

The Wind Employment in Spain (1995-2010): A Theoretical Approximation Applied to the Region of Galicia

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ABSTRACT: The development of the renewable energies, and especially of the wind power, in the last decades has stayed out of any discussion. The advantages associated with the energy of the odd wind have considered in occasions authentic information that they them should corroborate. For example, about the streghness of creating jobs, there do not exist official statistics that gather the dimension of the created employment, without forgetting that the field of the energy stands out for being intensive in the capital. In this paper, there is realized an analysis of the different bibliographical sources relative to the generation of employment in the wind sector in Spain, establishing a few margins of the creation of the same one for categories for the region of Galicia, in the period (1995-2010).

Keywords: Renewable energy; wind energy; wind promoters

JEL Classifications: Q25; Q43; 013

1. The Wind Energy Development: Recent Data

In recent decades, developed and implemented policies to promote renewable energy, with the lines of action the pricing, the requirement of production quotas, preferential marketing system, or possible tax levy. Although much of the countries share similar objectives in energy policy (reduce consumption of fossil fuels, reducing the environmental impact of the sector, expand the weight of energy from renewable sources and meet new business development), followed alternatives vary, depending on social, cultural, historical, etc.

The European Wind Energy Association (EWEA, 2012) and the Global Wind Energy Council (GWEC, 2012) indicate that in 2011 there were in the world installed wind power of 237,699 MW, highlighting the contribution of Europe, with more than 50% of the total, while the contribution of America slightly exceeded the 23% worldwide. In 2011, China was the world leader with a power of 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% correspond to the near shore and offshore wind. In Spain, the installed wind power has been concentrated in three regions, representing 70% of total: Castilla-Leon with 4,800 MW, Castilla-La Mancha with 3,700 MW, and Galicia (which had been an industry leader since 1995 to 2007) with 3,300 MW.

However, in some countries, this expansion was not without controversy, depending partly social acceptance of the transparency of the administrative process for the implementation of a wind farm, the reversion of citizenship or benefits on the valuation of forest land where they are located. It was the case of Spain and the north-west Galicia region, in which the development of the wind sector was characterized by a markedly productivist action by the competent public administration, in the sense that not bet on the definition of a regulatory framework allow comprehensive participation and defense of all participating agents, like had happened in other countries such as Denmark, Holland and Germany. Also of note is that the wind activity has been presented as a clear alternative employment

generation (goodness associated with renewables in general) even when there are no official statistics that show, in these terms, its actual capacity.

This work analyzes the ability to create jobs related to the installation of wind farms in Spain, from data contrast the main sources of information about, and highlighting the lack of consensus on the true extent of employment generated (net and grown). Also presented for the case of Galicia, an approximation of the jobs created in this activity in the period 1995-2010, based on the total installed wind farms and promotions conducted.

The balance of the paper is organized as follows: Section 2 reviews the literature on measuring the studies of the employment in wind energy and notes the general shortcomings typically associated with the methodologies used to date; Section 3 presents the methods and data used in this study; Section 4 describes the study region and sample data; Section 5 contains the results of the study, including the estimation about Galicia; and Section 6 provides a summary of conclusions and a brief discussion of future research directions.

2. The Wind Sector Employment in Scientific Surveys

One of the most controversial elements when assessing the benefits of the development of renewable energy and wind energy in particular is the ability to generate employment, being able to observe in the available literature a large discrepancy results.

The report *The Impact of Renewable Energy Policy on Economic Growth and Employment in the European Union* (European Commission, 2009) finds that among the positive contributions associated with renewable energy is creating jobs starting from small enterprises (SMEs) and micro-enterprises, located mainly in the environment rural or semiurban, estimating 900,000 jobs related to renewable energy in 2020¹. Similarly, in Spain and a time frame less wide, the *Plan de Fomento de las Energías Renovables 2005-2010* (Ministry of Industry and Trade, 2005), considering a total aggregate of net 94 925 jobs generated in that period, with the wind power to register a higher number, a total of 37 793 new jobs generated. In the autonomous community of Galicia, for the year 2004, the Galician Energy Institute (INEGA) estimated to a total of 2,500 jobs, explaining the evolution of the Sector Plan wind (ARGEM, 2005, p 49).

