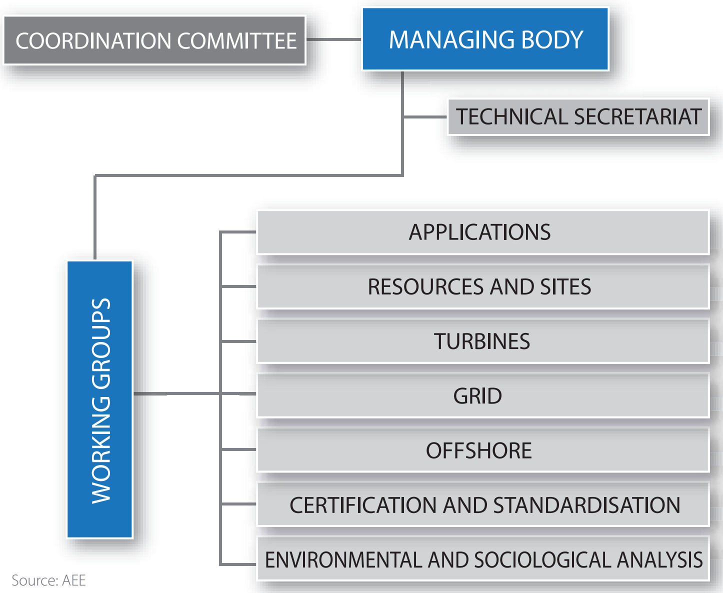
Always with an eye on the future, especially with regard to grid integration, some of the activities undertaken by universities and research centres have been monitored, mainly those focusing on the problems of new grid codes, grid stability and turbine modelling. Special mention should be made here of the collaboration by the Spanish Wind Energy Association (Spanish acronym AEE) and the German energy consultant Energynautics, together with the Universidad Pontificia Comillas in Madrid, in the organisation of the ***7th International Workshop on Large-Scale Integration of Wind Power into Power Systems,*** held in Madrid on 26-27 May 2008. This event was Europe's first seminar in this field and gave rise to the creation of a forum for the exchange of know-how, ideas and experiences concerning the large-scale integration of wind power into power systems and into offshore wind plant transmission networks.

X.1 The REOLTEC technological platform

As mentioned earlier, in order to bolster REOLTEC's role in TPWind and to disseminate the results of this Platform throughout the wind sector in Spain, **REOLTEC's Managing Body** held several meetings in 2008 with the Ministry of Science and Innovation with the aim of putting REOLTEC's wind sector priorities and positions relating to R&D and Innovation on the agenda of the meetings of the TPWind Mirror Group (of which the Ministry currently holds the vice-chairmanship).

This collaboration with the Ministry of Science and Innovation will undoubtedly give greater continuity to the work undertaken by the Platform and will aid in dissemination and put the Spanish wind sector's objective on the agenda of the European Platform TPWind.

Diagram X.01. REOLTEC structure



Source: AEE

These meeting were not only attended by members of the Ministry but also by Spanish participants in the European Platform, providing their first-hand impressions about the work being undertaken by TPWind and proposing the most necessary actions to be taken

It is important to point out that several of the Spanish companies taking part in TPWind are also members of REOLTEC's different working groups. In this connection, special mention should be made of Gamesa, CENER and Iberdrola in addition to international firms with offices in Spain such as Vestas, LM Glasfiber, GE Energy and Garrad Hassan.

There are a few differences between the TPWind and REOLTEC platforms which are described below.

REOLTEC is focused on technology (its duty being to identify the sector's technological needs) and is more precise in terms of its objectives and priorities and therefore has promoted the creation of consortia to coordinate different tasks and guarantee results. TPWind, on the other hand, while having technological interest in the development of wind energy in Europe and worldwide, has a more economic focus in terms of procuring Community funds earmarked for R&D and Innovation.

With their shared lines of action, the two platforms work in favour of **more secure and efficient grid integration** increasing the availability of turbines and promoting research for the development of infrastructure and marine foundations for offshore facilities.

The two centres also focus efforts on reducing per-kWh generation cost, enhancing equipment and component reliability, the use of new materials and design optimisation in response to rising costs.

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X.2 The surge of offshore wind generation in Spain

The Offshore Working Group has been considering the creation of an **experimental offshore wind plant platform** in Spain based on the success of Germany's North Sea experimental platform known as FINO established in 2003 to evaluate the technical parameters of offshore turbines and their effect on fauna and flora. This experimental plant could be located at a distance of between 10 and 15 km from the coast where ocean depth is between 20 and 30 metres with an approximate capacity of 15 MW (three 5-MW turbines).

This project would pave the way for a number of further studies including: the study and assessment of the different **technologies which could be installed offshore** and their further their adaptation to existing climate conditions; a description of offshore wind power potential by measuring wind speed at different heights; an analysis of loads on different parts of the turbines and structures; the study of grid integration possibilities and an assessment of environmental impact.

The **priorities** of this Offshore Wind Plant Working Group mostly dovetail with those of the European TPWind Platform but REOLTEC must especially prioritise offshore structures in light of sea depth, the major difficulty facing these plants along the Spanish coast both hindering and increasing installation cost. Other difficulties which need to be addressed include the complexity of operating and maintaining offshore facilities, the adaptation of turbines to the corrosive marine environment and grid connection.

Among the favourable aspects we should remember that offshore wind is stronger and features less turbulence since it is not affected by land relief factors and energy transport is easier in comparison to lines along roads.

