

COMPARING WIND DEVELOPMENT POLICIES IN EUROPE, ASIA AND AMERICA

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ABSTRACT

In recent years, the wind industry has undergone considerable development worldwide, thanks mainly to state support for renewable energy embodied in various standards and initiatives. However, the situation differs significantly among the main world producers of electricity from wind power, and in some, we can find incomplete energy policies and regulatory frameworks, which have led to very different economic and social outcomes. In this paper, we present a comparative study of wind policies (based on a multidisciplinary approach) in the leading countries of Europe, Asia and America, in order to establish a comprehensive framework for the sector's future.

1. – INTRODUCTION

In recent decades, policies promoting renewable energy have been focused on pricing, production quotas, marketing methods and the levels of relevant taxes. Many countries are united in their energy policy objectives: reduction in the consumption of fossil fuels, reduction of the environmental impact of the sector, increase in the importance of energy from renewable sources, and the promotion of new business development. However, the alternatives followed vary in terms of, for instance, their social, cultural and historical impact.

The European Wind Energy Association (EWEA, 2012) and the Global Wind Energy Council (GWEC, 2012) indicated that in 2011 there were 237,699 MW of wind power installed worldwide. They highlighted the contribution of Europe, with more than 50% of the total, while the contribution of America slightly exceeded 23%. In 2011, China was the world leader, producing 62 364 MW, followed by the U.S. / MW 46,919), Germany (29,060 MW) and Spain (21,674 MW). The joint EU-27 reached 93,947 MW of installed wind power, of which approximately 4% corresponded to offshore and near shore wind.

But, in some countries, this expansion was not without controversy. Its social acceptance depends on the transparency of the administrative process used for the implementation of a wind farm, the benefits perceived by citizens, and a fair system for the valuation of forest land where wind farms are located. In Spain, the wind sector has evolved under markedly productivist public policy, which has not defined a comprehensive regulatory framework for the participation and protection of all the participating agents, as was introduced in countries like Denmark, the Netherlands and Germany. In addition, wind activity has been seen as an alternative means of generating employment (renewable being seen as inherently good in general) even without official statistics, showing its actual capacity in this regard.

This paper analyses the main characteristics of wind energy policies developed in Europe, Asia and America, in particular the policies of the leading countries (as defined by their production level, their pioneering character or their potential future development of the sector):

-In Europe, pioneering in the development of comprehensive policies (with Germany and Spain the third and fourth biggest wind power producers worldwide), but with notable differences between the leading countries: Denmark, Germany, Spain, the UK and France.

-In Asia, we find the world leader China, where there are a variety of rapid development wind policies similar to the fossil fuel system. In contrast, Japan's model is notable for its emphasis on environmental and sustainability constraints.

-In America, the attainment of leadership positions in different spheres of wind power in the United States, and the clear potential of Latin America.

We use a comparative approach, relying on publicly available data to analyse the range of wind energy development in the main producers in Europe, Asia and America during the period 1995-2012, and also to define a common framework to guarantee sustainable development in this sector.

2.- A COMPARATIVE APPROACH

2.1.- *Europe*

The consolidation of global wind power cannot be understood without appreciating the characteristics of its advance in Europe, especially in Denmark- the global pioneer. The origin of the Danish model was in the oil crisis of the seventies¹, an event that affected the country significantly. By the middle of that decade, wind power was playing a significant role². In 1979, the Danish Parliament adopted a series of measures that guaranteed energy supply, rational consumption and the minimizing of dependence on energy from fossil sources. The main points were:

¹ Gregersen and Johnson (2009)

² Klaassen et al. (2005)

- Control of the Danish energy system by increasing the price of electricity and establishing fines for companies that demonstrated excessive energy consumption, as well as refunds for industries engaged in real-saving energy consumption projects.
- A commitment to the development of renewable energies, in particular the wind sector, which would require all the relevant agencies to be involved. From the nineteen-eighties, wind power became an element of the resistance to nuclear development in Denmark, and ensuring the participation of all stakeholders led to a rapid and strong consolidation of the sector. Subsequently, the Danish wind industry became a world leader³.

