

Wind Power Development in Spain, the Model of Navarra

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Summary

Wind power implementation in Spain has undergone spectacular growth in recent years. From 834 Megawatts installed at the end of 1998, the figure of 1,500 MW was reached at the end of 1999 and forecasts expect well over 2,500 MW by the end of the year 2000. A favourable legislative framework and tariff structure have brought about this rate of development, which is mainly based on the implementation of large wind farms on high altitude sites in Spain. The region of Navarra (northern Spain) has played a special role in this development, and EHN, a company born in this region, has carried out major projects that have given it 30% of the Spanish wind power sector. The challenges for the sector in Spain over the next few years are:

- 1) *make its development compatible with the supply guarantees required by the national electricity supply operator,*
- 2) *ensure that the implementation of wind farms is done with respect for the environment,*
- 3) *harmonise the wind power development of the different Autonomous Communities of Spain, and*
- 4) *reduce the investment costs in order to obtain enough profitability with falling energy prices in the coming years.*

1. The Consequences of a Favourable Legislative Framework

Up to 1994 the Spanish wind power sector was rather inactive with a lack of ambitious goals. An indication is that the National Energy Plan (PEN) approved in 1991 anticipated the installation of 175 MW from wind power in Spain by the year 2000. Nobody was in a position to foresee the spectacular boom that this form of energy was going to enjoy in the country. Since 1995 the sector has grown continuously, duplicating the power accumulated in previous years during 1996 and 1997, with increases of over 80% in the two following years.

There are many factors that have enabled this strong development of wind power in Spain to take place, and the most important is, without doubt, the legislative framework. The Special Regime Decree of 1994 had already guaranteed the injection of electricity to the Grid at a price that made the exploitation of wind farms with sufficient energy potential a viable prospect. The Electricity Sector Law of November 1997 served to acknowledge this preferential treatment, in the form of an unanimously approved amendment by the political groups in the Spanish Parliament, explicitly stating that renewable energy sources would receive between 80 and 90% of the price paid by the end consumer. Electricity from renewable sources thus remained outside the "pool", or auction system, that conventional energy sources have to go through to fix the sale price of electricity in Spain. Another measure was the establishment of a national objective that renewables should account for 12% of gross energy consumption in Spain by 2010, in line with the provisions of the White Paper approved by the European Commission in November 1997.

The Decree 2818/1998 on electricity production from renewable sources and co-generation expressed these principles in the form of a specific regulation. All renewables would have priority access to the Grid and prices for each were fixed, with two alternatives:

- A fixed price, including the premium that the legislator considers suitable payment for this type of energy
- A variable price linked to the average electricity price in Spain at any given time. This price would be based on the "pool", or auction, system for electricity from conventional sources, to which a fixed premium would be added to determine the final level of payment.

In the case of wind power, the fixed price was set at 11.02 pesetas for 1999 (€ cents 6,62), or a premium of 5.26 pesetas (€ cents 3,16) on the average sale price. Due to the end consumer price reduction in Spain, the fixed price for wind power in 2000 has been reduced to 10.42 pesetas (€ cents 6,26) and the premium at 4.79 pesetas (€ cents 2,87). This represents 5,4% of the past year without con

sidering the inflation rate, which will add another 2,9%. EHN's forecasts point to further reductions in the price paid for wind power-based electricity in Spain of over 50% in the next 25 years, considering a 2% inflation rate throughout the period, which is not being considered in the graphic. Although, investment in the field will continue to be viable because there is sufficient profitability involved.

The fact that there is a margin for the operators is the result of a series of circumstances:

- Legislative framework, already mentioned
- The wind energy potential of many areas in Spain
- A reduction in the cost of wind turbine manufacture as a result of high demand. Most of the machines are manufactured in Spain
- Improvements in turbine performance
- A reduction in the cost of loans.
- The size of the wind farms: those with a large number of turbines mean that the return on investment is better with, in our opinion, less impact on the environment.

2. Large Scale Wind Farms

In Spain, there has been a clear trend towards large wind farms, and EHN has played an active role in bringing this about. For energy, environmental and financial reasons we have always considered it preferable to build large-scale facilities than a large number of turbines scattered over several sites. Facilities located in a specific place with a single outgoing power line overcome the problem of affecting a large number of areas. Concentrating a wind power facility in a particular area well chosen under environmental criteria and ensuring that the area gains economic benefit from having it there, seems to us to be a more positive approach than scattering turbines in different zones.

3. Strong Competition for Land

The favourable legislative framework for the development of wind power in Spain has led to fierce competition for sites between promoters. Some have carried out major projects over the last few years, while others with no experience in wind power implementation have landed in the sector on the basis of solely financial approaches. Apart from this competition for sites for future wind farms, there has been a proliferation of business projects to develop this kind of energy. Some of them have their feet firmly on the ground while others are purely speculative and unrealistic.

The result of all this is that the Administrations of many Autonomous Communities, who have powers to authorise the installation of wind farms under 50 MW, have been overwhelmed by hundreds of applications to build wind farms, many of them for the same sites. This has taken place without the existence of a legislative framework to regulate this type of project in some regions.