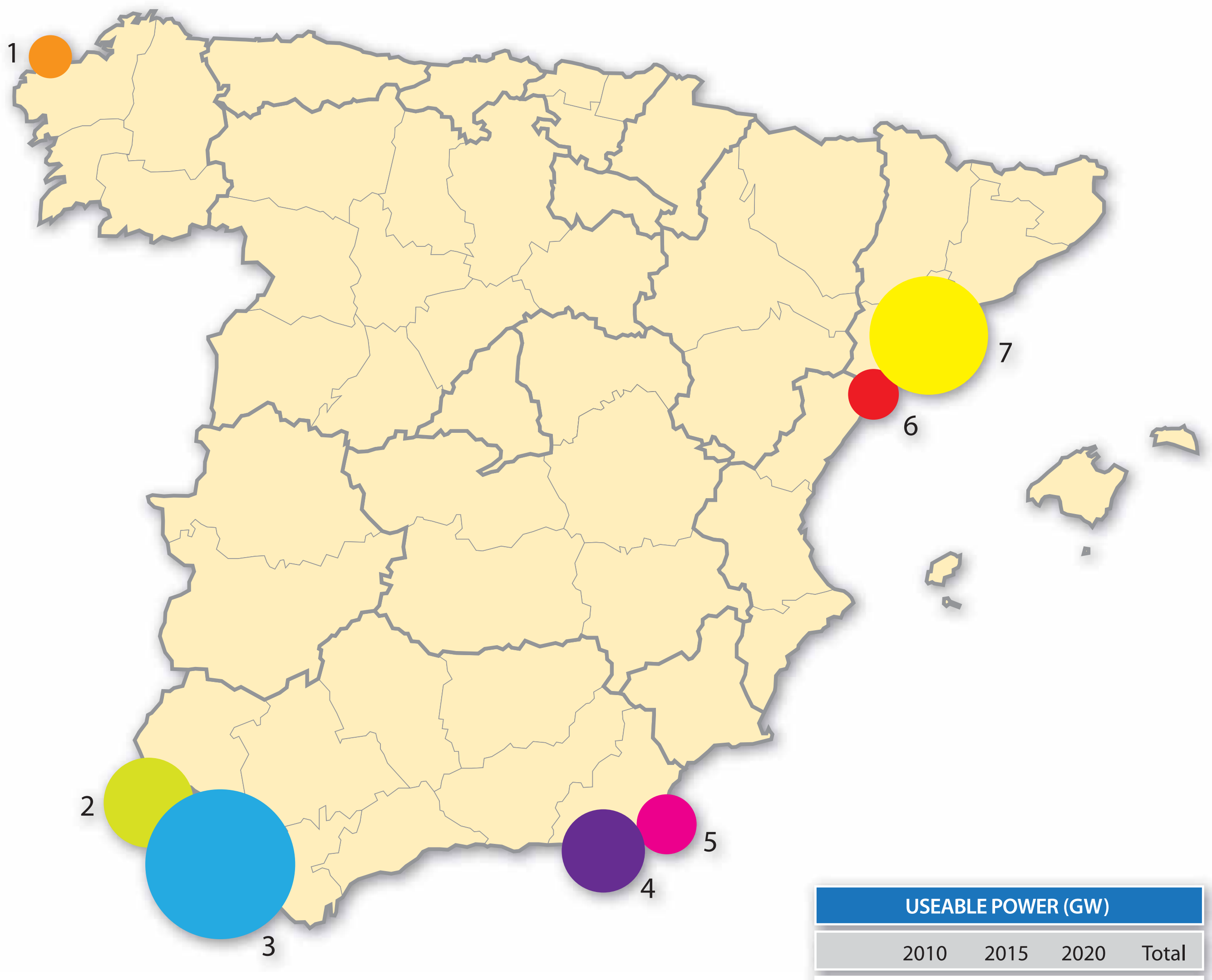
Given these expectations, the Offshore Wind Plant Working Sub-group is destined to be one of the Platform's most active in 2009 considering the above-mentioned recent approval of the Environmental Strategic Study of the Spanish Coast which will enable developers to carry out their planned projects along Spanish shores. The Sub-group's mission is, therefore, to analyse the different technical challenges entailed in implementing these projects.

32 projects have been submitted; 17 in Andalusia, 7 in Galicia, 3 in Valencia, 4 in Catalonia and 1 in Murcia and the main developers are Acciona, Iberdrola, Endesa, Unión Fenosa, Enerfin and Capital Energy.

Lastly, mention should be made of the work being done by a Spanish manufacturer **(MTorres)** in the development of a floating platform designed for deep water. The foundations are very similar to those used for offshore oil rigs where the turbine is fixed to a platform anchored to the seabed by means of steel tensors.

Offshore wind power is stronger and features less turbulence since it is not affected by land relief factors

Map X.01. Offshore wind projects submitted in Spain



USEABLE POWER (GW)	2010	2015	2020	Total
Spain	1.35	11.31	12.66	25.52
Europe	27.15	93.97	125.5	236.42

1 LA CORUÑA
- Punta de Lens, Muros
- Punta de las Olas, Carballo
- Bajo Ximiela
- Piedra La Tomasa
- A Mariña, Foz
- Bajo Ximiela
- Miñarzo, Carnota

2 HUELVA
- Isla Cristina
- Costa de la Luz
- Isla Cristina and Lepe
- Punta del Gato, Lepe and others
- Huelva I to VII

3 CÁDIZ
- Cape Trafalgar
- Banco de Trafalgar
- to Andalus, Almonte
- El Arrecife, Chiclana de la Frontera
- Chipiona I and II, Chipiona
- Costa de la Luz, Conil, Vejer and Barbate
- Banco de Trafalgar, Conil and others
- Trafalgar I and IV
- Cádiz I and IV
- Mar de la Janda, Vejer de la Frontera

4 ALMERÍA
- Mar de Alborán, I, II III and IV

5 MURCIA
- Cártago I, II and III, Cartagena

6 CASTELLÓN
- Costa del Azahar, Vinaroz and Benicarló
- Punta de las Salinas, Vinaroz and others
- Castellón I to VIII, Vinaroz

7 TARRAGONA
- Cap Term I, II and III, L-Ametila de Mar y Vandellós- L'Hospitallet del Infant
- Punta Aliaga I to VII, L'Ampolla and others
- Tarragona I to IX
- Tarragona IV to IX, phase 2

Source: Various

X.3 Development of new storage systems: electric vehicles

The Applications Working Group has been studying the development of new storage systems capable of absorbing excess wind power such as **electric car batteries** and hydrogen generation. Specifically, electricity storage using electric vehicles is under study and a project was presented on this subject in response to the 2008 call for proposals under the National Scientific Research, Development and Technological Innovation Plan which is addressed below in greater detail.