Denmark made effective and flexible use of demand pull and technology push, using appropriate instruments to achieve their goals for wind power⁴. The development of co-operative ownership of the land was crucial in order to enact comprehensive laws for the valuation of land to be used for wind power. This resulted in fairer valuations, and more social acceptance⁵. This model resulted in 85% of the installed capacity of wind power belonging to individuals, or wind co-operatives⁶. The co-operatives later moved to offshore wind, and at present, own a total of 8,553 installations, each of which has an average of 20 wind turbines situated in front of the Danish capital. These turbines produce 3% of the electricity needs of the city⁷.

The promotion of wind energy was included in all Danish energy strategies. A variety of policy instruments were used such as: taxes (tax contributions), production subsidies (from 1979 to 1989, and fixed-rate feed-in tariffs until 1999)⁸ and reliance on local property protection to avoid any kind of speculators⁹.

The importance of technological advances was also taken into account, as they led to significant growth in demand for wind turbines in the 90's (both in existing markets and in countries that began to get into this business) as well as enabling the export of know-how.

Following in the footsteps of Denmark, Germany entered the wind power market in the 1970's.¹⁰ The rapid growth of installed wind power was due to a successful promotion plan, which was categorized as programme 100/250 MW (compendium of programmes certified by the company). This plan included a feed-in tariff system which required public companies buying renewable energy to pay at least 90% of the average price of electricity paid by the final consumer. It also gave access to credit for business technologist builders of wind turbines¹¹. An analysis of Germany's leadership

³ El País (12 december 2009)

⁴ OCDE (2005)

⁵ Danish Energy Authority (2007: 10-11)

⁶ Vindmølleindustriens (2003)

⁷ El País (12 december 2009)

⁸ Klaassen et al (2005)

⁹ Danish Energy Authority (2007: 10-11)

¹⁰ Klaassen et al. (2005)

¹¹ Klaassen et al. (2005)

in terms of installed wind power should consider the strategic importance of having a proper institutional and regulatory framework for the sector, based mainly on three successive laws:

- The Supply of Electricity Act (STREGA): adopted in 1991. Key points: guaranteed access to power grids, the requirement that electric companies pay a fixed price for power, and recognition of financial incentives for the construction of new facilities¹².
- The Renewable Energy Sources (READ) Act: adopted in 2000, was a controversial law because it set a fixed price for this type of energy source over a period of twenty years. In 2004¹³, an amendment decreased the price to a level similar to that of normal energy. Moreover, for the first time companies were obliged to correct the differences arising from the oscillation between strong and weak winds.
- The Renewable Energy Sources Act: This was an amendment to the previous law, and dated from 2009. It established the objective of increasing the significance of renewable energy from 13% at that time, to 25% or 30% in 2030¹⁴. The goal set was to double the level of power over a period of twelve years, reaching 48,000 MW installed in 2020¹⁵. Germany has demonstrated that to guarantee the future of wind power, and to continue as a European leader, the only option is the sea; especially the high seas¹⁶, the Baltic and North Seas, where offshore wind farms of significant size (15,000 MW) are situated.

Spain is also a leader, in both European and global terms, but based on a partial model. At state level, a single law governing the valuation of land suitable for wind power does not exist, despite the publication of Directive 2001/77/CE and appraised regulations and/or regional initiatives, which further worsen the differences between regions. Law 54/1997 in the electricity sector¹⁷ includes regulations on the production of electricity in a special regime that referred to the production of electricity through cogeneration, the use of renewable energy, the combustion of biomass or biogas and waste recovery, and the central limit of 50 MW of installed power. From the point of view of the promotion of this action, it is an exception to the liberalization of the electricity sector, which is private enterprise, because it hinges on a grant regime (with a tariff compensation mechanism and a regulated price, neither of which exist for the consumer). This gives it greater access to the network and market, at the expense of the ordinary regime. However, neither this law nor other subsequent provisions have set out a model for the development and promotion of an ad hoc model for wind energy (terrestrial and marine) which would consider the participation of all the variables and all the stakeholders. Therefore, the process of implementation of wind power in Spain has been fed from

¹² Jaccobson (2006)

¹³ Ohl e Eichhorn (2009).

