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Project appraisal for small and medium size wind energy installation: The Italian wind energy policy effects

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HIGHLIGHTS

- Focus on the Italian wind energy sector.
- Analysis of Italian policy effects.
- Focus on small/medium size wind energy machines.

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ABSTRACT

In the last few years, the distributed energy production from small wind turbines (i.e. < 200 kWp) has developed into a relevant business opportunity for different investors in Italy. The market, especially in Italy, has rapidly grown, achieving 9 MWp only in 2011, with an increase from 1.5 MW in 2009 to 13.3 MW at the end of 2011. This paper reports the results of a case study on the installation of several small wind turbines. It aims to provide an analysis of the conditions in Italy that make it possible to install these machines and offer a reliable reference for designing, planning, and controlling small wind turbine projects while focusing on the strategic variables of time, cost, and quality used by typical enterprises in the investment projects. The results are relevant to investors as well as engineering, procurement, and construction companies involved in this new sector, which must understand Italy's renewable energy policy and its effects in practice. Moreover, certain national energy policy conclusions are reported and discussed in this paper. To properly study the sector, the data on time, cost and quality are analysed using typical project management tools.

1. Introduction

Over the last few decades, energy production from renewable sources has mainly focused on large projects in the photovoltaic and wind sectors. As reported by the European Wind Energy Association (EWEA) in 2012, the cumulative power from wind in Italy has reached 8 GWp (European Wind Energy Association (EWEA), 2013). Along with large wind plants, small wind production has also grown substantially throughout the world, reaching a total power of 600 MWp installed in 2011 (di Milano, 2012), with 80% equally divided between the USA and China. In Italy, the percentage of power from small wind plants is still limited, reaching a total of 13.3 MWp in 2011, but the market size has witnessed exponential growth, as shown in Fig. 1.

To confirm this exponential growth, it is worth noting that in Italy, the availability of the two main key resources for wind installations, i.e., land and electric grid capacity, remains high for small wind initiatives, while the same cannot be said for large wind farms. The reason for this is that medium (MV) and high voltage (HV) electricity grids are saturated and do not always offer the possibility to receive additional distributed loads from new large wind farms. For small wind turbines, however, this problem is not critical, because they usually require a low voltage (lV) electrical connection, which is normally less saturated. Furthermore, in terms of the availability of suitable land, small wind installations pose fewer problems because of the reduced size of the required site.

Another advantage of small wind farms (or stand-alone installations) compared to larger ones relates to the length of time for the authorisation process; currently, large wind farms in Italy may experience a three- to four-year time lapse to receive the required authorisation, while small wind initiatives are subjected to much shorter delays. In the case of large wind farms, the Italian Law 387/

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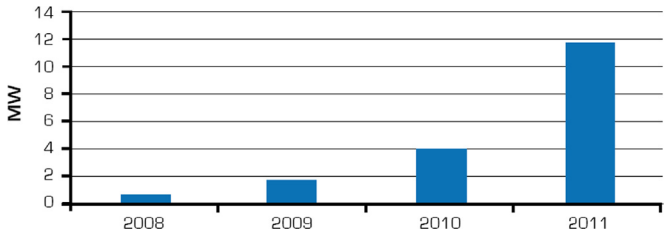

Fig. 1. Installed power for small wind in Italy (di Milano, 2012).

2003 requires the involvement of multiple parties, such as civilian and military agencies, the environmental protection agency, and other bodies (up to 35), all of whom must give their authorisation to the initiative. On the contrary, for small installations, this law is not applicable, with permission instead being granted directly by the municipal or provincial authorities.

As far as economic issues are concerned, it is important to note that income derived from wind energy production differs between small and large wind farms. The latter earns financial income from selling energy and 'green certificates', which have a variable and floating price depending on the market. The revenues of small wind initiatives, however, are determined using a feed-in-tariff (FIT) mechanism with fixed prices decided every three years by the Italian government; until 2015, the fixed price for selling energy to the grid is 0.268 €/kW h, almost twice the mean price per kW h obtained by large wind farms. This remuneration scheme for small wind energy production is similar to those applied in other European countries, and is usually operated through the FIT mechanism. Considering capital expenditure (Capex), large wind farms still have a considerable advantage in terms of the economy of scale. In fact, although turn-key unit prices are generally around 1500 €/kWp for machines over 1 MWp, they exceed 3000 €/kWp for machines under 200 kWp, so it is possible to recognise the typical behaviour of scale economies.