This Group also collaborated with the Universidad Politécnica de Madrid in directing a doctoral thesis submitted in September 2008 entitled ***Wind Power Management with Hydrogen*** focusing on the use of hydrogen to store electricity.

The REVE Project

As mentioned in the introduction to this Chapter, at the end of 2008 the REOLTEC Platform and the Spanish Wind Energy Association launched the **REVE Project** (www.evwind.es) to study wind power management using batteries installed in electric cars thus optimising the load curve and avoiding curtailment of wind generation during trough hours. The Applications and Infrastructures Working Group submitted this project in response to the National Scientific Research, Development and Technological Innovation Plan's 2008 call for proposals as mentioned above.

The REVE Project was approved by the Ministry of Science and Technology in November for a **period of 18 months** with the Spanish Wind Energy Association as the coordinator and DENER, CIRCE and Endesa as participants.

The Project basically focuses on the **storage of wind generated electricity** during periods of production surplus (trough hours) through the use of electric cars which could serve as electric energy storage units when at rest thus bolstering energy distribution efficiency.

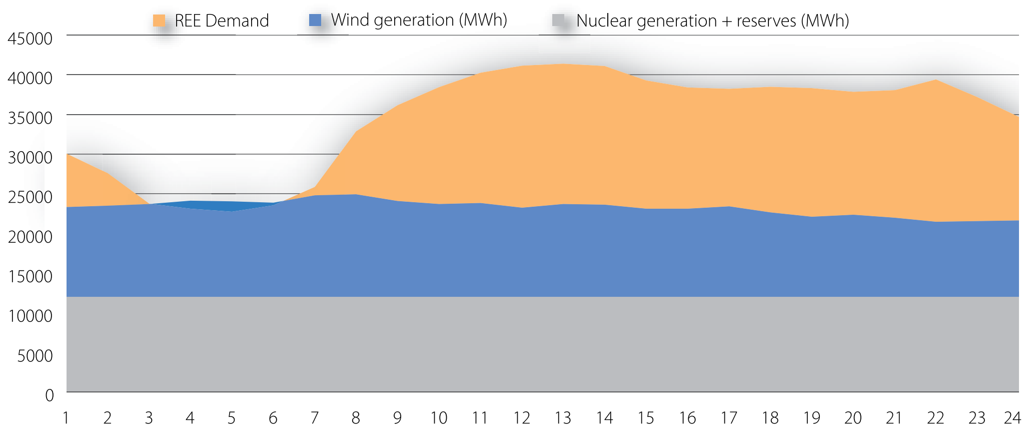
The Project features four main objectives:

A) Electric vehicles and the grid integration of wind power

As the number of installed megawatts rises (especially wind generated) the likelihood of wind generation curtailment due to excess production increases proportionally, especially during the night-time (trough hours) when demand barely reaches the 25,000 MW level. Considering that nuclear generation cannot be interrupted and the need for certain secondary and tertiary reserve levels, we need between 10,000 and 12,000 fixed MW meaning that when the 25,000 MW threshold of installed wind capacity is exceeded, wind generation curtailment becomes necessary at night during high wind periods. This means that renewable energy plans should establish their objectives not so much in terms of installed capacity but rather based on the volume of energy that can be absorbed by the grid.

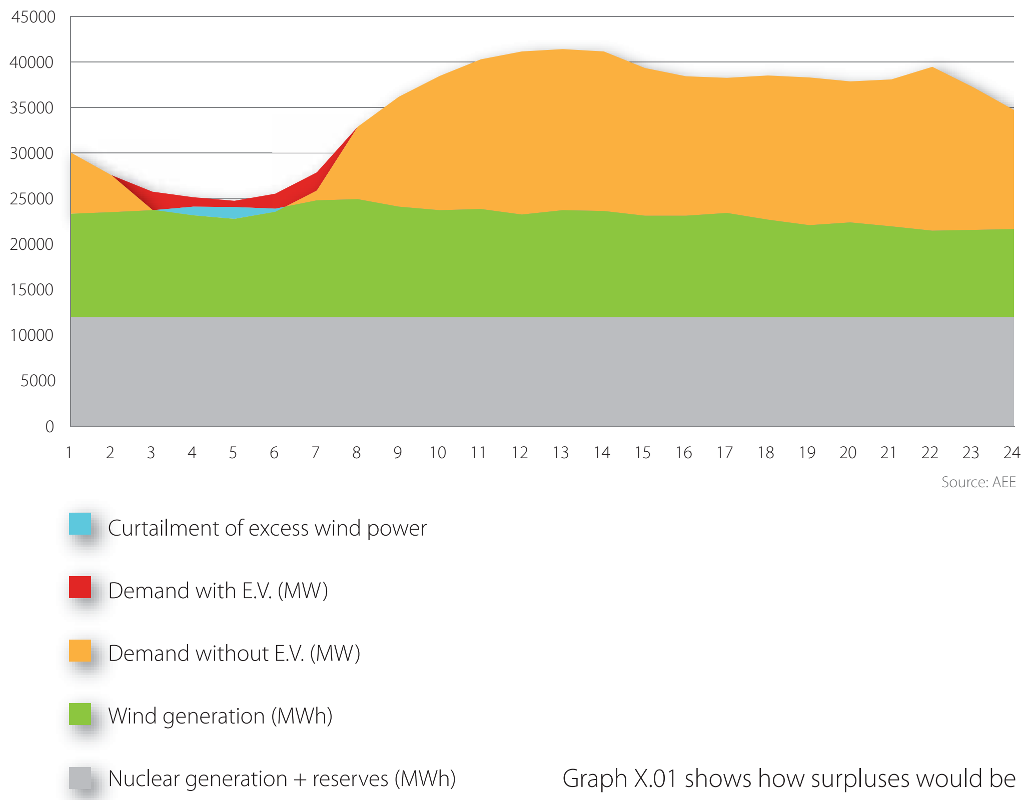
The REVE Project was approved by the Ministry of Science and Technology in November for a period of 18 months