¹⁴ Kreussel (2008)

¹⁵ Isaac et al (2008)

¹⁶ Kreusel (2008)

¹⁷ BOE N° 285, 28 november 1997

different sources depending on the legislative issues involved in each region and the geographical location of wind farms. From these, the following stand out:

- The lack of regulation in some regions and the automatic application of the Law on Expropriation, December 16, 1954 (LEF), when agreement between the parties is not possible. This has most often occurred in regions with less of a tradition of wind power (Extremadura, Andalusia).
- The appearance, in Catalonia, of tentative avant-garde movements, based on the Danish model.
- An intermediate model, in Galicia, based on renting land.

In France, the publication of Directive 2001/77/CE on the promotion of electricity from renewable energy sources in the internal market encouraged greater development of wind power. The most important regulations implemented were: high fixed rates and feed-in tariffs, resulting in the advancement of marine and terrestrial wind; and the setting of 25,000 MW as a goal to be reached by 2020, of which 40% will correspond to offshore wind¹⁸. However, comparison with other European Union leaders in wind power shows this development to be unremarkable for two reasons:

- The lack of a comprehensive legal framework on wind energy. The financial and administrative aspects were included in laws, highlighting the existence of a tax that took part of the profits to local authorities. However, the environmental impact or connection to the network were aspects that were added successively through less important laws.
- The debate on the decentralization of energy policy. Wind policy is decided locally, in areas selected for its development, but the central government continues to have powers, giving the impression that it acts through a system of supply contracts.

The United Kingdom (UK) and Germany are the European countries with the best measurement systems for wind, many of them located on the coast¹⁹. In 1989, the UK made a strong commitment to the development of renewable energy, concentrating on making it competitive, even if the budget available continued to fall²⁰. Following the establishment of the first wind farm in Delabole in 1991, the British had opted for a wind model very similar to the Danish one, in which social consensus was a determining factor²¹. However, it became clear that the appropriate model should be centred on offshore wind, relying on key elements such as: proper geographical location, shallow water and a coast with great offshore potential.

In 2002, the Off-Shore Wind Energy Network was created. It combined public administration and offshore wind industry specialists. However, even with this new

¹⁸ GWEC (2011)

¹⁹ BWEA (2011)

²⁰ Klaassen et al (2005)

²¹ Klaassen et al (2005)

network the UK did not have a wind power industry as prominent as that of Denmark or Spain. Then, in 2010, a system of fixed rates was established,²² *feed-in tariff*, to encourage the use of clean energy, and implement wind energy projects with a maximum power of 5mW. This proved to be an attractive measure for foreign investors looking for business opportunities in British wind, as in the cases of Iberdrola and FCC Renovables.

2.2-Asia

Both in the present and the immediate future, Asia's importance in economic and energy issues is beyond doubt. The most striking aspect of the wind sector is the co-existence of two successful but diametrically opposed models, i.e. China and Japan.

China started developing wind energy from 1986, introducing an energy policy based on little information and with no protection for private investors. Regional governments had the power to approve the development of energy projects without the authorization of central government, and without incentives for establishing wind farms. Furthermore, the price of kWh could not compete with that of coal, which was heavily subsidized. From 1994, installed wind power began to grow²³ due to the widespread belief that its consolidation could reduce the heavy environmental burdens that threatened the country and which could lead to political repercussions. There were, although, barriers limiting the development of wind power:

- Given that they did not have their own technology, there was the cost of importing wind turbines, along with transaction costs and the cost of local services.
- Lack of coordination between public agencies competent in the field on the one hand and government authorities on the other. There were three agencies with expertise in energy, and their powers were not clearly defined²⁴. The Renewable Energy Act which came into force on 1 January 2006, established a more favourable environment through a series of objectives:
 - Reduction of the very high dependence on coal (from 74% to 60%).
 - Limiting the use of oil, so as to lessen the strong dependence on external sources.
 - Support for the development of renewable energy in order to reach the level of 30% of energy resources by 2030²⁵.
 - A model of public concessions was implemented, set-up and monitored by the Energy Planning Commission of the Chinese government. It offered a combination of

²² Rubio (2010)

²³ BTM Consult (2005).

