

RENEWABLE ENERGY, ELECTRICITY MARKET AND EMPLOYMENT: THE CASE OF SPAIN¹

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Abstract

In last decades, renewable energies in the European Union are acquiring a great importance due to the positive economic-social implications that entail its development. So, among other factors, we can highlight the obtaining of environmental benefits or the employment creation.

The objective of this paper is to analyze the economic-social implications of the development of renewable energies in the case of Spain. The results show that household electricity prices have not been reduced and environmental costs are increasing. However, an important increase of employment was developed where workers a high level of skill and a steady job.

Palabras clave: mercado de electricidad, energías renovables, precios de electricidad, empleo.

Clasificación JEL: Q42, Q50, Q58.

1. Introduction

The proliferation of renewable energy is a key issue in the EU policies (European Commission, 2010). Clean and efficient energy is in line with the objectives of Europe 2020, which urges for a more sustainable development through promoting resource efficient, greener or environmental friendly technologies. Renewable energy is expected to result in energetic security, lower oil and energy imports, lower emissions, financial saving, less dependence on carbon resources and job creation (Díaz-Vázquez and Vázquez-Cancelo, 2009, 2008; Mentaneau *et al.*, 2003).

The involvement of national governments in the diffusion of renewable energy is necessary in the initial phases of the integration of green energy in the economy. The national governments help to protect the green energy solutions from the direct competence of conventional technologies (Mentaneau *et al.*, 2003). When renewable technologies enter the market, they have not got their optimum potential in terms of cost and efficiency. The best performance will be obtained systematically as a result of the process learning by doing (Jacobson *et al.*, 2009). Action to implement green energy requires governmental mechanisms (incentives) that allow the development of innovative technological solutions that are economically viable (Schwartz, 2009).

However, maximizing the economic and social welfare through the proliferation of green energies should ensure that consumers do not support the costs of the governmental

¹ *Acknowledgement:* This paper has been developed in the framework of the 10SEC100020PR Project “Analysis of the effects of renewable energies on employment in European Union” supported by the Spanish Government-Xunta of Galicia.

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incentives (Fronzel, 2009). This is particularly relevant, in countries characterized by an important development of renewable energy promotion mechanisms that could lead to a significant increase in final energy price paid by consumers (Sáenz de Miera *et al.*, 2008).

Besides, one of the main advantages of the development of clean energy is the creation of employment (direct, indirect and induced). Results of the research in this topic obtain that renewable energies entail more jobs than the fossil combustible sector by delivery energy unit (European Wind Energy Association and Greenpeace, 2009; SkyFuels and National Renewable Energy Laboratory, 2009; European Photovoltaic International Association and Greenpeace, 2006). However, some criticisms have emerged related to the high costs of the green job programmes because such programmes involve the elimination of other jobs or the change of some jobs for new green jobs (Wei *et al.*, 2010).

The objective of our paper is to analyze the implications of renewable energies in electricity market and in the employment in the Spanish case inside European Union context. The choosing of this country is due to Spain is one of the leader member states in installed capacity and production of renewable energies. For it, the paper is structured in the following way: firstly, we analyze the public policy of renewable energy promotion in European Union. After that, we study the implications of renewable energy in the Spanish electricity market. Later, we analyze the employment creation that such production technologies entail in such member state. Finally, we draw the main conclusions of the paper.