Graph X.01. Hypothetical surplus wind generation hypothesis



Source: AEE

Graph X.02. Simulated increase in demand with electric vehicles



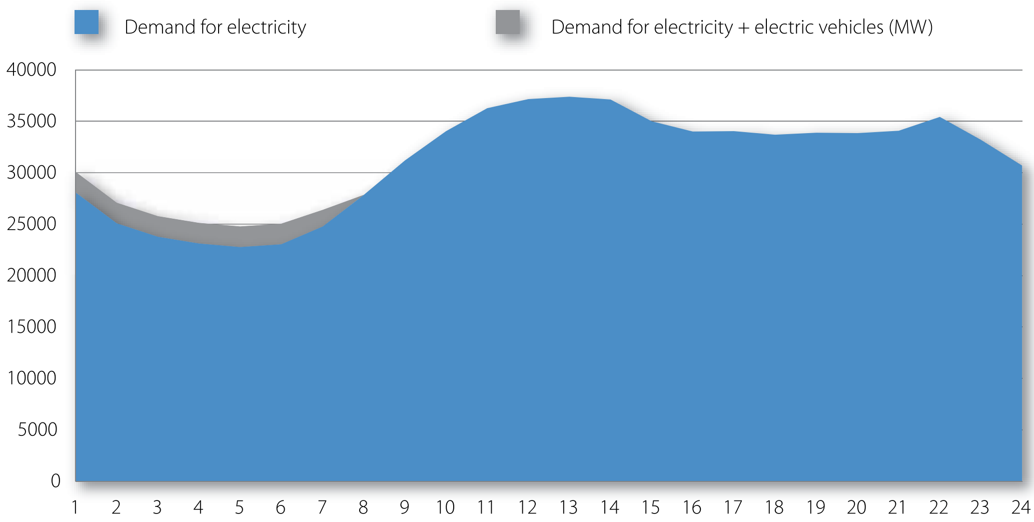
Source: AEE

Electric cars could serve as electric energy storage units when at rest, thus bolstering energy distribution efficiency

Graph X.01 shows how surpluses would be produced between 03:00 and 07:00 with wind power of 25,000 MW and wind generation at 50% of installed capacity.

In a simulated situation (see Graph X.02) of **two million electric automobiles** each equipped with a 7 kW/h battery, demand could be increased at a rate sufficient to absorb wind-generated surplus power during the most critical night-time trough hours.

Graph X.03. Uniform rise in demand during the hours of least consumption through the use of electric vehicles



Source: AEE

B) Impact of electric vehicles on system operation

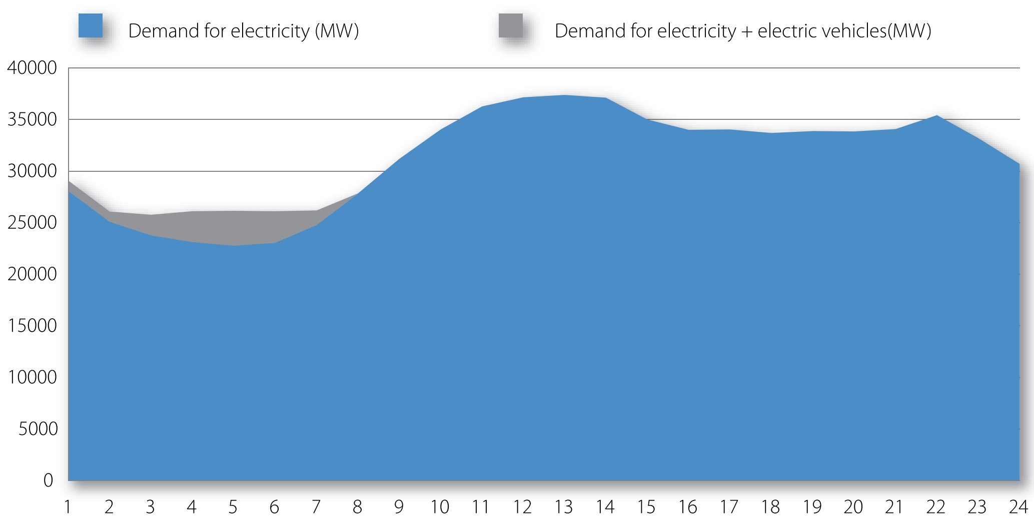
Due to the importance of incorporating new demand to help flatten the load curve, always an important objective but absolutely crucial in the context of the growing penetration of renewables in electricity generation, energy storage and management must become an integral part of electricity system operation.

Primary renewable energy resources present a number of storage difficulties and their manageability is limited. Hence, in the hypothetical scenario of two million electric automobiles equipped with a 7 kWh capacity battery and uniform charging, during the seven night-time hours when consumption falls off there would be an increase in demand of approximately 2,000 MW during each of those seven hours as illustrated in Graph X.03.

If intelligent systems monitoring overall demand on the system were used for charging vehicles, an increase of 4,000 MW in demand could be achieved during the most critical hours of electricity consumption which would flatten the load curve even further as shown in Graph X.04.