²⁴ Lema and Ruby (2007).

²⁵ Igadi (2010).

incentives and regulations that guaranteed maximum benefits for all wind power agencies²⁶. These measures were centred on:

- Promoting competition among business developers, reducing their corporate profits, and ensuring the price of kWh of wind origin was reduced.
- Giving full and effective control of the concessions process to the central authorities so that designers of energy policies could facilitate the creation of large wind farms, creating economies of scale and reducing the cost of access to the electricity grid.
- Encouraging the establishment of foreign wind companies to reduce the cost of long-term facilities, while also making local participation a condition of access to the awards system.
- Facilitating the participation of foreign capital in the financing of installed wind farms.

Finally, there has been a remarkable advance in wind energy, with the following particular characteristics:

- Most wind farms have been built by subsidiary companies of local public services, and there is also a system of loans or grants to existing wind farms.
- There has not been a specific pricing policy for wind power, but rather it has been treated as any conventional power source; a policy that has slowed down its growth. Chinese wind energy policy has failed to attract foreign investors and to consolidate new channels for expansion. Neither has it led to direct citizen involvement in this new industry.

At present, it is the world leader in installed wind power, and its strategy is clear:

- A clear commitment to the development of offshore wind through agreements between wind companies and provincial governments, ensuring resource exploitation and the establishment of an industrial base in the area.
- The creation of strong business partnerships between local companies and established Nordic and American enterprises (both installers and component suppliers).

Two Chinese firms, Sinovel and Goldwind, are among the world's top five companies in terms of revenues from sales of wind turbines and components, and have a growing international presence²⁷.

Japan has achieved remarkable socio-economic dynamism through its development of technologies aimed at the exploitation of renewable energy. They have taken a very different approach – a pro-active social attitude, called "Social Innovation"²⁸.

²⁶ Lema and Ruby (2007).

²⁷ GWEC(2011)

²⁸ Maruyama Yasushi, Nishikido Makoto, Iida Tetsunari (2007, p.2761)

After the first oil crisis (1973), Japan prioritized the application and commercialization of technologies for new sources of energy, including renewables. This action became known as the "Sunshine Project". In the 1990's, an adaptation of the project emerged, and between 1993 and 1998 the main emphasis was placed on the promotion of electricity generation from photovoltaic plants. This led to wind energy having a tentative importance.

After several setbacks, there came, in 2003, a Japanese Ministry of Economy, Trade and Industry initiative, "The New and Renewable portfolio Standard Law"²⁹. This fixed a quota for energy sold, based on the production of electricity from renewable sources. It was an incentive to set up wind energy development in Japan. However, it was unable to achieve its goals due to its poor design. There were 5 main reasons for this:

- Wrong choice of policies and no framework for global action
- Objectives and action calendars allowed insufficient time.
- Inappropriate design of effective measures for energy policy, which did not consider the internal problems of lack of infrastructure, resources and trained personnel.
- Policies were heavily influenced by the interests of the most powerful companies.
- There was no clear prioritization of the different energy options.

The public authorities designed a model of community development for wind cooperatives in which citizens invested, and which looked at four main participants: citizens, business developers, the public authority of the areas of implementation and financial institutions. The incentives which citizens perceived as critical in order to engage these wind farm co-operatives were based on three factors³⁰:

1 "Personal choice of energy type," related to a clear vocation for protecting the environment, and articulated a model of sustainable development. Citizens could decide to go for a type of energy that was considerably less damaging to the environment.