2. Analysis of public policy on renewable energy promotion in European Union

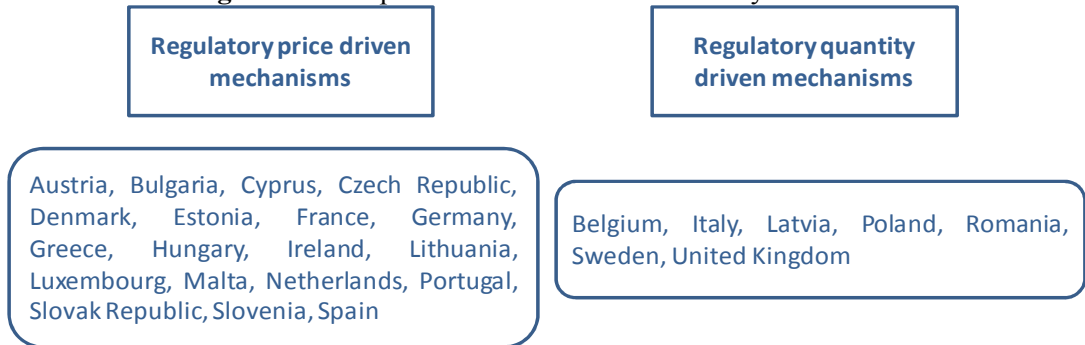
The development of renewable energies is set as a key factor in energetic subject in European Union. One of the more relevant regulations is given by Directive 2001/77/CE on the promotion of electricity produced from renewable energy sources in the internal electricity market. It establishes the objective of reducing the contaminant emissions of carbon dioxide in 8% during the time period 2008-2012. Therefore, the public renewable energy promotion has become a political priority in the European Union by means of the development of EC legislation in such field. This Directive establishes, as objective, the obtaining of a share of 21% in energetic consumption from renewable energies. For it, this regulation determines the indicative -not obligatory- objectives for every country that are established in function of its renewable potential and its initial situation. However, such Directive does not fix a common promotion system of renewable energies in all countries but they will decide which mechanism is the most suitable according to its characteristics (energetic consumption, energetic diversity or composition of the electricity generation).

Due to the difficult for getting the established aims in this regulatory framework, Directive 2009/28/CE sets three obligatory objectives for all member states -and, therefore, for Spain- in 2020: a) reduction in the greenhouse gas emissions in a share of 20%, b) lowering of primary energy consumption in a share of 20% by means of the energetic efficiency and c) the obtaining of a global quota of 20% of renewable energy in final energetic gross consumption.

However, this regulation does not establish a certain renewable energy promotion mechanism in each member state. Therefore, according to its characteristics (energetic consumption and diversity or composition of the electricity generation), they will decide

what mechanism is the most suitable. There are two main categories: regulatory price-driven and regulatory quantity driven mechanisms (Hass *et al.*, 2011) (See Figure 1)

Figure 1. Main policies for renewable electricity in EU-27



Source: Own elaboration

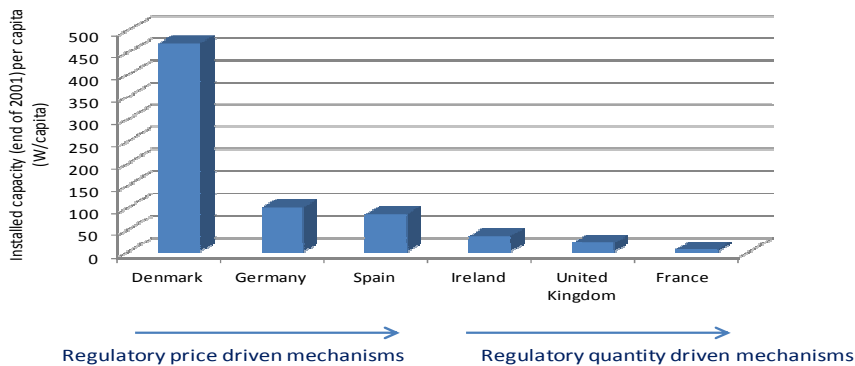
Regulatory price-driven mechanisms include feed-in tariff. This system entails an obligation for the grid operator to buy all renewable electricity produced at a pricing scheme where the producers have two options: a) they can sell the renewable electricity production at a pre-set price per kilowatt-hour with this fixed price (feed-in tariff) normally resting above the conventional market price for electricity or b) producers can sell renewable electricity at market price plus a premium. In both cases, the value established by tariff is guaranteed for a number of years added to the price (Venetis *et al.*, 2009). This type of incentive is the oldest and most widely used in countries such as Spain, Denmark, Germany and Italy.

