

# **Analysis of Renewable Energy Policies Related to Repowering the Wind Energy Sector: the Spanish Case**

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## **ABSTRACT**

In countries that started early with wind energy, the old wind turbines were located in places where the wind is often very good. Since the best places in which the wind is concerned are occupied by old wind turbines (with lower capacity than the more recent ones) the trend is to start replacing old turbines with new ones. With repowering, the first generation of wind turbines can be replaced by modern multi-megawatt wind turbines. The aim of this article is to analyze energy policies in the Spanish energy sector in the repowering of wind farms from the viewpoint of the current situation of the wind energy sector. The approach presented in this article is meant to explain what have been the policies related to the repowering sector making a brief analysis of the spectrum of different stimuli that are demanded by the market analyzing also the future perspectives of the repowering sector by establishing the new opportunities based on the new published regulations.

**Keywords:** Energy policy, Regional development, Repowering, Wind energy.

## **1. INTRODUCTION**

In countries like Germany, Denmark or the Netherlands, wind power is now so widespread that few sites are available on-shore to build new units. There are two main roads that are being taken to further increase the electricity generated from wind: building off-shore wind farms, and replace existing turbines by larger models (3 to 5 MW) (UPDATE, 2012). Replaced models are emerging in the second hand market and allow other countries start using wind power at a lower price.

The second boom in the development of wind technology particularly affects countries such as Denmark and Germany, which are operating under what might be the most productive sites (Trends Influencing the Costs of Wind Power, 2012). In these countries, more efficient turbines replace small and medium sizes and in addition it is most productive for new and larger turbines, the construction of new wind farms in more productive sites. This process is called repowering.

In general, there are many factors in favor of repowering policies:

- More wind power from the same area of land: the generation of wind power is multiplied without the need for additional land.
- Less wind: the number of wind turbines can be reduced. The building height will tend to rise. The impact on the landscape changes: fewer turbines but probably higher.

- Lighter efficiency, lower costs: modern turbines make better use of available wind. The production cost is significantly reduced.
- Minor visual and auditory impact: modern wind turbines rotate at much lower speeds and are therefore more visually and aurally pleasing than the old wind turbines turning faster.
- Better integration into the grid: modern turbines offer network integration much better, as they use a connection method similar to plants of conventional power generation, and also achieve a higher degree of utilization.

When evaluating the proposed upgrade, is not presumed that simple, and will need to first understand the existing law and then consider the economic and other variables that affect it, making a full financial and economic study.

## 2. SPANISH POLICES ON WIND SECTOR

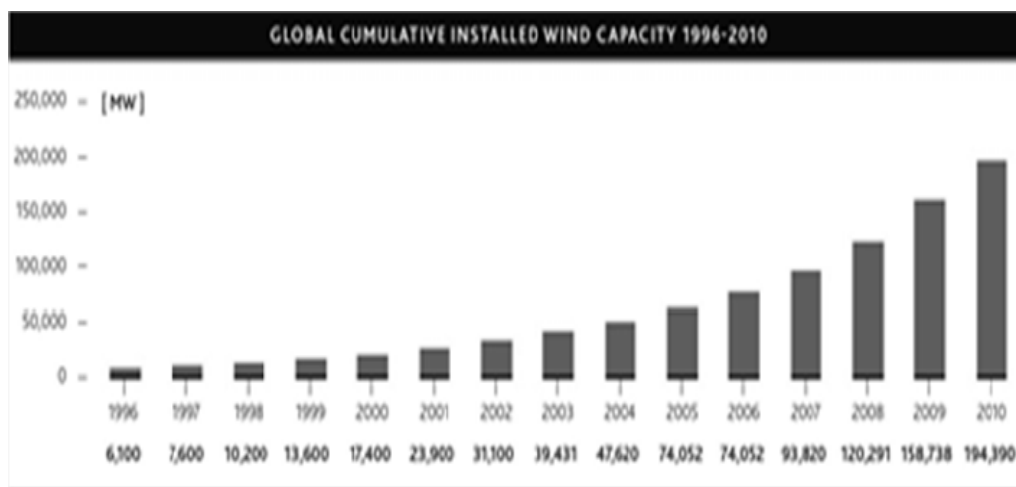
Against most predictions made a few years ago, today the wind grows not only hit in Spain and breaks all records, but also has become the best proof that renewable energy can help transform the model traditional energy. It is an undeniable fact that this green energy input to the network implies a significant reduction in thousands of tons of CO<sub>2</sub> that is no longer released into the atmosphere (Energy, 2008).

The growing market for wind energy has been produced by several factors (Council, 2011). These include the diversification of energy sources, increasing environmental awareness, particularly climate change, and the great potential and development of technology. The combination of these factors along with political support from governments has made this development possible.