- 2 "Sense of Ownership," related to individuals owning wind turbines on their property.
- 3 "Economic Factor," which showed the possibility of obtaining economic benefits while helping to establish a business and industrial fabric more respectful of the environment.

Three funds were created to finance the implementation of wind farms, with a combined total of close to 2 billion yen. Most of this came from individuals, with the wind companies providing a smaller part. Contributions per person were between 100,000 yen (the Japan Fund and Aomori Fund) and 500,000 yen (in the Hokkaido Fund). Individual funding of wind farms is growing in Japan because the perception is that when a company creates a promoter park, the positive effects for the region are

²⁹ Ibid: This is the English translation provided by the authors

³⁰ Ibid (2007, p. 2766).

limited. However, when citizens participate, a new type of wind farm owner is created; one who fosters a relationship between those who live in the town and the owners who live outside, and this relationship increases confidence in the system.³¹ However, a dynamic element has undoubtedly been the devastating effect of the Fukushima nuclear disaster, which has increased the wish of the Japanese to promote wind energy.

2.3. *America.*

The data on wind power installed up to 2011, as provided by the Global Wind Energy Council (GWEC)³², indicated that China was in first position and the United States in second. The USA's placing being due to the growth of political support for wind power, especially since 2009. The states of Texas (10 085 MW), Iowa (3675 MW), California (3177 MW), Minnesota (2,192 MW) and Oregon and Washington(2,104 MW each), lead in terms of installed wind power, and meet significant percentages of electrical needs (in the case of Iowa wind power production covers 20% of the total electricity consumption).

The United States is also a leading country in the production of small wind turbines, and controls a third of the world market³³. At the same time, they are generating processes of concentration and merger in response to the needs of the market and the current economy. One of the most well-known examples is the division of General Electric and Enron Wind, which has bought the company Zond Wind Turbines. In addition, they have developed a policy of attracting foreign wind companies. Their emphasis on diversified support for the wind sector is bearing fruit, as shown by the increase in rural employment³⁴.

The development of wind energy in Latin America has been modest. At the end of 2009, capacity was only 1072 MW, of which 50% was installed during that year, with the construction of new wind farms in six countries. However, the reality is that Latin America has accepted the importance of wind energy in its energy market, and is starting to develop a wind industry that complements the rich hydropower and biomass available. It is beginning to tap into its wind potential³⁵, primarily terrestrial, although it has not rejected the possibility of a substantial advancement of offshore wind, especially in Mexico and Brazil.

Mexico is the second great power of the American continent after Brazil, and excluding the United States. The Mexican Association of Wind Energy (AMDEE) estimated the country's wind potential at about 30 GW, with the goal of reaching 12 GW by the year 2020. The great wind potential is principally located in the Isthmus of Tehuantepec, in

³¹ OCDE (2005).

³² GWEC (2011)

³³ AWEA (2011)

³⁴ P.J.Brown (2012)

³⁵ Gwec (2011)

the region of Oaxaca, with a total installed capacity in 2009 of 202 MW, and a total estimated potential of 10 GW. This progress was due to the completion of two projects which included private participation: "Wind Farms in Mexico" with 79.9 MW and the first phase of the Eurus³⁶ with 37.5 MW. The Baja Region also has good wind potential, and is an interesting region for international investors, those being principally the United States and Spain. However, the Gulf of Mexico and the Yucatan Peninsula³⁷ are also important regions, in which modern wind turbine installation with high production capacity could give optimum performance.

Approximately 85% of Mexico's wind power is developed in a context of self-generation, so electricity is sent to the interconnection network and then redirected to the final consumers. It is important to appreciate the incentive package that has been developed in recent years, which includes a tax allowance of 100% of the depreciation in the first year of operation, creating a virtual bank that allows energy producers to generate maximum power when wind is available. If this energy is not consumed immediately by the dealer, you have the option of buying virtually during a period of twelve months. At the same time, the Mexican market is dominated by four large multinationals: the Spanish companies Acciona and Gamesa, and the Danish Vestas and Clipper³⁸.