Navarra, Galicia and Aragon have taken the lead by creating regulations that, from different perspectives, make the development of wind power possible. In other regions, however, the authorisation processes are being postponed. Another important factor is that ALL Autonomous Communities are asking for industrial compensation or job creation in the Region, which is unrealistic under the point of view of a long term industrial sector.

4. 9,000 MW in a few Years

It does not seem likely, however, that difficulties in some regions will condition the evolution of wind power in Spain. The Plan to Promote Renewable Energy Sources in Spain, was approved in December 1999. It envisages overall wind power energy in Spain of around 9,000 MW (8,974 MW to be precise), with energy production equivalent to 10% of the country's electricity demand.

Wind power will account for 28% of the renewables' contribution, bringing it very close to the large hydro-electric sector. This sector currently accounts for 64% although it is anticipated that its contribution will drop to 32% by 2010. If these forecasts are fulfilled, and we believe they will be reached in just a few years, Spain will cover 22% of the wind power development objectives marked out by the European Union for 2010, that is, 40,000 MW.

5. A Conditioning Factor for the Future: The Capacity of the Grid

The three elements that will condition the development of wind power in Spain are, in this order: the capacity of the Grid to accommodate all the electricity generated by wind power, particularly in off-peak hours, the energy price and the environmental impact that the progressive proliferation of wind farms in Spain could produce.

So far, there have been no major problems in sending wind power-generated electricity into the Grid. Its limited level of production led to shutdowns in certain thermal power stations and this did not mean major setbacks for the system operator. However, 9,000 MW injected into the Grid is rather a different matter. This is why the system operator wants to set up mechanisms that guarantee the predictability of the energy to be fed in (through more accurate local wind speed forecasts) and probably with certain limitations on the injection of electricity into the Grid at off-peak times.

This, together with the already mentioned energy price reduction, may be in conflict with investment payback forecasts by those starting out as promoters in the wind power sector, but it is a conditioning factor that has to be taken into account. In Spain, only a part of the applications for the ten thousands of MW presented will prosper. Promoters of authorised facilities will have to work under future scenarios which will probably be less favourable than the current situation, despite the fact that favourable conditions will, quite rightly, continue to exist so that they can compete with conventional energy sources on an equal footing, once these internalise their environmental cost.

It is therefore necessary for wind power project promoters in Spain to be aware of the need to improve costs and performance, bring about technological developments in wind turbines, and work on the basis of lower payment for generated electricity. It is the only way we can look to a risk-free future.

6. The Environmental Variable

A third element that could condition the development of wind power in Spain is the Environment. To date, wind farms have been put into service, with very few exceptions, without major opposition from environmentalists and conservationists. The organisations most concerned about the environment on a world-wide scale unreservedly support the development of this type of energy, yet it is local conservationist organisations that are opposing the construction of certain wind farms.

Nevertheless, the high rate of wind power development taking place in Spain, which will be higher over the next few years, may lead to greater opposition if things are not done properly, that is, if wind power is not implemented in a rational manner, excluding the use of sites of great natural value and not building facilities with the greatest respect for the surroundings, including the recovery or revegetation of the areas affected by building work.

7. The Model of Navarra

Navarra is undoubtedly an outstanding case on the Spanish wind power development scene. This region of 10,000 square kilometres has a northern border with France, a population of 540,000 and a per capita GDP currently at 97% of the European average. It has placed particular emphasis to the development of wind power. The wind farms already installed produce electricity equivalent to almost 30% of the region's electricity needs, and in just a few years the figure of 50% will be reached. This is far above the most ambitious international objectives in the development of this type of energy.

This has been possible thanks to a very clear perception that Navarra should develop renewables as a future option in the energy, environmental and socio-economic areas, converting them into a hallmark of the region. Navarra does not have thermal, nuclear or large hydro-electric power stations, nor coal, oil, or gas fields. It does, however, have resources in the renewables area. Given its high external energy dependence, the Government of Navarra considered it necessary to encourage the development of its own energy resources and opted for renewables.

8. The Creation of EHN

In 1989 the Government of Navarra boosted the creation of the company Energía Hidroeléctrica de Navarra (EHN), with both public and private capital, to be the leader in the development process of renewables in the region. The Regional Government and its dependent Savings Bank hold 48% of the capital, the utility company of the region (Iberdrola) holds 37%, and another long-standing company in Navarra, which is also a large electricity consumer (Cementos Portland) holds 15%, so the private capital component of EHN is 52%.

EHN started by building mini hydroelectric power stations, and now has 25 covering 8% of Navarra's electricity needs. In 1990, however, the company decided, in collaboration with the Government of Navarra, to build wind and sun measuring stations to evaluate the wind and solar potential of a region which no Wind Power Atlas considered had sufficient wind power potential to produce electricity.