Flattening the load curve is a crucial objective in a context where renewables are accounting for a growing proportion of electricity generation

Graph X.04. Demand increase during the hours of least consumption through the use of intelligent charging systems

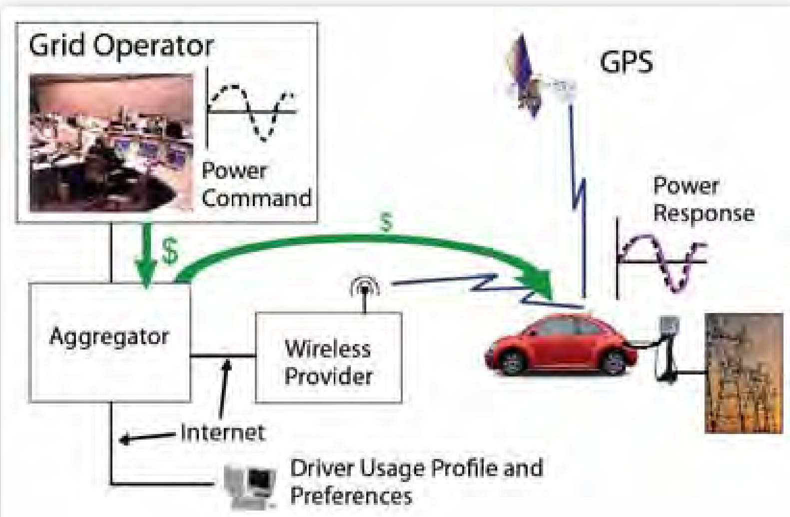


Source: AEE

C) Development of a transmission and distribution Network infrastructure for the charging of electric vehicles

The widespread use of electric vehicles requires the development of a distribution network which is compatible with this means of transport. Countries such as Israel, Denmark, Australia, France and the U.S. have already presented intelligent network projects and Spain is working along these same lines in addition to the REVE project. There are also other projects such as the one known as MOVELE being developed by Spain's Institute for Diversification and Energy Savings (Spanish acronym IDAE). Both projects seek to demonstrate that these types of networks, with their recharge and battery exchange stations are feasible over the short and middle term.

Diagram X.02. Basic technical requirements for the connection of electric vehicles to the distribution network



Therefore, one of REVE's objectives is to analyse the network's supply capacity for both high and low voltage power, describing it from the point of view of consumption and generation and analysing its performance in the event of contingencies and disturbances.

D) Management of the transmission and distribution network to make the project technically and economically viable

Project feasibility depends upon an economic management model and especially needs to be made profitable and attractive for consumers given that the main concern of individual users will be the cost of acquiring the electric vehicle.

The major innovation the system needs to introduce, and which is already in place in countries like Israel and Denmark through the Better Place project featuring electric automobiles with interchangeable batteries, is the elimination of one of the principal barriers standing in the way to the mass use of electric vehicles: the cost of batteries. Ways to bring battery prices down include renting them or paying a monthly fee for the battery or the vehicle as occurs on a smaller scale with mobile telephones.

Establishing the basic technical requirements for the connection of electric vehicles to the distribution network is as important as the economic model. The REVE project is working on defining these technical requirements paying heed to the definition of protective measures and the parameters needed to integrate these into control centres.

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Part four: AEE – the point of reference

Chapter XI
Objectives and action

Chapter XI
Objectives and action

XI.1 Objectives

The Spanish Wind Energy Association—Asociación Empresarial Eólica (AEE)—is undoubtedly the wind sector point of reference in Spain. Its overriding objective is to contribute to sector development and consolidation, both at national and international level. Strides towards that objective are reflected in membership, which has increased from 127 members in 2007 to 185 by end-2008, grouping together most of the Spanish sector's economic agents.

Wind power growth experienced over 2008 keeps Spain in third place globally in terms of installed capacity (only behind USA and Germany). Moreover, outside national borders Spanish companies—including manufacturers, developers and auxiliary companies—also stand out among the global leaders, especially in the main international markets.

The Association's work towards sector development and consolidation includes promoting abroad stable economic regulations and improved processing techniques. That is done through exchanging experiences and through other kinds of cooperation with foreign administrations, agencies and institutions. AEE has been working on all those aspects since its foundation.

In order to carry out all its tasks, AEE has created a whole series of working groups, where information is shared in the search for solutions to a diversity of problems and challenges. Moreover, the Association attends the main international trade fairs, such as the ones celebrated over 2008 in Houston, Brussels and Shanghai. AEE also organises its own events, like the Wind Power Convention, which took place on June 9, 2008, or the series of Technical Seminars it organised at Power Expo in Saragossa, which tackled the key issues facing the sector now and the outlook ahead. Similarly, AEE members participate in numerous events and forums to put forward their view of this ever growing sector.

Together with its routine publication of press releases on everyday sector issues, AEE also released in 2008 two important publications: the ***Wind Power Yearbook 2008***—a compilation of all the relevant sector facts and figures for 2007—and the ***Macroeconomic Study of the Impact of the Wind Power Sector in Spain***, produced together with Deloitte.

On top of all that comes AEE's website, www.aeeolica.org, a practical and accessible site covering the Spanish wind power sector and divided into four main sections: the Association, the Wind Power Observatory, Events and Newsroom.