Brazil has regions with high wind potential, along with a growing demand for electricity and a solid industrial base. Its well-known hydropower industry supplies 80% of the country's electricity needs and is complemented by wind potential, resulting in a robust energy system, which has generated large-scale wind development. In 2002, it introduced the Incentive Program for Alternative Sources (PROINFA)³⁹ with the aim of diversifying the country's energy mix by insertion of 3,300 MW of installed capacity, of which 1,100 MW are related to biomass plants, 1,100 MW to wind power and 1,100 MW to small hydro.

They started from a model of regional development, based on the German system, and given their awareness of the country's strengths and weaknesses, they allowed foreign companies to settle so as to share their know-how with the local workers⁴⁰. A significant step came in 2006, when the National Electric Energy Agency (ANEEL)⁴¹ adopted Resolution 247. This introduced discounted rates for use of the electrical distribution system (TUSD) and/or transmission (TUST), with percentages ranging between 50% and 100%, for all participants (producers, traders and consumers) using renewable. This model became known as incentivized sources. In September 2007, ANEEL issued Resolution 309 on the marketing process and rules for incentivized power. It was a system that some considered protectionist, but it allowed the

³⁶ Ibid

³⁷ Ibid

³⁸ Ibid

³⁹ Tello Ortiz E. and Fadigas, E.,(2010)

⁴⁰ Bernal-Meza R.,(2008)

⁴¹ ANEEL, (2008)

participation of foreign companies through its links with local partners⁴². In 2011, the Brazilian wind industry installed 583 MW, reaching a total capacity of 1,509 MW, meaning an increase in installed capacity of 63% over the previous year and an increase of 56% in market share. It should be noted that 2011 was the last year of the Proinfa Programme, whose main achievement was to stabilize the development of renewable energy in the country for a decade. This normative model relied on significant elements such as the feed-in tariff system, which is attractive for investments in wind, biomass and small hydropower, allowing power generated to go to the grid.

3. - CONCLUSIONS

The study started with an examination of different models for the development of renewable energy in general and wind energy in particular. This led to an appreciation of both the common and significantly different features. The wind potential, administrative requirements, technical and financial resources for the establishment of wind farms, or even the ability of the grid to interconnect with other countries, are clearly differentiating elements, while the existence of a system of materials, support and promotion rates seems to be present in most of the leading countries in this sector.

The first element to be considered is the inclusion of all stakeholders in the development of wind strategy. It is essential to consider the participation of the owners of the land, and they can act as promoters, investors/shareholders, or as producers. We should also recognize the rights and responsibilities of promotion businesses, technologists, financial institutions and state administration, as well as the local councils involved. A process which only considers the interests of companies is partial and discriminatory, given that they could not develop their businesses without minimal levels of wind on land, and therefore the involvement of the landowners seems logical.

The second element necessary, directly related to the above, is the recognition of the category of land particularly suitable for wind power for industrial or semi-industrial use. It is, therefore, necessary to develop a method to assess the usefulness and productive capacity of land. It should not be forgotten that land suitable for wind power development brings together variables of an economic, environmental, planning, land distribution and social nature, so it is necessary to define a specific category.

The next item to consider is a framework for effective regulation at the environmental level, establishing mechanisms for analysis, auditing and environmental control, which will not permit projects that may damage the environment. For those projects that do not pose this type of threat, a government mechanism for tight control must still be put in place. In addition, periodic audits must be carried out to monitor the situation.

A fourth block, which is of a general nature, is "General state support". It should encompass government economic policies such as: creation of employment in the wind sector; the development of the country's own technology; and a grant mechanism to

⁴² Castro, N.J. et al (2009)

price the home kwh wind, so as to guarantee general awareness and availability while avoiding a high cost to support the consumer. In this sense, it emphasizes the fact that the energy sector is characterized by intensive use of capital but not of labour⁴³. In any case, a comprehensive advancement in the sector means a commitment to the future, in which sustainable development, security of supply and the participation of stakeholders will be ever-present factors.

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