Regulatory quantity driven mechanisms include bidding systems and tradable certificate systems. In the first case, call for tenders are launched for defined amounts of capacities. With this mechanism, winners of contracts will obtain a guaranteed tariff for a specific time period. It has been used mainly in United Kingdom and France (in the last case, until the year 2000). However, tradable certificate systems are characterized by producers of renewable electricity receive a certificate for each pre-defined unit of electricity produced. These certificates represent the “society value” of the production of electricity from renewable energies and it is tradable and sellable through a trading system. The main problem is that tradable green certificates price developments are uncertain and difficult to forecast in illiquid (not developed) energy markets and, therefore, investor risks are higher than the last mechanism (Ciarreta and Gutiérrez, 2010; Venetis *et al.*, 2009). This system is being used, or recently will be used in various countries on a more or less experimental basis (Netherlands, Denmark, Sweden or Italy).

The diversity of the renewable support mechanisms applied by member states has entailed different introduction of such production technologies (see Figure 2 for wind energy case).

However, there is non-unanimity about what policy is more suitable in promoting the development of renewable energy. Meyer (2003) obtains that a suitable design of feed-in tariff system involves a greater effectiveness and efficiency than other renewable promotion mechanisms.

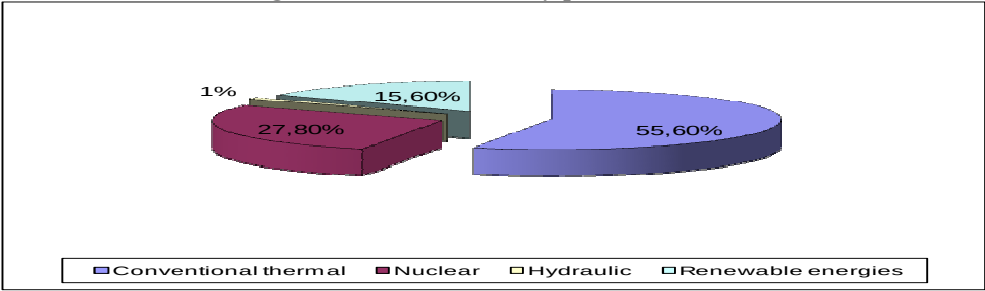
Figure 2. Wind installed capacity with different renewable promotion policies



Source: Hass *et al.* (2004)

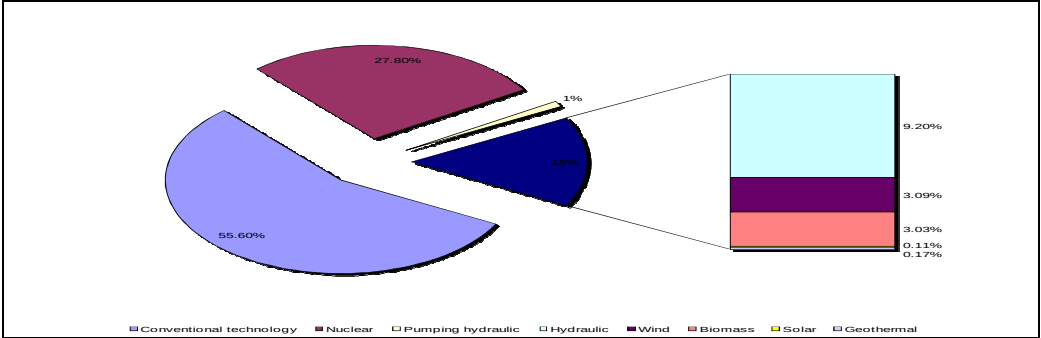
Van der Linden *et al.* (2005) establish that, although the systems based on quotas seem to be effective and efficient from a theoretical view point, it is necessary to make an analysis in the long term. Dinica (2006) and Haas *et al.* (2011) consider, as main characteristic, the development of regulatory stability which guarantees an adequate profitability and a scarce risk for investors. Jacobson *et al.* (2009) conclude the necessity of introducing an energetic policy that allows the entrance of new companies and secures attractive investment conditions. The use of the renewable energy promotion mechanisms, commented before, have entailed that, in 2008, the production capacity of these production technologies in EU-27 has a share of 15.60% (see Figure 3) where hydraulic technology has a primordial role, followed by wind and biomass (see Figure 4).