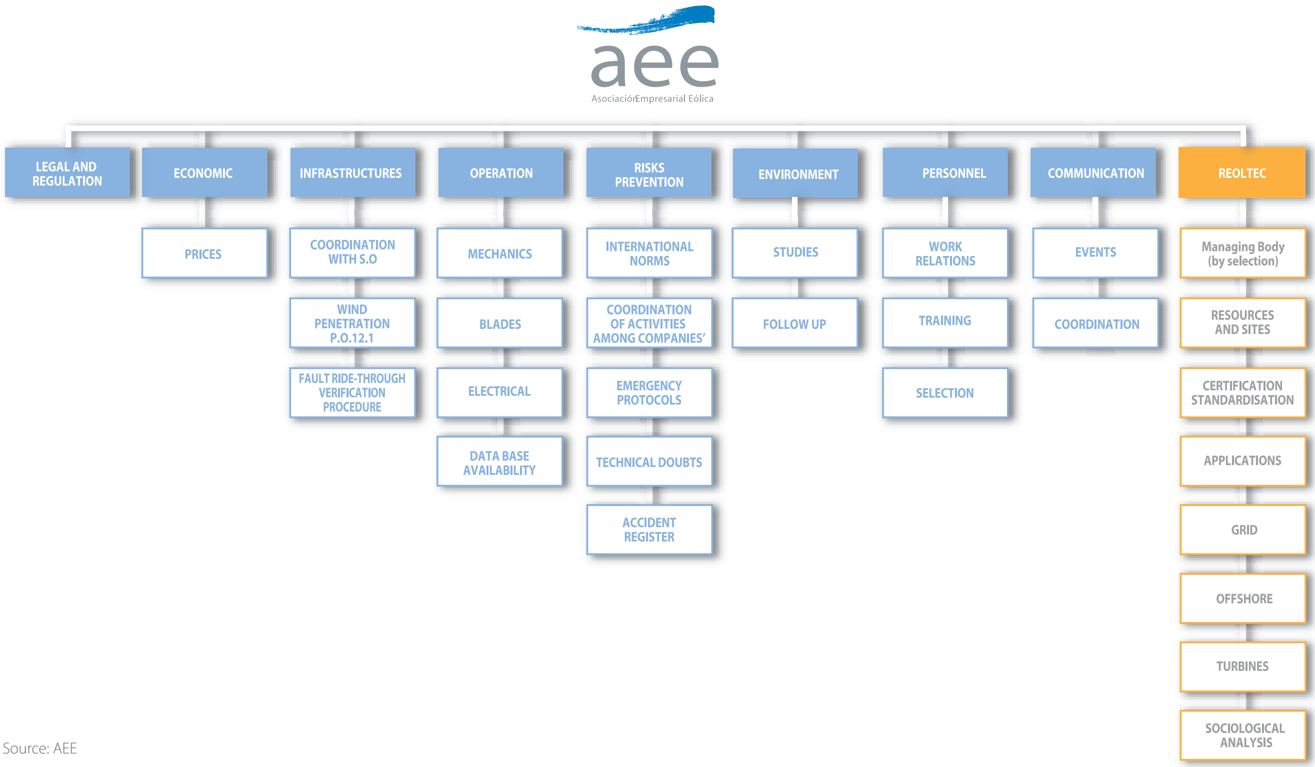
XI.2 Working Groups

As well as its **intense work as wind sector representative** before the Administration, AEE also plays other basic roles. A major one of those is its work **bringing together and co-ordinating different facets of the wind sector** through a series of **Working Groups.** In those groups, information and experience are shared in the search for solutions to a diversity of problems and challenges, often resulting in proposals for joint action.

Figuring among the Working Groups currently operating (some of them very actively) are the ones devoted to **Wind Plant Operation, Environment** (created in 2008), **Verification of Voltage Dip Ride Through** and **Risk Prevention.**

In the working groups, information and experiences are shared in the search for solutions to a diversity of challenges

Diagram XI.01. Structure of Working Groups



Source: AEE

XI.3 ICEX – AEE agreement

As part of the Power Expo 2006, in Saragossa, the Spanish Wind Energy Association—Asociación Empresarial Eólica (AEE)—and the Spanish Institute of Trade Abroad (ICEX in its Spanish initials), invited the Egyptian and Moroccan authorities to see the Spanish wind sector at first hand by visiting the trade fair and attending the parallel technical seminars organised by AEE. Continuing from that event, AEE signed a collaboration agreement with ICEX in 2007, with the aim of promoting the presence of Spanish wind sector companies abroad and consolidate their penetration in international markets. The agreement, still standing today, aims at jointly promoting the participation of as many companies as possible—both AEE members and non-members—and the presentation of specific action plans. Throughout 2008, AEE backed those plans with the financial, logistic and organisational help of ICEX.

In 2007, AEE signed an ongoing collaboration agreement with ICEX

XI.4 Events 2008

Throughout 2008, the Spanish Wind Energy Association—Asociación Empresarial Eólica (AEE)—did not only participate in the main international wind sector events but also organised some of the most relevant ones itself, as follows:

1st European Meeting on Risks Prevention in the Wind Power Sector

An initiative of the Working Group for Risk Prevention at Work, AEE organised this international conference in 2008. The objective was to channel sector interests in risk prevention before the appropriate institutions, to exchange information and experiences in this field and, above all, to become the Spanish wind sector reference in questions of health and safety at work. At the event, celebrated in Pamplona May 21-22, 2008, the wind industry made manifest its commitment to improving and promoting the development of risk prevention techniques at work in the sector. That initiative also responds to the considerable growth of wind power both in Spain and Europe.

The event celebrated in May was a complete success attended by a large number of sector professionals.

The wind industry made manifest its commitment to improving and promoting the development of risk prevention techniques at work in the sector

The public's attraction to the Convention demonstrates the degree of interest in wind power, an energy technology in which Spain is among the global leaders.

The Secretary General for Energy, Pedro Marín Uribe (just after his instatement), received the prize awarded to IDAE (like the energy secretariat, also dependent on the Ministry of Industry, Tourism and Commerce) for its support of wind power development.

Wind Power Convention

For the second year running, 18 European Union countries celebrated the **European Wind Day** with the objective of bringing the realities of this form of energy generation to European society at large. The Spanish Wind Energy Association (AEE) contributed to the event by holding in Madrid, on June 9, its **Wind Power Convention**, a point of encounter for all sector professionals.

This time round, the convention's central event was a conference, which was attended by high-level Spanish and European politicians, as well as representatives of a diversity of social entities and organisations involved in the sector. Together with the key wind company decision makers, all these participants discussed the current situation and the main changes facing the sector. The four key topics were the leadership of Spanish companies on the world stage, the proposal for a new EU Directive, the environmental and socioeconomic benefits of wind power and, finally, the sector outlook for the future.

AEE organised the Technical Conferences last September, in Power Expo.

A key session was devoted to wind sector employment, whereby a space was dedicated to meetings with companies

Power Expo 2008

The wind industry turned up at the 2008 edition of the biennial Power Expo, celebrated in Saragossa 24-25 September. It was a crucial moment in time marked by two key elements: firstly, the backdrop of the record growth of more than 3500 MW installed in Spain over 2007 and, secondly, the growing expectations arising from the outlining of new European objectives for the Directive on the Promotion of Energy from Renewable Sources.