### 2.1 WIND ENERGY IN THE WORLD

The installation of wind farms is increasing in all countries. In recent years the growth rate has been around 25% in 2010 respect to 2009, as shown in Fig. 1(GWEC, Global Wind Energy Council, 2011). This confirms a significant change in the development of this industry and only serves to endorse the idea of globalization of wind energy.

In regard to the world rankings, the five countries in the world with wind power accumulated in late 2008 were again the United States, who first stood in first place and whose growth prospects are very high, Germany, which has given way to the United States but remains a leader in Europe, Spain, China, and India.

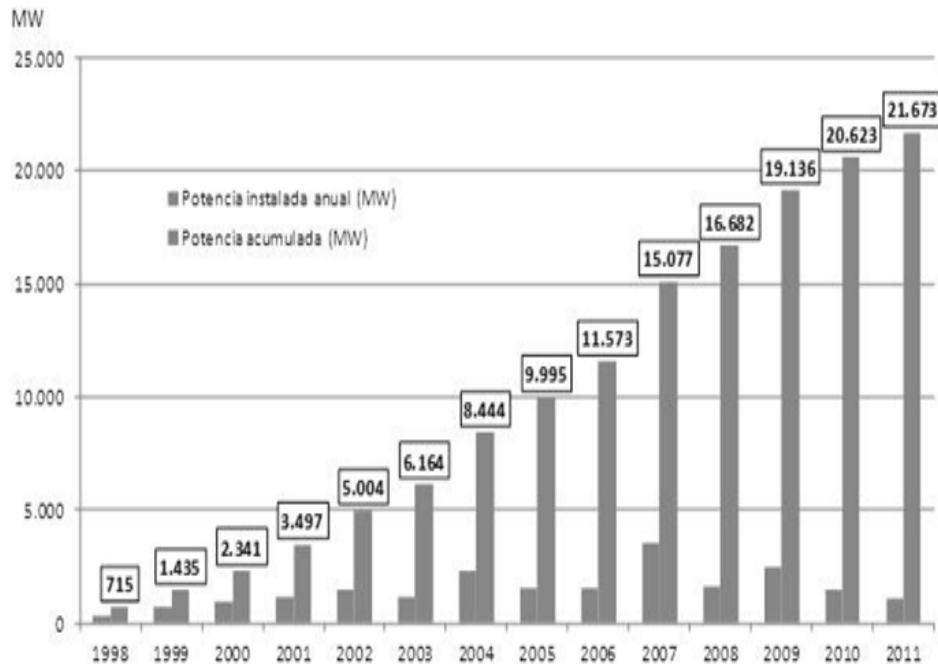


**Fig. 1: Global cumulative installed wind capacity 1996-2010**

According to the report Global Perspective for Wind Energy 2008, better known by its English meaning Global Wind Energy Outlook, published by the World Energy Council Wind (GWEC) and Greenpeace International, wind energy can meet 12% of the overall final energy demand and allow a saving of 10 billion tons of carbon dioxide in the next 12 years. The report highlights the global potential of wind energy by 2050 and its important role in reducing emissions by 2020.

## 2.2 WIND ENERGY IN SPAIN

The wind energy situation in Spain has experienced strong growth in recent years, being higher than any other type of renewable energy, reaching the end of 2011 with 21.673 MW of installed capacity, Figure 2 (AEE, Asociacion Empresarial Eolica, 2011). Spain is one of the four countries with more power installed in late 2010 along with China, U.S. and Germany.



**Figure 2: Spanish Installed Capacity at December 31, 2011**

Wind power in 2010 covered 16.33 percent of demand according to the data of REE (REE, Red Electrica Española, 2011). Also in that year prevented the emission of 20 million tons of CO<sub>2</sub> and fossil fuel imports worth over 1,200 million euros. The wind directly and indirectly contributes EUR 3,270 million to GDP in that it represents 0.35 percent (AEE, Asociacion Empresarial Eolica, 2011). The development of this energy is explained by the continued support of all governments through the adoption of favorable state legislation, the launching of domestic manufacturing of wind turbines and the attraction of investors from great economic capacity and / or financial.

The Spanish Renewable Energy Target Plan for the period 2005 – 2010 (called PER 2005-2010) (IDAE, Instituto para la Diversificacion, Ahorro y Eficiencia, 2011) was developed with the aim of strengthening the priority objectives of energy policy, which are very important: guarantee of safety, power quality, respect to environment, determination to fulfill the commitments of Spain in the international - Kyoto Protocol (United Nations Framework Convention on Climate Change, 1992) and the National Allocation Plan- and deriving from his membership in the European Union.

In the forecasts predicted the important contribution of wind energy, which raises its target of 20,155 MW installed power in 2010 (with an estimated production for that year of 45,511 GWh) and the reality was that the installed capacity on 31 December 2010, which turned out, was 20.623 MW in Spain.