Figure 3. Gross electricity production–EU 27



Source: European Commission (2010)

Figure 4. Gross electricity production from renewable energies–EU 27



Source: European Commission (2010)

3. Renewable Energies and Electricity Market: Analysis of The Spanis Case

Economic literature establishes that an increase of renewable energies production entails an ambiguous effect on consumers' well-being (Skytte, 2006). On the one hand, the introduction of mechanisms of renewable energy promotion tends to reduce the electricity price because the green technology reduces the dependency of conventional technologies characterized by being too costly and emission-intensive (Gurria, 2009). On the other hand, the costs of the promotion mechanisms of renewable energies are passed to consumer electricity price (Jensen and Skytte, 2003).

Table 1. Main results of studies that analyze the relationships between the promotion systems of renewable energy and electricity prices

STUDIES	RESULTS
Moreno et al. (2012)	They analyze the evolution of the final electricity prices in the member states of EU-27 The results indicate that the final electricity prices increase with the deployment of renewable energies.
Traber and Kemfert (2009)	They establish that the introduction of renewable energies in Germany has supposed an increase of electricity prices paid by consumers around 3%, while wholesale electricity price has been reduced in 8%.
Rathmann(2007)	His study shows that the introduction of renewable energies in Germany supposed a reduction of wholesale electricity price, in the period 2005-2007, in 6,4 Euros/Mwh. The cost increase is given by feed-in tariff that entailed an amount of 3,8 Euros/Mwh. Therefore, renewable energies supposed a saving in the consumers of 2,6 Euros/Mwh.
Bode (2006)	This paper establishes that German electricity industry has complained of prices increase that entailed the feed-in tariff and it damaged their competitiveness. Like that, this study shows a price increase, in absolute terms, of 0,05 Euros cents/kwh.
Ragwitz et al. (2006)	The obtained results indicate that transference costs for consumers (due to the promotion of renewable energies) and electricity prices have a relative negative correlation. So, the consumer burden due to the higher renewable promotion costs could be (only partly) compensated by lower wholesale electricity prices.
Martin (2004)	This study estimates the impact of photovoltaic generation in electricity price of New England. It obtains that 1 GW of this type of renewable energy could have reduced wholesale electricity price, in 2002, with a 2% savings. It could have supposed savings of 129 millions of dollars annually.
Sorrell (2003)	This author establishes that promotion policy of renewable energy could increase electricity prices in United Kingdom by 4.4% in 2010.

Source: Own elaboration.

According to Sáenz de Miera *et al.* (2008), there are three possible scenarios describing the relationship between renewable energy production and electricity price:

Absolute negative correlation: the cost increase derived from the support mechanism of renewable energy is more than compensated for the reduction of wholesale electricity price. Therefore, a reduction of final electricity price is developed and consumers are in a better position than in lack of renewable energies.

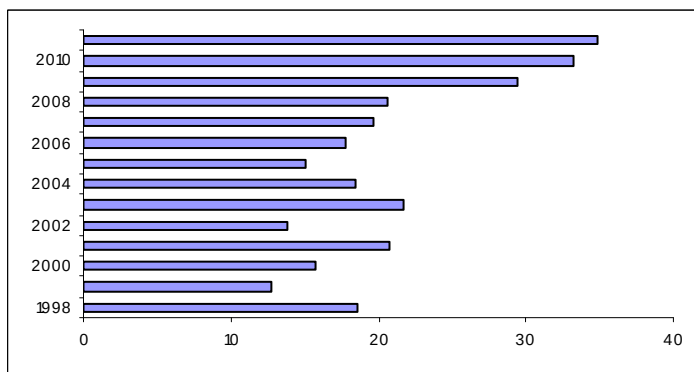
Relative negative correlation: the reduction of wholesale electricity market does not compensate the cost increase related with the support system of renewable energy. So, it entails an increase of final electricity price.

Positive correlation: the use of renewable energy does not suppose a reduction of wholesale electricity price. Therefore, final electricity price is increased due to the cost increase that entails the support system of renewable energy. If we assume a perfect competition in electricity market and the price is given by marginal cost, this type of correlation is highly unlikely, at least in the short term.