Given the multiple pathways of impact, assessing the local economic development impacts of wind power installations is likely to require multiple methods and outcome measures. P. Brown et al (2012) indicates that almost all studies of the economic development impacts of wind energy have relied on two methods, as the project-level studies of the gross cases impacts of current wind power plants (employment, cost, revenue data) and the input-output model estimates the potential, direct, indirect, and induced an individual impacts of completed or planned wind power plant or an aggregate amount of assumed wind development activity.

Wei et al., (2009) collected the results of the definition of an analytical model of job creation, making a comparison between the number of jobs created by a sample of companies concludes that renewable energy companies generate more jobs per kW produced than companies of fossil energy. This issue should be considered in the assessment of potential job growth linked to renewable energy, considering that it provides limited data on the renewable energy sector.

Two studies of the European Wind Energy Association, EWEA (2008a) and EWEA (2008b), start from data provided by the organizations wind European countries. Features which will be the trend to continue as the overall level of development of wind power, mainly in terms of installed capacity, employment generated and contribution to the reduction of harmful environmental effects. The data necessarily agree with that, in Spain, provides the Wind Spanish Association (AEE) in other studies different approach, which highlights the remarkable job creation and the clear upward trend in the stage of 2020.

The situation is analyzed by German by BMU (2005), which highlights the implementation of renewable energy and, in particular, in the production of wind power source, providing data on job creation for the year 2004 and making a projection for the years 2020 and 2030. The impact on employment growth coincides with the dynamics introduced by other countries, although it is not fully comparable due to the characteristics of each economy.

¹ This data were include on Eufores (2006)

For Spain, also referred to AEE, Calzada et al. (2008) try to reflect the evolution of jobs in renewable energy from the type of public policies implemented. In relation to the research fields exposed only mention the creation of jobs, accepting the figures provided by the European Union. Regard to our field of research, the data provided in the terms of employment should be considered with caution: the data provided by the AEE do not correspond with those of other entities. The Union Institute de Trabajo, Environment and Health (hereinafter ISTAS) (2006, 2008, 2009a and 2009b) conducted a sample of the leading renewable energy company in Spain. Presents an approximation of the value of employment for each of the renewable technologies in Spain, without differentiation by regions, with the exception of Catalonia and Madrid. *The Statistical Yearbook of the Electrical Industry of Spain's Ministry of Industry and Trade* (1994-2010) provides the main official data regarding power, highlighting the changing structure of employment (in the activities of production, transportation, distribution and general services) and type of staff (unpaid, technical, administrative and junior workers and total), labor costs, hours of dedicated work with data by regions and indicating the number of companies according to the number of employees they have hired. Include activities related to renewable energy, and see a decrease in workers linked to the sector in Spain, due to the privatization of certain activities, showing a different dynamic to the collection in other studies. The Ministry of Industry, Tourism and Trade (2005) considered a total aggregate net jobs in that period, with the wind to register a higher number, a total of 37.793 new jobs generated. High numbers but with differences in relation to other sources.

The Wind Association of Galicia (hereinafter EGA) (2005) analyzed data from companies linked to the wind association in the period 2000-2004, in Galicia, providing data in terms of installed capacity, production, the economic and employment impact, basically.

But they aren't appropriate to apply to our survey because we don't know the real data about the generation of employment in Spain, because there isn't an official statistic that shows this evolution, neither Spain nor Galicia. The aforementioned and other information sources available, they generally their calculations using estimates, even when referring to current or past data, based on samples of companies. There is however, a basic statistical source that allows to know the real evolution of direct and indirect employment generated in the wind. Another notable aspect is the inability to determine if the companies provided data have a gross or net character, or if it is direct or indirect. This lack of definition makes no doubt, the discrepancy between the figures provided by different sources, as indicated in the most data refer to annual estimates.

3. The Theorist Comparative Survey Applied in Galician Case

We use a theorist and comparative study relying on publicly available data to analyze the range of employment in wind energy development in Spain between 1995-2010, and particularly, in Galicia. To proceed with this contrast data is selected literature on employment generation in the wind power in Spain, meaning that if the various publications matched the AEE estimates, the aggregate data would be valid. The phases were developed:

a) analyze and compare the *Electricity Sector Statistics in Spain* (ESEE) (1994-2010), (Ministry of Industry and Trade, 2011) and the data provided by the farm sector employers in Spain Wind Energy Association (AEE) and the Association of Renewable Energy Producers of Spain (APPA), and employers wind Galicia, Galicia Wind Association (EGA).

