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Forecasting job creation from renewable energy deployment through a value-chain approach

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ABSTRACT

This paper introduces a new approach to the study of the socioeconomic impact of renewable technologies through the analysis of the reinforcing effects of the expansion of this industry and the specific characteristics of the employment along the value chain.

The method proposed is based on the collection, critical analysis and presentation of the results obtained using primary information sources. The model design includes contributions extracted from a prior analysis of the existing assessment methods, to lessen the uncertainty of the job ratios often used in these types of analysis.

One factor to be taken into account is the high degree of development in the sector and above all the maturity of the technology considered from the point of view of the industry fabric: the economy of scale and technological development actually influences the human resources needs, sometimes increasing the demand for professionals within the scope of R&D and sometimes reducing jobs in the manufacturing industry, which is gradually applying processes with a greater degree of automation. The influence of these experience curves is different for every single stage of the value chain. Trade balance of technologies is also crucial for local employment generation.

An analytical model was developed based on the above assumptions and applied to the Spanish PV industry. This industry has been playing a leading role in the expansion of renewable energy and offers a high potential towards the short-term development of the smart grids in this country.

This model represents very well the history of the Spanish PV industry reflected through the evolution of the jobs and is shown to be the foundation of a methodology for prospective studies in the social and economic impacts of renewables.

Contents

1. Introduction

The main argument for the renewable energy deployment in industrialized countries has been their contribution to reducing the environmental impacts of energy consumption. However, renewables integrate the three dimensions of sustainable development of a territory providing many other socio-economic impacts, for instance, energy security, economic growth, territorial vertebration and employment.

As many studies show, renewables have a positive effect on the balance of payments of the territory, specially in regions with a high dependence in fossil fuels [1]. As own resources are able to

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reduce imports and ensure supply without relying on energy markets, an increased share of renewable energy aims to a reduction of the trade deficit and a stabilization of the energy prices. However some authors maintain that the promotion of renewable energy over other forms of generation can be in some cases counterproductive to economic growth because of the increased costs or the shifting of other sectors [2–4]. Territorial cohesion, requiring more resource efficiency and greener economy, has been viewed too as another important issue where renewables can play an important role. Moreover, renewable energy has special implications for rural communities because large renewable installations, mainly wind farms or biomass plants, have to be sited in relatively open countryside and create jobs to increase local tax incomes among other benefits [5,6].

Regarding employment, it is fully accepted that an increase in renewable power leads to the creation of jobs [7]. Nevertheless labour intensity is not the only aspect that should be covered by a whole study about renewable employment as was indicated by [8]. Obviously the induced job losses due to the replacement of conventional sources of generation [2,9] or gains due to the increasing activity in other related sectors [10] are to be assessed. In this line, some studies have demonstrated that the exploitation of renewable energies for electricity production generates a greater number of jobs than that supplied by conventional energy plants: for every MW installed it is estimated that renewable energy sources generate between 1.7 and 14.7 times more jobs than natural gas generation plants [11] and up to 4 times more jobs than those supplied with coal [12].

Among all socioeconomic impacts, it is the employment generation which has focused most attention in the vein of the numerous reports elaborated by different types of organisations having different interests about the information. While companies are usually interested in the employment created by a specific project, public administration focuses its studies on the employment created by a stimulus programme and associations of different industries quote the total employment supported by a sector.

In general terms, most of the reports about employment in renewable energy industries are aimed on the assessment of the number of existing jobs (usually direct jobs) by means of analytical methods [12–14]. These studies are often focused on a technological area (i.e. biomass in [14] or solar thermal in [15]) and in a territory (i.e. Greece in [16] or Germany in [17].

The obtained results allow to estimate coefficients or ratios that quantify the employment created per unit of installed power or electricity from the energy sources. There are several references where some of these ratios are collected [18,19] highlighting the dispersion in the values presented as well as enough variability in the used ratios.