The first generation of projects wind generation were installed in the U.S. and Europe in the 80, they have now begun to reach the end of its life, the older technology used in these projects has generally proven to be more durable than that was originally anticipated. However, in some older projects, there has been the repowering or upgrading. (SEA, Sociedad Eólica de Andalucía, 1992).

### **2.3 POLICIES TO STIMULATE DEMAND**

Several reasons make it convenient to expand immediately the use and production of wind energy repowering, without waiting for change is cyclical aspects expansive wind market. On the one hand the commitment to Kyoto, meeting the objectives set out in Directive 2003/30/EC, the effect size can experience a secular increase in productivity both in the wind sector and in companies that are part of industrial sector.

The actions included in this group have a threefold character:

- They are primarily of short term.
- In many cases have already been implemented so it has results from its implementation.
- Focus primarily on removing obstacles to the emergence of a latent demand, or to create conditions favorable for installation of the repowering wind-farms.

The stimuli are:

- Compliance obligations of operating procedures, which led to increase the security of the network against potential voltage dips. This legal imposition has not been widely used in the past, except in countries like Germany, which have been established in domestic law, but presumably will be enhanced in the near future. The obligation to fulfill the operating procedure is given by the possible adaptation to the technological requirements that many wind turbines, especially those less than 500 kW models have incorporated when mechanical-electronic devices to ensure network stability. In the short term, these obligations should be used to start, somehow the repowering market, and therefore the market for second hand generators. Likewise also to take advantage of logistics and distribution network, without additional costs or move users or manufacturers, yet, support the fulfillment of the quantitative targets set in Directive 2003/30/EC.
- Tax incentives for repowering. These grants (partial or total) in premiums received by wind farm developers are established to offset the negative externalities avoided by the use of fuel, while generating industrial environment and promotes the country's GDP. This measure has been adopted by many countries of the Union, with a different extension. Countries such as Spain and Germany have opted initially for a grant. It also helps that it is accompanied by a regulatory system of electricity market as we have seen it has been helpfully in eliminating the deviations of the market.
- Alternatively, increased taxes on fuels, both fossil and biological, so that the amount reflects the varying environmental impact of each fuel type, based on the principle that "polluter pays" (Conference on Environment and Development, 1992). Any decision in this regard must be weighed carefully the effects that such action may have on the competitiveness of other economic sectors.
- Incentives (tax or otherwise) to the acquisition of vehicles using mostly or exclusively electric batteries, including the so-called flexible fuel vehicles. Many laws already addressed that possibility which is not alien to our own legal system. In the Spanish case, the deduction from the tax payable for commercial vehicles or trucking industry under the current corporate income tax (Instituto Para La Diversificación, Ahorro y Eficiencia Energética, 2012) meets precisely this purpose.

The proposed measures are the most commonly have been used until now though there is still a long journey and at the moment appear to be on the appropriate line of view to achieving the objectives proposed in the Spanish Renewable Energy Plan (PER 2011-2020) (IDAE, Instituto para la Diversificación, Ahorro y

Eficiencia, 2011). Thanks to regulatory instruments described above, the course of market liberalization has led to the emergence of a growing number of voluntary actions. They are based primarily on the willingness of consumers to pay premium for renewable energy. However, to date, its impact on total employment of RES is negligible.

## **2.4 REPOWERING POLICIES**

The repowering of wind farms in Spain is regulated through the seventh transitory provision of Royal Decree 661/2007 and subsequent correction of errors in the BOE of 25 July 2007 (BOE, 2007). We must also take into account Royal Decree-Law 1/2012 of 27 January, by which we proceed to the suspension of pre-allocation procedures and the removal of economic incentives for new production of electricity from cogeneration, power renewable energy and waste (BOE, 2012). In the first paragraph of Royal Decree 661/2007 are certain facilities that may receive premium upgrade, as those with final registration date prior to December 31, 2001, meaning upgrading "a substantial change is aimed at replacing of its wind turbines with higher-power, under certain conditions." Therefore, it is important to consider that date, just as will other factors such as technology. The repowering without complying with these characteristics, for example date of registration after this date may not receive any premium.

As determined in second paragraph, is targeted power limit, the effects of the economic system established in this Royal Decree of 2000 MW to the installed capacity of the facilities that may be repowered, and not consider the effects of the limit in Article 38.2. Thus, establishing a target power of 2,000 MW to 20,155 MW, which is the objective of that Royal Decree of 2010. Understanding that if the date of one installation that had been previously registered before 31/12/2001 and now it is extending from 15 MW to 25 MW, the additional is 10 MW.