The *Electricity Sector Statistics in Spain* is a set of annual statistics official public electricity sector in Spain, which provides production data, direct employment and labor costs, but not disaggregated by subsectors, so that only serve to describe the general evolution employment linked to the energy industry.

The *Macroeconomic Study of the impact of Wind Energy sector in Spain* has been made by the AEE (2008, 2011) and whose data have been reflected in the reports of the European Wind Energy Association (EWEA). Deloitte to AEE is a socio-economic impact analysis of the wind sector in 2003-2007, and 2008-2010. It was drawn from the public economic information offered by the Companies Registry, related economic activity of enterprises, and also considering the data provided through interviews with references from 430 companies in the sector, a total of 706 companies.

The *Study of the Macroeconomic Impact of Renewable Energies in Spain* (APPA, 2009, 2011) is a quantitative analysis of the development of renewable energies in Spain, considering economic data, social, environmental and energy dependence, from 2005 until 2008, and from 2008 to 2011.

Neither of these studies provides disaggregated data type generation farm employment by region, so that their interest lies in the evolution of employment generation in Spain.

A report analyzing the wind sector of Galicia was conducted by EGA (EGA, 2005). It was a reporting data since 2000 to 2004 from some wind companies of the association..

b) Determine the contribution ratios and implement studies as: *SMEs sector Employment renewable energy and ancillary industries in Spain* (2006), *Renewable energy and employment in Catalonia* (2008), *Renewable energy and employment in the autonomous community of Madrid* (Institute of Work, Environment and Health, ISTAS, 2009a) and *Renewable energy and job creation in Spain, present and future* (ISTAS, 2009b), and *The analysis of economic and financial feasibility of a renewable energy project* (Aranda and Scarpelini, 2009).

c) Apply the information provided (under confidentiality agreement) by organizations linked to the wind activity in Galicia, which was occupied by staff relations businesses.

4. Results

4.1. Statistical Analysis of the Statistics of the Electricity Industry in Spain (1994-2010) and the reports of the AEE, the APPA and the EGA

The statistics of the electricity industry in Spain, on the period 1994-2010 provides production data, direct employment and business progress in the energy sector in Spain, aggregated and disaggregated by regions, but by industry. This book devotes a chapter to existing direct employment in electricity industry in Spain, providing the total number of workers, with gender distribution (table 1). *The Study of the Macroeconomic Impact of the Renewable Energy in Spain* (APPA, 2009,2011) is a quantitative analysis of the development of renewable energies in Spain, considering the sub-economic data, social, environmental, and energy dependence, from 2005 to2008, and from 2008 al 2010. It presents data broken down by regions. The methodology of this study indicated that the direct employment data were collected directly from reports submitted by companies to the Register. The data of indirect and induced employment calculated from the elasticities employment / GDP for each sector of the Spanish economy (table 1).

Table 1. Direct Employment On Spanish Energy System (ESEE) and Direct employment On Spanish Wind Sector (AEE-APPA)(1994-2010)

YEARS	ESEE	AEE			APPA		
	DIRECT EMPLOYMENT	DIRECT	INDIRECT	TOTAL	DIRECT	INDIRECT	TOTAL
1994	49.550	---	---	---	---	---	---
1995	48.074	---	---	---	---	---	---
1996	45.126	---	---	---	---	---	---
1997	45.703	---	---	---	---	---	---
1998	39.981	---	---	---	---	---	---
1999	37.055	---	---	---	---	---	---
2000	33.243	---	---	---	---	---	---
2001	34.436	---	---	---	---	---	---
2002	25.965	---	---	---	---	---	---
2003	25.071	16.802	10.409	27.211	---	---	---
2004	24.597	17.495	11.918	29.413	---	---	---
2005	26.407	18.562	13.751	32.133	18.562	14.696	33.258
2006	26.349	19.598	15.621	35.319	19.698	15.553	35.251
2007	26.811	20.781	16.949	37.730	20.781	16.408	37.189
2008	25.957	22.970	18.468	41.438	22.970	18.468	41.438
2009	28.738	20.092	15.627	35.719	20.092	15.627	35.719
2010	30.753	17.898	12.849	30.747	17.898	12.849	30.747

Resource: Author's elaboration from ESEE (1994-2010), AEE (2008, 2011) and APPA (2009, 2011)