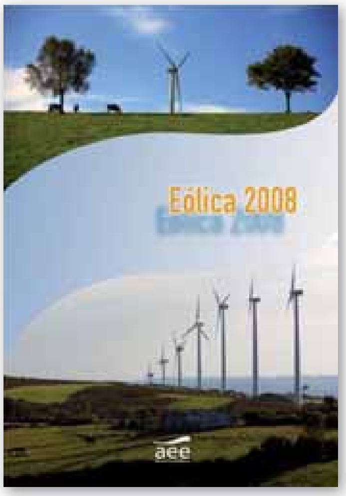
In Power Expo, AEE organised a series of Technical Seminars addressing the key sector issues and proposals for future growth.

Parallel sessions included a presentation of the Windlider Platform, an industrial research project led by Spanish turbine manufacturers Gamesa and Ecotècnia and aimed at keeping Spain at the technological forefront in energy. Another key session was devoted to wind sector employment, whereby a space was dedicated to encounters between companies, job seekers and training centres.

In short, the Spanish Wind Energy Association has participated in numerous events, both as exhibitor (as in the Genera 2008 International Energy and Environment Fair) and as conference participant, as is the case in all relevant energy events.

AEE Secretary General, Ramón Fiestas, at the Spanish Wind Energy Association's stand at Genera'08.

XI.5 AEE publishes



Cover of Wind Power 2008 Yearbook.

As has become the norm, since 2006, the Spanish Wind Energy Association (AEE) published in June 2008 a new edition of the sector yearbook: Wind Power 08. Sponsored by ICEX, the yearbook has become the sector reference publication, as it includes a thorough report on Spanish and global wind power. It also includes an analysis of the Spanish wind industry as a global point of reference, both because of the leadership of Spanish companies and for the national sector's efforts in grid integration. The yearbook also includes chapters on key aspects such as economics, technology and development.

AEE presented in December 2008 the *Macroeconomic Study of the Impact of the Wind Power Sector in Spain,* produced by Deloitte for the Association and which is summarised in the first part of this yearbook (as mentioned in Chapters I, II and III). The study both analyses the socioeconomic impact of wind power on our country in recent times and presents a future forecast. To achieve that, Deloitte used economic data supplied by 95% of sector companies, together with a broad spectrum of statistics from different organisations and entities. The report offers an exhaustive and accurate view of the key economic repercussions of the wind sector, such as it contribution to GDP, its effect on the trade balance, on tax revenue, on employment and on energy dependency, among other aspects.

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

Furthermore, as is the case every year, and as part of its objective to extend and consolidate knowledge of the wind sector, the Assocation published a series of press releases and statements over 2008.

XI.6 Reaching out

At the click of a mouse, the website of the **Spanish Wind Energy Association** (AEE), www.aeeolica.org, offers a wide range of practical information on the Spanish wind power sector. That information is divided into four main sections: **the Association, the Wind Power Observatory, Events and Newsroom.**

An outstanding feature at www.aeeolica.org is the information offered by the **Wind Power Observatory.** There, a **Wind Map** shows the location of all wind plants in Spain, together with facts regarding each one including among other elements, the developer, the municipality, plant capacity, number and type of turbine and grid connection point.

The **Wind Power Observatory** pages also offer general statistics regarding wind development, both in Spain and in the rest of the world, such as wind generation over recent years and the capacity installed in each autonomous region, or by each developer or manufacturer. The section offers links to web sites and pages where details on daily programming and production can be found. Furthermore, under the tab **Regulatory Framework,** the Observatory provides copies of the regulations applicable to wind, not just for Spain and its autonomous regions but also for Europe. The service also includes related documents and reports.

The Wind Map section shows the location of all wind plants in Spain

The tab **The Association** not only shows a list of the more than 180 member companies and the Association's management structure, but also AEE's own publications, such as recent yearbooks or the *Macroeconomic Study of the Impact of the Wind Power Sector in Spain*. The section also includes a new tab called **Wind Power Job Search** jointly managed by our partner Ginko, a human resources consultancy specialising in wind power and other renewables. The service offers and advanced job search in the sector by entering candidate details into a database and distributing profiles among our members, respecting confidentiality.

www.aeeolica.org

Part four:
AEE – the point of reference

Chapter XII
AEE, members and structure

XII.1 Member list according to activity

Associations

AEPA Principality of Asturias Wind Energy Association

APECYL Castile and Leon Wind Energy Developers Association

APREAN Andalusian Renewable Energy Developers and Producers Association

APRECAM Castile-La Mancha Wind Energy Developers Association

Component manufacturers

3M ESPAÑA, S.A.

AEROBLADE, S.A.

ALSTOM POWER SERVICE, S.A.

AREVA T&D IBÉRICA, S.A.

ASEA BROWN BOVERI, S.A.

AVANTI WIND SYSTEMS, S.L.

C.C JENSEN IBÉRICA, S.L.

DANOBAT 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 ENERGY, S.A.

INNEO TORRES, S.L.

JIMÉNEZ BELINCHÓN, S.A.

KINTECH INGENIERÍA, S.L.

LM GLASFIBER IBÉRICA, S.A.

MANUFACTURAS ELÉCTRICAS, S.A.

MATZ-ERREKA S. COOP.

MITA-TEKNIK A/S

MORGANITE ESPAÑOLA, S.A.

PRAINSA PREFABRICADOS, S.A.

RÖCHLING PLÁSTICOS TÉCNICOS

SANTOS MAQUINARIA ELÉCTRICA, S.L.

SKF ESPAÑOLA, S.A.

TECNOTRANS BONFIGLIOLI, S.A.

TRACTEL IBÉRICA, S.A.

WIND TO POWER SYSTEM, S.L.

WINERGY (FLENDER IBÉRICA, S.A.)

ZIGOR CORPORACIÓN

CONSOLIS HORMIFUSTE S.A.

Wind turbine manufacturers

ECOTÈCNIA ENERGÍAS RENOVABLES, S.L.