Results obtained in the economic literature about the relationship between renewable energies and electricity prices are not conclusive (they show both an increase and a reduction of final costs of consumers) (see Table 1).

In Spanish case, Law 54/1997 establishes, between other objectives, the liberalization of electricity industry and the creation of electricity production market. The regulatory framework introduced for the promotion of renewable energy (Royal Decree 436/2004, Royal Decree 661/2007, Royal Decree 1578/2008, Order ITC 1723/2009) is based in a feed-in tariff system². It has allowed that Spain was set as the second European country with higher installed power and production in renewable energy. In Figure 5, we can observe the percentage of such clean production technologies in demand supply (including the hydraulic).

Figure 5. Percentage of renewable energy in electricity supply (including hydraulic). Spain. 1998-2009

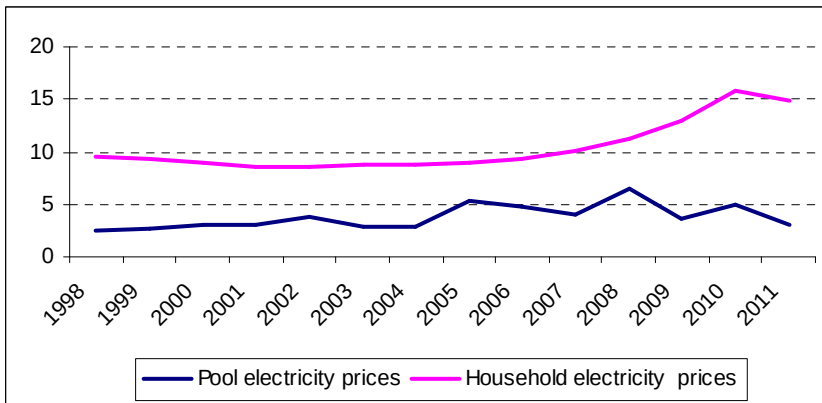


Source: Eurostat

Another element that is emphasized, in Figure 6, is the increase of household electricity prices (even in periods where pool prices are reduced -such as in 2004, 2007 and 2009-) except 2010. So, despite the important development of renewable production technologies in Spain, electricity pool prices have hardly been reduced. It can be due to renewable promotion mechanism in Spain is paid by consumers and, therefore, the reduction of wholesale electricity prices can not compensate the increase of final prices that entail the payment of feed-in tariff.

² Decree-Law 1/2012 entails an abolition of the renewable energy promotion system. This indicates that Spain achieved the foreseeable expectations.

Figure 6. Evolution of the electricity prices (cent euros/kwh). Spain. 1998-2011



Source: Eurostat

4. Renewable Energies and Employment: Analysis in the Spanish Case

Green jobs refer to those jobs that entail a direct role in reducing environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable (Union Nations Environment Programme, 2008).

Economic literature obtains that renewable energies generate more jobs than the fossil combustible sector by delivery energy unit whilst the type of employment differs by production technology (European Wind Energy Association and Greenpeace, 2009; SkyFuels and National Renewable Energy Laboratory, 2009; European Photovoltaic Industry Association and Greenpeace, 2006). However, some criticisms have emerged related to the high costs of green job programmes because they involve the elimination of other jobs or the change of some jobs from new green jobs. Besides, those criticisms indicate that, perhaps, the governmental investments for the promotion of renewable energies would be better spent in elsewhere of the private sector (renewable energies require of greater subventions that entail higher costs -including the employment costs-) (Wei *et al.*, 2010).

European Commission (2009) establishes that this industry has supposed around 400,000 jobs (direct, indirect and induced) and that the improvement of the present support policies of renewable energies (with the aim of obtaining the objective of 20% of renewable energy sources in 2020) which could lead to the creation of 410,000 new jobs.

The responsible countries of the greater part of the renewable energy installations have higher number of jobs (such as the case of Spain). Spain is characterized by having high energy dependence (more than 80%) due primarily to fossil fuels and nuclear. This causes a great volatility in energy prices, a danger to the security of supply and, consequently, a deficit in the trade balance (García-Álvarez and Moreno-Cuartas, 2012; ISTAS, 2010).