The analysis of the data provided by EGA, included in the study *Wind economy in Galicia* (EGA, 2005) initially allowed to see a tremendously encouraging picture in terms of employment generation type wind power in Galicia in the period 2000-2004. In the methodological precision indicated that the information gathered came, among other sources, the completion of a questionnaire designed by the association, which responded by leading companies in the industry, without indicating anywhere you were all companies that belong to the EGA or if it was a party. In addition, it also indicates that consulted "several studies and documents made by the companies themselves as management tools; sources general statistics compiled by the Spanish Government, the European Union and the Government of Galicia, and other studies partially consulted effect" (EGA, 2005, pp.37). But in the bibliography of the study only included references appear legislation. According to the data provided, the operation and maintenance activities of a park type of 23.2 megawatts, would have given employment to 7.25 workers. Concludes that the direct employment generated by the companies that make up the association has 2,200 jobs for the year 2004, having to add the value of the indirect employment arising from the construction of the park and considering to build a park of 20 MW will be required 120,000 hours work indicates that the total investment in a wind farm, the 73.54% that repercute the Galician economy corresponding to the cost of commissioning. This percentage translated in the creation of 51 jobs circumstantial, one year for each park facility of 23.2 MW. The employment generated in the operation would be lower in this case, not exceed 7'25 workers per each unit to generate the same power. Speaking of jobs created (EGA, 2005, pp. 84) is referring to the continuous use throughout the year, ie, the equivalent of permanent jobs, stressing that there must be essentially circumstantial factors. It is estimated that in the year 2010 will take created about 3,300 jobs structural in Galicia. To this figure must be added the use of circumstantial derived from the renovation of the wind farms.

To calculate the indirect job generating sector, EGA data obtained from studies conducted for the calculation of indirect jobs in medium-sized economies (not defined in the study), measured in terms of GDP per capita.

Table 2. Relation Between Direct Employment On Galician Electric System (Esee) and Direct Employment On Galician Win Sector (Ega) (2000-2004)

YEAR	2000	2001	2002	2003	2004
ESEE	3.488	3.303	2.148	1.749	1.616
EGA	1.134	2.120	2.061	1.848	1.666
% EGA/ESEE	32,5	64,2	96	105,6	103

Resource: Authors elaboration from ESEE (2000-2004) and EGA (2005)

4.2. The application of the ratios of direct job creation and gross, from ISTAS studies and for Aranda and Scarpellini results.

The Institute of Work, Environment and Health (ISTAS) has conducted a series of reports on job creation in renewable energy, for the whole of Spain (no data disaggregated by all regions) and regions of Catalonia and Madrid:

- SME-sector employment in the renewable energy and ancillary industries in Spain (ISTAS, 2006)
- Renewable energy and employment in Catalonia (ISTAS, 2008)
- Renewable energy and employment in the autonomous community of Madrid (ISTAS, 2009a)
- Renewable energy and job creation in Spain, present and future (ISTAS, 2009b).

The analysis (ISTAS, 2009b) made from a collection of direct information from companies associated directly and indirectly with the sector, of which 35.7% are related to wind activity. The level of respota the survey was 41% of all companies in the wind sector in Spain. Stands that are major barriers to measure the size of jobs created in the wind industry, subcontracting and the definition of indirect employment generating activities.

The major contribution of this study is to apply a ratio of jobs to ISTAS use (the definition of them collected in the study of occupations related to the environment (INEM, 2007)), which indicates the jobs generated by MW installed in the wind, differentiating values activities: for construction and installation activities will be 3.25 EE / MWI is created 3.25 jobs per megawatt wind up, and have a value of 0.2 EE / MWI for the operation and maintenance activities.

In the study *Analysis of economic viability finance a project of renewable energy* (Aranda and Scarpellini, 2009) contains a brief reference on the job, showing the ratios considered by the PER 2005-2010 for different types of renewable energy for construction and installation activities and the activities of maintenance and operation. In particular, employment in the construction and installation of wind farms occupy 25% of the direct jobs, with a ratio of 13 people per year and MW, and operation and maintenance activities, 1 job for every 5 MW. Indicates that for the period 2005-2010 and for the whole of Spain, in the wind, according to the PER 2005-2010, would create 37,793 net jobs in Spain, of which 34 680 correspond to the activities of construction and installation, and 3113 operating activities and maintenance. Both ratios are applicable to Galicia, all provides the technical information needed (table 3).