ENERCON GmbH Sucursal en España

EÓLICA DEL ZENETE, S.L. (EOZEN)

GAMESA EÓLICA

GE WIND ENERGY, S.L.

M. TORRES, ÓLVEGA INDUSTRIAL, S.A.

NORDEX ENERGY IBÉRICA, S.A.

REPOWER ESPAÑA, S.R.L.

SUZLON WIND ENERGY ESPAÑA, S.L.U.

TECNOARANDA, S.L.

VESTAS EÓLICA, S.A.U.

Other entities

CENER NATIONAL RENEWABLE ENERGY CENTRE (CENTRO NACIONAL DE ENERGÍAS RENOVABLES)

UNIVERSITY OF CASTILE-LA MANCHA RENEWABLE ENERGY RESEARCH INSTITUTE

Developers / operators

ABO WIND ESPAÑA, S.A.

ACCIONA GREEN ENERGY, S.L.

ALARDE SOCIEDAD DE ENERGÍA, S.A.

ALDESA ENERGÍAS RENOVABLES, S.A.

ANEMOI RENOVABLES, S.L.

APROVECHAMIENTO DE ENERGÍAS RENOVABLES ADER, S.L.

ASTURWIND, S.L.

BANCSABADELL INVERSIÓ I DESENVOLUPAMENT

BEAS DE INGENIERÍA, S.L.

CALIDAD ENERGÉTICA, S.A.

CAPITAL ENERGY, S.A.

CASTELLWIND-03, S.L.

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)

ENERGY RESOURCES, S.A.

ENERGYO RENEWABLE ENERGY, S.A.

ENFINITY SPAIN, S.L.

EOLIA RENOVABLES DE INVERSIONES, SCR, S.A.

EÓLICA BOSQUE ALTO, S.A.

EÓLICA DE NAVARRA, S.L.

EÓLICA DEL CIERZO, 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.

FORTUNY ENERGÍA, S.L.

GAELSA ENERGÍAS, S.A.

GAMESA ENERGÍA

GECAL, S.A.

GENERA AVANTE, S.L.

GESTAMP EÓLICA, S.L.

GUASCOR WIND, S.L.

GRUPO VI ENERGÍAS RENOVABLES, S.L.U.

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.

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

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.

CENTRICA ENERGÍA, S.L.U.

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

CONTROL Y MONTAJES INDUSTRIALES CYMI, S.A.

DEWI GMBH

EDUINTER, S.A.

EFACEC Sistemas de España, S.L.

ELDU, S.A.

ELECTRIA, S.A.

ELECTRIZITATS-GESELLSCHAFT, S.L.

ELSPEC ENGINEERING LTD

ENERGY TO QUALITY, S.L.

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.

GINKO (ADERLEX IBERIA S.L.)

GLOBAL ENERGY SERVICES SIEMSA, S.A.

GRUPO BIOTECH DOS MIL, S.L.

IBERDROLA INGENIERÍA Y CONSTRUCCIÓN, S.A.U.

INDOORWIND, S.L.

INDRA SISTEMAS, S.A.

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

INTEGRAL MANAGEMENT FUTURE RENEWABLES, S.L.

ISASTUR, S.A.

ISOTROL, S.A.

LA CAIXA, S.A.

LASO ABNORMAL LOADS

LEADERNET COMPUTER, S.L.

MAECO EÓLICA, S.L.

MARSH, S.A.

MASTER DISTANCIA, S.A.

METEOLÓGICA, S.A.

METEOSIM TRUEWIND, S.L.

MLS, S.L.

NEREO ENERGÍA, S.L.

NORMAWIND, S.L.

NORTH IBERIAN CONTROL, S.L.

OPEX ENERGY Operación y Mantenimiento, S.L.

OPERACIÓN Y MANTENIMIENTO ENERGY, S.A.

RONÁUTICA

SERVICIOS RENOVABLES DE NAVARRA, S.L.

SG DOCUMENTA, S.L.

SGS TECNOS, S.A.

SIEMENS, 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.

VERTICAL MULTISERVICIOS

WINDBROKERS ESPAÑA, S.L.

WINDTEST IBÉRICA, S.L.

WIND TO MARKET, S.A.

YNFINITI ENGINEERING SERVICES, S.L.

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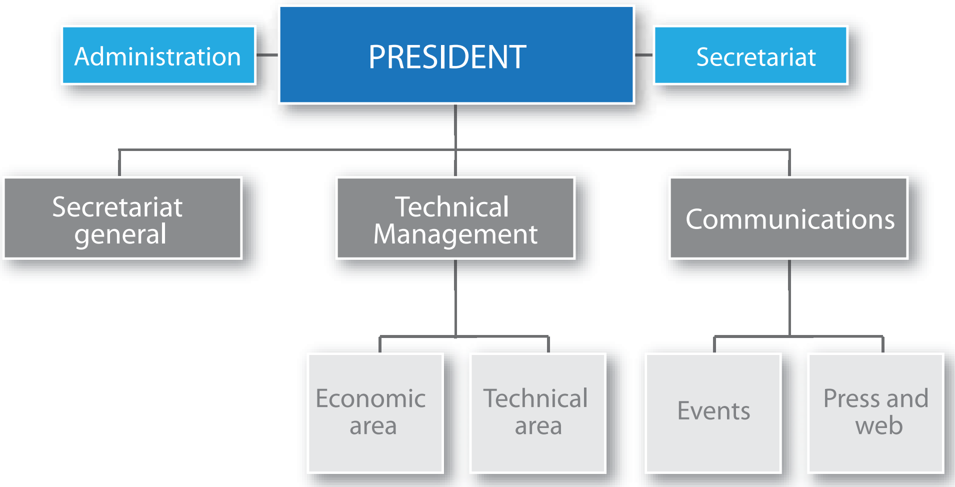
XII.3 Staff

Diagram XII.01. AEE Staff



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Juan José Mostaza	Technical Department
Mar Morante	Communications Department
Sheila Carbajal	Communications Department
Paz Mesa	Secretary

Annex
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