It was soon clear that there was wind in Navarra. EHN built a wind farm near Pamplona, the capital city of the region, installing the first turbines in December 1994. The company chose this site for its exceptional wind conditions (average annual wind speed of 8.2 metres/second), but also for its proximity to the largest urban area in Navarra. 250,000 people could see the wind farm from their homes, which was important because we were sure that if this experience turned out to be positive and public opinion was favourable towards it, we would be in a position to extend wind power facilities throughout Navarra.

That is precisely what happened. Three months after the first six machines were installed, a public opinion poll was held on a sufficiently large sample. About 85% had a positive opinion of the wind farm and only 1% said they were against. Since it opened the El Perdón wind farm has been visited by about 325,000 people and opinions on it have been very favourable.

9. A Wind Power Development Plan for Navarra

Based on the wind farm at El Perdón, EHN prepared a Wind Power Development Plan in Navarra that envisaged the implementation of almost 600 MW after ruling out sites of high environmental value and studying energy and environmental variables on other sites where there was sufficient wind. Both variables were weighted in the same proportion, so an attractive site in wind power terms could be rated below another with lower wind potential in the final proposal if the environmental impact of a wind farm would be greater on the site in question.

Following a proposal by the Regional Government, in January 1996 the Parliament of Navarra approved an Energy Plan which constituted an impulse to the development of renewables, particularly wind power. The Government of Navarra laid down an objective of 220 MW for 2000, and an indicative figure of 636 MW for 2010. This objective will be reached well before then. Indeed, by the end of 1999 Navarra already had 336 MW installed wind power. In addition to this setting of energy objectives, a regulatory framework for the implementation of wind farms has been developed, what has served as an example for other Autonomous Communities.

10. A Major Industrial Sector

The investment drive of the renewables energies has also led to the creation of an industrial factory for the manufacture of wind equipment in Navarra by Gamesa Eólica, a joint venture between the Gamesa Group (51%), Vestas (40%) and the Government of Navarra (9%). Gamesa Eólica currently accounts for 55% of the Spanish wind power sector, with three manufacturing plants in Navarra, two in Galicia, one in Aragon and another in Castilla La Mancha. Recently, Ecotècnia, another important Spanish manufacturer has established a factory in Buñuel, Navarra, to assemble turbines. DEWI has also established the first office outside Germany in Navarra.

The wind sector in Navarra presently employs over 1,350 people. These jobs are mainly in manufacturing but include installation, promotion, operation and maintenance, technological development, wind power evaluation and ancillary services. EHN has contributed to the Research and Development of wind turbines with the "Ingecom W" (a variable speed control system) and the development of a 1,3 MW wind turbine.

Navarra will be home to the National Technological Centre for Renewable Energy Sources. It will promote studies on the research and development of all 'clean' energy sources, and EHN will use it to advance as many projects it considers of interest within the overall aim of the Centre. EHN has also promoted an Experimentation and Development Area for Renewable Energy Sources in Navarra, established in the National Technological Centre. In it will be located the largest photovoltaic solar plant of Spain (1.2 MWp) that the company will install this year. A 25MW biomass power plant, which is right now under construction, will complete the investments in renewables sources.

11. Extensive Dissemination and Educational Programmes

All these initiatives have been backed up by a wide-ranging communication strategy, through hundreds of guided visits to our wind farms by all kinds of groups; the Media have received informative materials; EHN has sent speakers to a large number of conferences and congresses, and surveys have been carried out regarding public opinion on the wind farms in operation. Six years ago EHN also started an educational programme in schools in Navarra on the environmental problems associated with the production and consumption of energy. This consists of talks in schools, advice for schoolteachers, the publishing of teaching materials and guided visits to wind farms. Over 35,000 schoolchildren from Navarra have taken part in this experiment, which EHN is now transferring to other regions in Spain. The wind farms appear in tourist brochures issued by the Government of Navarra, and wind power has become a trademark of the region as it looks to the future.

12. Social and Political Consensus

There is a clear political and social consensus in Navarra on the development of renewables, and this has been a key factor in achieving the objectives we set out. There has also been another key point in the achievement of these successes: talking to all groups that are directly or indirectly involved in the preservation of the environment, and a firm option to take on the development of renewables from a stance of maximum respect for the surrounding countryside. This approach has been widely recognised in many international forums, and this May, the Award Prince Felipe for Business Excellence was given to EHN for its Industrial Environmental Management. Furthermore, EHN is expanding into other areas of Spain on a large scale. The company currently has over 550MW in operation, expects to have 900MW connected to the Grid by the end of 2000.

13. Conclusion

To conclude, I would say that Spain will be one of the world leaders in wind power implementation, based on a model of large-scale wind farms on sites at high altitude. It will also have a large associated industrial fabric, although over-diversified as a result of the implementation demands for industrial plants by different Autonomous Communities.

Within this overall framework, Navarra offers a development model that is planned, the result of political and social consensus, with great consideration given to the environmental, industrial and technological fields. It allows us to contribute to the development of an energy source that we consider to be of great importance in the process of change of the energy model of the world.

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