One problem with the array of existing studies is that they apply a wide range of methodologies, assumptions and reporting formats which make a direct comparison of their job findings – or any agregation and extrapolation – very difficult or impossible unless wide knowledge is applied.

The diversity of these ratios can be firstly justified with the different scopes of the research and analysis carried out in each of the studies when calculating the direct and/or indirect employment generated.

In general terms, the studies analysed provide two separate ratios, one for the construction and manufacture and another for the operation and maintenance stage, making it difficult to interpret in some cases exactly which stages are considered in each ratio. For example in the study carried out in Germany by Lehr [20] the installers are added to the ratio corresponding to the jobs generated in operation and maintenance, to be able to differentiate between jobs that are probably local and jobs that may be created in distant manufacturing plants. Other studies such as those by EPRI and CEC in California [21] add the jobs in the installation stage to the first of the ratios to make the distinction between temporary and permanent employment. Anyway, Kammen et al. state "making the distinction between these two kinds of jobs is also important because the categories 'scale' differently as the industry expands" [22] and this is definitively what this paper tries to go on with.

In terms of terminology and ratios it can be seen that in most of the studies focused on the analysis of the stage of manufacturing and construction the use of "person-year per installed MW" ratio is widely used so as to reflect the short-term character of the employment during this phase. On the other hand, if phases of operation and maintenance and fuel processing are considered the ratio of "number of jobs per MW of installed capacity", i.e., the number of people who would be needed stably to operate the plant, is quoted.

When comparing ratios between different reports, apart from knowing with security what is the timescale for which the ratios are referred to, it is necessary to put these employment numbers on a common basis specially if the estimation of the total employment associated with each technology is targeted. When adding short-term and long-term jobs the concept of job years becomes instrumental.

Even by ensuring consistency in the methods used for data collection, the interpretations obtained from employment ratios could have a high degree of uncertainty unless territory aspects, deployment of renewable technologies, maturity of industry or availability of skilled workers among others are considered [23].

The case of the wind energy in Denmark is very illustrative. According to the data from EWEA [24,25] in 2007 only 3 MW were installed in Denmark whereas 23,500 jobs were reported for the wind sector. These figures give an unrealistic ratio of 7 833 jobs/MW far from other countries with a higher amount of installed MW. Dalton and Lewis [26] compare ratio for several countries and advert how these ratios drive to confusing resuls in a first approach. Only making an interpretation of these ratios in the light of the structure and the development of the industry, differences can be explained.

On the other hand, for a given sector and territory, the time when the information is obtained has a strong effect on the ratios too. While in the 2003 EWEA report a rate of 6 jobs/MW [27] was reported for wind turbine installation in Europe, this ratio drops to 1.9 jobs/MW in the 2008 report [25], reflecting the reduction in the number of jobs relative to the installed capacity as economies of scale increase and renewable technologies mature.

In addition to the errors due to extrapolation methods, these estimates sometimes provide overall figures, i.e. the total number of jobs arising from the installation of a given power without discriminating the phases in which they are generated, the stability or temporary employment or the geographic location of the workers, and should be considered as trend and not absolute. Nevertheless these job characteristics are secondary variables whose analysis can yield valuable information for the strategic promotion of renewables at a local level.

According to the study carried out by Singh and Fehrs [12], 1 MW of wind power installed operating for one year supports 9500 h of labour that is theoretically shared as follows: 67% of the work occurred in component manufacture, 11% in installation, 20% in service and 2% in transport. The installation of a 30 MW wind farm will generate an employment of 144 people-year approximately that, distributed over 30 years, results in 4.8 stable jobs throughout the whole life of the installation. Only if the local wind power industry covers every link of the business chain, the jobs will remain in the territory but if as usual the components are acquired abroad, only an average of 1.6 jobs per year remain in the closest environment. This indicator may turn out to be even lower due to the temporary nature of some of the stages.

Definitively it is important to understand the structure and running of the sub-sector object of each study to be able to correctly interpret the employment ratios.