4.3. The information provided by some companies in the sector

To try to establish a data indicative of direct employment generated in the wind sector in Galicia, activities ² (tables 4-5) considered the information provided by the companies consulted in the process of gathering direct information, which allows you to establish a relationship between the number of workers-the number of wind turbines-kw power, so it would be possible to determine the number of jobs of workers and maintenancetechnical operation, as well as staff management and topography to the study periods considered. This information is specified in the following assumptions:

- Assembly complete wind turbine at wind farm: 19 people / 1 week (9 people to ride in the shoe shaft; 7 people to assemble wood floor; 3 people support)
- Construction shoe turbine: 11 people / 1 month (the excavation participate 3 people; in building 8 people and cemented 5 people who have participated in the construction, usually)
- Building evacuation line wind turbine: 6 people / 1 wind turbine / 1 day
- Excavation trench line disposal turbine: 2 people / 1 day (every day would make a dig approximately 200 meters long, and between wind turbines, can be considered an indicative distance of 300 meters)
- Building the wind farm substation: 6 people / 6 months
- Tasks of topography and wind farm management: 2 people / 1.5 years
- wind farm maintenance: 8 technicians / 64 MW (it should be considered that the maintenance staff rotates between wind farms, and also moving services out of Galicia).

5. Discussion

The discrepancy in the data obtained from contrasting sources is evident, both in value and even in the study period. Regarding Spain, the comparison between public data provided by the ESEE, and by representatives of industry, the AEE and the APPA (table 1) to visualize a divergent trend, in that the Electricity Industry Statistics, presents a contraction in the evolution of direct employment in the sector, while in the wind sector increases employment and representation in relation to the total direct employment in the energy sector in Spain.

Moreover, data for direct employment is the sema for both AEE to APPA while data for indirect employment present some modifications. It is remarkable the same two data from both studies, when they are performed by the same consultant and use neither the same methodology of performing, nor the references. If the data were homogeneous in both sources, reveal a significant relative weight direct employment do wind sector on total or direct employment do electricity sector in Spain, a percent that, a priori, considered too high due to existence others electrical subsectors: thermal coal, nuclear thermal, hydro, etc.

² To carry out a calculation of the number of employees by activity and year bought together in a data table provided by two sources, INEGA and IAEST, because it does not offer all of the data by each of them, not to mention appreciatedifferences in installed capacity per year. It is necessary to point out that the data provided by IAEST were provided by AEE.

TABLE 3.- EMPLOYEES BY ACTIVITY AND YEAR OF WIND SECTOR IN GALICIA ACCORDING TO THE RATIOS EE/MWI AND PER (1995-2010)

PERIOD	RATIOS EE/MWI				RATIOS PER		
	INSTALLED CAPACITY ANNUAL (KW)	BUILDING AND INSTALLATION ACTIVITIES	OPERATION AND MAINTENANCE ACTIVITIES	TOTAL	BUILDING AND INSTALLATION ACTIVITIES	OPERATION AND MAINTENANCE ACTIVITIES	TOTAL
1995-2001*	1.024.805	3.328	205	3.533	13.322	205	13.527
2002	290.185	+943	+58	1001	+3.772	+58	3.830
2003	263.690	+857	+53	910	+3.428	+53	3.481
2004	253.720	+826	+51	877	+3.298	+51	3.349
2005	489.530	+1593	+98	1691	+6.364	+98	6.562
2006	203.480	+661	+41	702	+2.645	+41	2.686
2007	426.280	+1384	+85	1469	+5.542	+85	5.627
2002-2007*	1.926.885	6.264	386	6.650	25.049	386	25.435
2008*	144.325	+469	+29	498	+1.876	+29	2.555
TOTAL 1995-2008	3.144.940	10.061	620	10.681	40.247	620	40.867
2009	67.800	+220	+13	233	+881	+13	894
2010	59.430	+193	+12	205	+772	+12	748
TOTAL 1995-2010	3.272.170	10.474	645	11.119	41.900	645	42.509

Resource: Authors' elaboration from the data provided by INEGA (2011), corresponding to the installed capacity in the period from 1995 to 2001.2008, 2009 and IAEST (2008), which makes the remaining values of power, and treated based on information in the study of occupations related to the environment for Aranda and Scarpellini (2009).