In this section we elaborate a brief description of employment in renewable energies in Spain today. It seeks to identify the strengths and weaknesses to enable screening potential job creation of this type of energy and enhance the actions necessary to adapt the existing professional profile of workers to the needs of the industry.

In recent years, great efforts have been made to promote renewable energy. One motivation for this rapid development has been the ability to create jobs that may involve these clean energies. In Spain, the employment generated in renewable energy is estimated at 68,737 in 2009, a remarkable figure despite the declining employment experienced as a result of the current economic crisis. However, the creation of employment in the sector has not been uniform but is greatly polarized.

Table 2. Distribution of employment by renewable subsector. Spain.

	Direct Employ ment	%	Coeff icient ³	Indirect Employ ment
Total Employment				
Wind	30,651	44.60%	0.8	24,521
Photovoltaic solar	19,552	28.40%	0.45	8,798
Solar thermal	6,757	9.80%	0.45	3,041
Activities common to all subsectors	4,263	6.20%	0.65	2,714
Biomass	3,191	4.60%	0.88	2,808
Hydro and mini hydro	1,078	1.60%	0.45	485
Biofuels	964	1.40%	1.025	988
Biogas	664	1.00%	1.025	681
Solar thermoelectric	511	0.70%	0.6	307
Geothermal	415	0.60%	0.39	162
Others	268	0.40%		
Aerothermal	184	0.30%	0.45	83
Small wind	165	0.20%	0.8	132
Tidal	74	0.10%	0.52	38
TOTAL	68,737	100%		44,758

Source: ISTAS (2010)

Table 3. Type of contract for professional in Spain

	Permanent contract	Fixed-term contract	Training Work placement	Autono mous
	93.6%	3.4%	1.1%	1.8%
Technicians (medium)	91.3%	6.4%	1.1%	1.1%
Managers	95.3%	3.2%	0.2%	1.3%
Officers (qualified)	74.9%	23.7%	0.6%	0.6%
Auxiliary (not qualified)	62.2%	35.1%	2.2%	0.5%
TOTAL	83.7%	14.1%	0.9%	1.2%

Source: ISTAS(2010), EPA (2010)

As seen in Table 2, nearly two-thirds of employment in renewable energies is mainly concentrated in subsectors of wind energy and photovoltaic solar. The remainder is subsectors, with the exception of solar thermal and biomass is not representative. More interesting is the finding that almost equates indirect employment to jobs directly linked

³ This ratio has been obtained from the "Survey of Macroeconomic Impact of Renewable Energy in Spain".

to the sector. It is therefore a sector with a huge possibility of linkages between sectors, generating a total of 113,227 jobs.

The majority business structure in Spain is based on small and medium enterprises. The renewable energy sector is no exception. However, larger firms have more workers as they are present in both types of companies in a similar percentage

But not only the business structure is important in this sector. Moreover, the use of renewable energy is characterized by high stability since almost all sector contracts are indefinite, although this falls to reduce worker qualifications (see Table 3).

Table 4 shows a wide disparity between women and men. The role of women in this field is limited exclusively to administrative work, dominating the male sector all other types of work in renewable energy. This makes it necessary to find ways of female employment incentives in this sector, such as specific training programs for female employment in this industry, tax incentives, promotion of women's employment, etc.

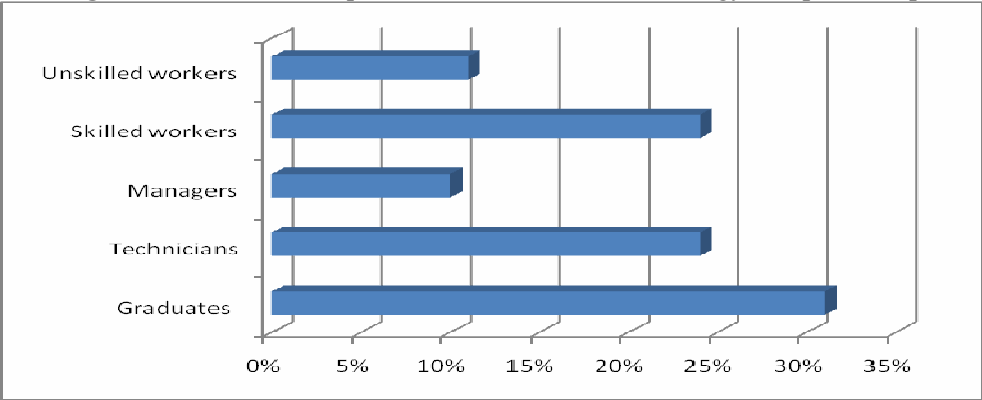
Table 4. Gender distribution in the departments of renewable energy companies. Spain