Third section provides the raw: For these facilities, by agreement of the Council of Ministers, after consultation with the Autonomous Communities may determine the right to an additional premium, specified for each facility, maximum of 0.7 cent. €/kWh, to receive up to 31 December 2017. This premium is discretionary therefore, the processing, in general, will be slow. The facilities must meet certain requirements set out in fourth paragraph: "These facilities must be assigned to a control center for the generation and must have the necessary technical equipment to assist in the continuity of supply against voltage sags, according to corresponding operational procedures, due to new facilities.

When increasing the power of each facility to refurbish, should take into account fifth paragraph: Whenever the installed capacity is not increased by more than 40 percent and the facility has the equipment necessary to ensure that given power will not exceed at any time the electric power authorized for disposal before the upgrade, will not apply a new request for access to the system operator. Otherwise, the owner of the facility shall make a new request for access under the terms provided for in Title IV of Royal Decree 1955/2000 of 1 December, regulating the activities of transmission, distribution, marketing, supplies and authorization procedures for electric power facilities. That is, if the power does not exceed by more than 40% of installed capacity, will not apply a new request for access to the system operator.

## **3. FUTURE PERSPECTIVES**

One of the cornerstones of the new regulations that will be developed for the wind energy sector should be the upgrading because it will improve resource allocation and increase the use of wind stocks while you can create new business opportunities energy in the country. (AEE, Asociacion Empresarial Eolica, 2011). We are talking about 7,000 to 8,000 million euros of investment by 2020 and a renewal that would affect 5,000 megawatts (MW), (Donoso, 2007). This power is equivalent to almost a quarter of the total 19,149 MW installed at the end of 2009. This renewal of facilities is another example of the wind sector that could be exerting a countercyclical role ( Shari Spiegel, 2007) and its ability to provide wealth in a time of economic crisis. Moreover, every time he does so with less need for subsidies, as demonstrated by in the two years of the Royal Decree 661/2007 to 60% of the wind activity took place outside of the premium ( Asociacion Empresarial Eolica, 2011).

However, wind is now very affected by an institutional crisis and in need of respectability, (Donoso, 2007) and the resolution of this problem is one of the main objectives of the Spanish association of wind energy entrepreneurs (Asociacion Empresarial Eolica, 2012). Recent regulatory changes have led to paralysis in the field of eight months, accompanied by the loss of more than 5,000 direct jobs, which adds to the image loss caused by inspections of the National Energy Commission (CNE) (Comision Nacional de la Energia, 2012).

We must distinguish between those who commit offenses and who do not and the CNE would have to say it clear. On the latest regulatory changes, Spanish government has determine to stop the subventions for the new installations, so the problem now is that it is not possible to plan based on the situation and it is necessary to assume that, after the "break" applied by Minister of industry, now is not going to meet the objectives targeted by the European Union on 2020 (European Union Committee, 2008).

The Spanish Ministry of Industry has applied a straightjacket without consulting sector and imposed a suit that perhaps others do well, but no wind. The industry has never created a boom, but is mature and has specific characteristics, which requires proper treatment. In April of 2011, the Government adopted Royal Decree Law 6/2009, establishing a record of pre-allocation of power for renewables, including wind, similar to what was designed to address speculation that it suffered the photovoltaic industry. Soon after, it was approved the entry of 6,389 MW and by 2012 will still receive bonuses of Royal Decree 661/2007. AEE reports that, of the power industry approved, much has been made due to the acceleration of projects by developers, who expected regulatory changes. The association estimates that 961 MW in 2012 of 2,898 MW are already made, so that the workload for 2012 is 513 MW (AEE, Asociacion Empresarial Eolica, 2011).

#### **4. CONCLUSIONS**

The wind sector is a turning point for his future and an important aspect to consider will be the adoption as soon as possible of the new legislation to replace the Royal Decree 661/2007, and a new Renewable Energy Plan for the period 2011 - 2020 to continue in the line of the objectives of the European Union like for example, 20% of final consumption must be from renewable sources. While we have seen that the wind energy sector has a promising future, it is necessary to establish a stable regulatory framework to improve the opportunities for expansion in wind power and allow new companies to add highly diversified set of over 600 companies involved in wind energy sector in Spain ( Asociacion Empresarial Eolica, 2011).

The wind current crisis is due to more institutional situation to an economic problem. The wind companies have also experienced a hardening in the conditions of access to credit, but often this difficulty is not so much the economic environment as the absence of a clear regulatory framework. Spain has invested very strong in the energy from the wind. The development of this energy has surpassed 20 percent of domestic demand in Spain, however, about 4,000 MW are unwilling to voltage dips that occur when the distortion of the system to jump the same protections and make all parks trigger a domino effect. Consequently, 25 percent of the parks are not prepared for power outages, in fact, may be exacerbated in the case of system failure, so it is a great opportunity for market development and repowering market wind turbine secondhand.

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