Table 4. Installed Capacity, Wind Farms And Wind Turbines Installed In Galicia (1995-2010).

PERÍOD	INSTALLED CAPACITY CUMULATIVE (KW)	INSTALLED CAPACITY ANNUAL (KW)	WIND FARMS INSTALLED CASES	WIND FARMS INSTALLED ANNUAL	WIND TURBINES INSTALLED ACCUMULATED
1995-2001*	1.024.805	---	46	---	---
2002	1.314.990	290.185	---	13	---
2003*	1.578.680	263.690	73	12	2.530
2004	1.832.400	253.720	84	12	2.815
2005	2.321.930	489.530	108	24	3.286
2006	2.525.410	203.480	117	9	3.468
2007	2.951.690	426.280	130	13	3.833
2002-2007**	1.975.810	---	---	---	---
2008	3.145.240	193.550	----	---	---
2009	---	---	---	---	---
2010	3.272.170	---	150	2	4.035

Resource: Authors' elaboration from the data provided by IAEST(2012) and INEGA (2011)

Making a comparison (table 2) from the data presented in the study by EGA and the statistics data for the Electrical Industry in Spain (1994-2010) to see the lack of uniformity among them. Understood that the data provided by the latter, to reflect the global situation of the electricity sector, pick up the evolution of employment in the wind industry (data provided by EGA). In principle, the data set of the electricity sector would be significantly higher than those of the sectors that are, so to view the contrast of both sources seems deduced a clear overvaluation in the EGA data (2005), and if we note that for the years 2003 and 2004, direct employment data in the wind sector in Galicia offered by EGA (1,848 direct jobs in the wind sector in Galicia in 2003 and 1,666 in 2004) exceed the total direct employment for the electric sector in Galicia (1,749 direct jobs in 2003 and 1,616 direct jobs in 2004).

Analyzing together all these data appreciate two facts: in the years considered, the direct use of the wind sector reduces its significance in total direct employment in the wind industry in Spain, and also increases the weight of the direct employment of the total direct employment the Spanish electricity sector. Detected peak employment for the year 2001, with 2,120 jobs. From that moment on there was a gradual decline due to reduced construction activity, a factor, since it depends on the number of wind farms to be installed each year. This also mean that they put the projects necessary to achieve the provisions contained in the National Energy Plan (stipulated achieve by 2010 a total of 3,400 MW installed wind in Galicia, among other guidelines) and Galicia remains the goal of be above 30% of the Spanish wind employment figures circumstantial shoot so remarkable between 2006 and 2010, and then maintain a stable trend or slightly lower through 2020.

Table 5. Employees By Activity And Year Of Wind Sector In Galicia (1995-2010).

PERÍOD	INSTALLED CAPACITY ANNUAL (KW)	ASSEMBLY WIND TURBINES	CONSTRUCTION WIND TURBINE BASE	LINE EVACUATION WIND TURBINES	DRAINAGE DITCH LINE WIND TURBINES	CONSTRUCTION SUBSTATION	TOPOGRAPHY AND MANAGEMENT	MAINTENANCE	TOTAL
<i>1995-2001*</i>	<i>1.024.805</i>	<i>713</i>	<i>1.652</i>	<i>492</i>	<i>14</i>	<i>121</i>	<i>34</i>	<i>128</i>	<i>3154</i>
<i>2002-2007*</i>	<i>1.926.885</i>	<i>877</i>	<i>2.032</i>	<i>603</i>	<i>15</i>	<i>276</i>	<i>154</i>	<i>263</i>	<i>5453</i>
2008*	144.325	+51	+120	+35	+0	+18	+8	+18	250
1995-2008	3.144.940	1641	3804	1130	29	415	196	409	8857
2009	67.800	+24	+56	+16	+0	+8	+3	+8	115
2010	59.430	+21	+49	+14	+0	+7	+2	+7	100
1995-2010	3.272.170	1686	3909	1160	29	430	201	421	9072

Resource: Authors' elaboration from the data provided by INEGA (2011), corresponding to the installed capacity in the period from 1995 to 2001.2008, 2009 and IAEST (2008), which makes the remaining values of power

The application of the ratios EE / MWI and PER 2005-2010 (table 3) show interesting similarities. Indicates that for the period 2005-2010 and for the whole of Spain, wind sector, according to the PER 2005-2010, would create 37,793 net jobs in Spain, of which 34 680 correspond to the activities of construction and installation, and 3113 to the operation and maintenance activities. Given these assumptions and from the calculations carried out for Galicia:

- Applying the ratios of the PER 2005-2010, and in relation to the construction and installation activities, adding the data from the period 2005-2009, obtained a total of 17308, missing imputed data from the year 2010. Would mean that 50% of employment in these activities is generated in Galicia, where there are three other Spanish regions in which there has been an intense process of developing wind, in the case of Castilla-León and Castilla-La Mancha is higher than in Galicia while in Andalusia is lower. On the other hand, if we compare these results with those obtained by applying the ratios EE / MWI can be seen that the data for the ratios the PER 2005-2010 cuadruplican to above.
- However, if you apply the ratios PER 2005-2010 for the operation and maintenance activities, we observed a complete coincidence with the results of the application of the ratios EE / MWI, so consider both proportionate and appropriate methods.
- We conclude that the ratio of PER 2005-2010 presents data oversized, do not collect employment actually net (as stated in the bibliography) if they have a cumulative character. But as we have seen, the importance of construction activity derives most of its continuity over time that a stay in the job. We can not consider these net figures because it would mean that, once built wind farms remain connected to the wind farm, and it is not so.

Indicated that the generation of employment in the wind energy sector, essentially depends on the installation of new wind farms, not detract from the opportunities linked to the activities of the maintenance of the facilities. This heche is showed clearly from the relationship between employment / MWI provided by it consulted business sector (table 5) getting employment data directly below them generated for the application it ratio EE / MWI.

The lack of consistency between the data provided and analyzed highlights the urgent need to have reference to official statistics, to analyze the evolution of a booming sector in the economy Galician and Spanish, and can better contextualizarse its international role.

6. Conclusion

In this context and taking into account the data provided by different sources consulted, we have established that, in order to provide a quantification as consistent as possible with the real dimension of the employment generated, we should consider the following assumptions:

- The most appropriate source to provide data broken down by subsector employment Electric (in the present case, the wind sector) activity and gender, is the Statistics of the Electrical Industry, for its type, has the ability to offer these data.
- In his absence, we believe that the weighting ratio of employment in the wind industry to ISTAS sets and used in the studies referred to, would be an alternative that would establish values less imperfect, since it allows to consider the intensity of the job activities.
- It should also consider the directions given by the companies consulted, not providing specific data, provided general concepts that contribute to scale in a more consistent way the jobs created in the sector.

Given these assumptions and from the calculations performed, we conclude that:

- Applying the ratios of the PER 2005-2010 for Galicia, and in relation to the construction and installation activities, adding the data from the period 2005-2010, would mean that 50% of employment in these activities is generated in Galicia, where there are three other Spanish communities in which there has been an intense process of developing wind, in the case of Castilla-León and Castilla-La Mancha is higher than in Galicia. On the other hand, if we compare these results with those obtained by applying the ratios EE / MWI can be seen that the data for the ratios the PER 2005-2010 quadruple to above.
- However, if you apply the ratios PER 2005-2010 for the operation and maintenance activities, we observed a complete coincidence with the results of the application of the ratios EE / MWI, so consider both proportionate and appropriate methods.
- We conclude that the ratio of PER 2005-2010 presents data oversized, do not collect employment actually net (as stated in the bibliography) if they have a cumulative character. But as we have seen,

the importance of construction activity derives most of its continuity over time that a stay in the job. We can not consider these net figures because it would mean that, once built wind farms remain connected to the wind farm, and it is not so.

- Joining the three premises above, and being aware of the limitations of existing thought for the period 1995-2010 for Galicia, the operation and maintenance activities generated at least 417 jobs and up to 645, type net, mainly due the number of wind farms that were entering in continuous operation and the maintenance companies also expanded their market out of Galicia. For the same period, and in relation to the activities of the construction of the wind farm, numbers were between 9072 and 11 119 jobs, consider gross, given the existing high level of turnover in these activities and also the number of wind farms built. In relative terms, it would be a net employment / MWI in the activities building (highly vulnerable all depend on the promotion of wind farms), and a net employment / 7 MWI in the activities of operation maintenance (but comparable to long term employments and high qualification).
- Buy also indicate that the operation and maintenance activities are those that record greater durability over time, which could be fitted with permanent jobs, while construction and installation activities, depend directly on the promotion of wind farms, with effective early, that is, without expanding staff.