	Women	Men
Administration	63.8%	36.2%
Promotion, marketing, sales	39.9%	60.1%
Project development	30.8%	69.2%
Research, development and innovation	30.5%	69.5%
Others:	22.4%	77.6%
Direction and coordination tasks	16.4%	83.6%
Production staff: instalation	16.1%	83.9%
Production staff : industrial	15.2%	84.8%

Source: ISTAS(2010), EPA (2010)

Finally, it should be noted the profile of professionals engaged in renewable energy in Spain. As shown in Figure 7, the highest percentage of workers has a higher degree. There is also a high percentage of technicians and skilled workers. This distribution is bell-shaped as the highest positions (managers) and the lowest (unskilled workers) are less representative.

Figure 7. Professional qualifications of renewable energy companies. Spain



Source: ISTAS (2010)

5. Conclusions

In the last years, a process of development of renewable energies has been taking place in EU with the aim of taking their advantages, such as lower greenhouse gas emissions or their sustainability with regard to fossil sources. With the aim of taking such benefits, the participation of the governments is necessary in the initial phase of the renewable energies with the objective of securing their development and protection of the direct competition that entail the conventional technologies. European regulation (Directive 2001/77/CE and Directive 2009/28/CE) gives freedom to member states in the decision of choosing the renewable promotion mechanism that consider more relevant in function of their characteristics.

There are two main types of policies: regulatory price-driven and regulatory quantity driven mechanisms. The diversity of renewable energy promotion mechanisms applied for member states applied by member states has involved a different introduction of these production technologies in them. However, there is non unanimity about what type of policy is the most suitable for favoring the development of renewable energy.

Renewable energies have important economic-social implications, such as in electricity markets or in employment. With regard to electricity markets, green energy can entail a reduction in wholesale electricity price because they reduce the dependency of conventional technologies characterized by being too costly and emission-intensive. However, in the Spanish case, household electricity prices have been not reduced with the introduction of renewable energies in a permanent way. It can due to the renewable energy promotion mechanism in Spain has been paid by consumers and, therefore, the reduction of wholesale electricity prices can not compensate the increase of final prices that involve such mechanism.

Another of the main advantages of the development of clean energy is the creation of green jobs. In the economic literature, various papers obtain that renewable energies entail more jobs than the fossil combustible sector by delivery energy unit. European Commission (2009) establishes that this industry has supposed around 400,000 jobs and that the improvement of the renewable support policies could duplicate this value. In the case of Spain, the sector employment generates a significant number of jobs, not only direct but also indirect. It is especially focused on wind and solar photovoltaic. On average profile of workers have a high level of skill and has a steady job, but this stability decreases for the group of employees with less training. Furthermore, it is interesting to discover that it is a male dominated industry, with the exception of administrative and management tasks.

We note that the renewable energy sector is becoming a haven for highly qualified staff that has also has knowledge and experience in the energy sector, whether more traditional or emerging in recent years. Thus, it was born the opportunity to start new businesses, develop new markets and reduce the cost of energy. The fact of discovering the strengths and weaknesses of jobs in *renewables* will allow us to greatly enhance the development of the sector and therefore further increase get bullish expectations in terms of increased employment. Remain as pending tasks, first, eliminate the concentration that persists in wind power and photovoltaic and direct job creation to the other sectors and, secondly, to promote gender equality in the sector, especially in the management tasks and production staff.

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