References

- Aranda, U.A., Scarpellini, S. (2009) *Análisis de viabilidad económico-financiero de un proyecto de energías renovables*. Ediciones Prensas Universitarias de Zaragoza.
- Argem (Agencia de Gestión de Energía de la Región de Murcia) (2005): "El sector energético: las energías renovables y su entorno industrial". *Concerra 2005. Congreso Nacional sobre las energías renovables*, p.41-47.
- Asociación Empresarial Eólica (AEE) (2008): *Estudio macroeconómico del impacto del sector eólico en España*. Madrid.
- Asociación Empresarial Eólica (AEE) (2011): *Estudio macroeconómico del impacto del sector eólico en España*. Madrid.
- Asociación Eólica de Galicia (EGA) (2005): *A economía eólica en Galicia. Magnitudes, dinámicas y efectos estructurales*. Edicións EGA. Santiago de Compostela.
- Asociación de Productores de Energías Renovables (APPA) (2009): *Estudio del impacto macroeconómico de las energías renovables en España*. Madrid.
- Asociación de Productores de Energías Renovables (APPA) (2011): *Estudio del impacto macroeconómico de las energías renovables en España*. Madrid.
- BMU(2005): "Renewable energy: employment effects".
Online: http://www.bmu.de/files/pdfs/allgemein/application/pdf/employment_effects_061211.pdf
- Calzada, Blas (director) (2009): *Study of the effect on employment of public aid to renewable energy sources*. Universidad Rey Juan Carlos. Madrid.
- European Comision (2009): *The impact of renewable energy policy on economic growth and employment in the European Union*.
- Eufores, (2006): *Opportunities for the development of renewable energy in the UE*. Online: www.eufores.org.
- European Wind Energy Agency (EWEA, 2012): *Wind Energy: the facts. Executive Summary*. Brussels.
Online: http://www.ewea.org/fileadmin/ewea_documents/documents/press_releases/Facts_Summary.pdf.
- European Wind Energy Agency (EWEA, 2008a): *Pure Power: wind energy scenarios up to 2030*. Brussels. Online: http://www.ewec2008.info/fileadmin/ewea_documents/documents/publications/reports/purepower.pdf.
- European Wind Energy Agency (EWEA, 2008b): *Wind at work. Wind energy and job creation in the UE*. Brussels. Online: http://www.ewec2008.info/fileadmin/ewea_documents/documents/publications/reports/purepower.pdf
- GWEC (2012): *Global Wind Report 2011*. Brussels. Online: <http://www.gwec.net/fileadmin/documents/Publications/Global%20Wind%202011%20Report.pdf>.
- Instituto Energético de Galicia (INEGA) (2011): *Relación de parques eólicos autorizados*. Online: <http://www.inega.es>

Instituto Aragonés de Estadística (IAEST)(2008,2011,2012):on line

http://portal.aragon.es/portal.page/portal/IAEST/IAEST_00

Instituto Nacional de Empleo (INEM) (2007): *Estudio de las ocupaciones relacionadas con el medio ambiente*. Madrid.

Instituto Sindical de Trabajo, Ambiente y Salud, ISTAS, (2006): *Empleo en pymes del sector de las energías renovables e industrias auxiliares en España*. Madrid.

Instituto Sindical de Trabajo, Ambiente y Salud, ISTAS, (2008): *Energías renovables y empleo en Cataluña*. Madrid.

Instituto Sindical de Trabajo, Ambiente y Salud, ISTAS, (2009a): *Energías renovables y empleo en la comunidad autónoma de Madrid: situación actual*. Madrid

Instituto Sindical de Trabajo, Ambiente y Salud, ISTAS, (2009b): *Energías renovables y generación de empleo en España, presente y futuro*.Madrid.

Ministry of Industry and Trade of Spain (2005): *Plan de Fomento de las Energías Renovables 2005-2010*. Madrid.

P.Brown, JP., Pender J., Wiser RH., Lantz E.,and Hoen B. (2012). Ex post analysis of economic impacts from wind power development in U.S. counties. *Energy Economics*, 34, 1743-1754.

Wei, M.; Patadia, S. and Kammen, D.M. (2009). Putting renewables and energy efficiency to work: how many jobs can the clean energy industry generate on the US?. *Energy Policy* 38, 919-931.