The abovementioned aspects lead us to understand that a business evaluation in this growing field is still complex. To obtain a reliable assessment of businesses and properly allocate financial risks, a coherent and full analysis of all of the characteristic parameters in the investment is needed. Nevertheless, it should be recognised that the growth of this energy sector offers investors new possibilities to develop the market and differentiate their business, also taking advantage of the lower capital needed to launch a business and the shorter times to start production (Rose, 2010).

The aim of this study is to present an outline of small wind power projects in Italy, examining especially the projects' effects in terms of time, cost and quality in the Italian context. This approach will hopefully prove useful to investors, project managers, and all stakeholders, helping them to understand the key variables of the different activities, the critical steps and activities normally faced, and the main financial and technical risks arising during the development stages, which was analysed by the authors in previous works (Fera et al., 2011).

This paper was a case study aiming to study a set of 29 installations and outline all critical issues faced during the initiative, such as permission grants, purchasing, construction, and commissioning, from a project management perspective that allows an understanding of the effects of national policies through the real cases. Our main purpose was to describe this case study in a beneficial fashion for investors, engineering, procurement, and construction (EPC) companies, and stakeholders who wish to enter this new field.

The aim of this paper is to identify the times and costs of installing small wind turbines to assist policy makers drafting texts in the energy sector. A survey was carried out to assess the main project variables of wind energy installations using the project management computational technique generally referred to the PMI framework.

The results revealed in this paper could be useful for any kind of wind turbine installation in southern Italy, since every project to install a machine – whether identical or not – will follow the same installation phases.

2. Material and methods

A careful analysis of the existant international literature was conducted to understand if the sector was the subject of other investigations or analysis. It was not possible, as made clear hereafter, to detect any remarkable publications in the specific field of small wind-related businesses. The literature review was conducted for projects executed in any part of the world as well as in Italy, but no particular elements were found to offer a basis for our survey.

A first contribution in this field was made by Nouni et al. (2007) who discussed wind energy production from small wind turbines in off-the-grid applications, that is, when energy is used by industrial plants or villages isolated from the distribution grids. In particular, the authors describe technical and economic issues related to the installation of 19 wind turbines in India. This type of project is rather different from those discussed in this paper, which are on-grid solutions. Moreover, the project discussed by Nouni et al. – energy supply for off-the-grid users – also requires a system configuration with storage technologies to allow energy supply to be stored in the case of non-production. Another example of small wind farms in isolated areas is given by Bechrakis et al. (2006). They studied the integration between wind and hydrolysis technologies to allow isolated households to live without a grid connection, while also taking into account economic and financial issues. On the contrary, the small wind turbines described in this paper are usually grid connected, with the energy produced being sold to the system.

Abderrazzaq (2004) evaluated the six-year performance of a small wind farm in Jordan. This work highlighted how this small wind farm was able to cover on average around 50% of demand for users from the area, with remarkable effects on the energy context.

Other studies in the literature focus on social issues related to small wind energy production. In particular, Dimitropoulos and Kontoleon (2009) report a study about the main factors considered by stakeholders in the evaluation of an initiative in small or large wind farms. A wind farm in the Aegean region was considered, but the main problem of this production plant was recognised to be the initiative's relationship to the territory and local people. This study confirms the success of small wind power generation, also due to the fact that investment initiatives often come directly from the territory.

Many other studies assessing the feasibility or convenience of investing in the wind energy sector in various countries are traced in the international literature in energy journals such as the contributions by Garrett Richards et al. (2012) or Phuangpornpitak and Tia (2011). Another source which attempts to design a context framework for renewable energy projects is found in a paper published by Kaygusuz (2010) about the status of wind energy in Turkey. Other contributions relating to the impact of policy on the feed-in-tariff systems were studied and analysed by Black et al. (2014). To date, no particular attention has been given to small wind energy applications.

In our appraisal, particular attention was paid to the fact that project management is a flexible and useful tool, applicable to many sectors as underlined by Nenni et al. (2014) or Lappe and Spang (2014). So, based on this assumption, i.e. the project management and its computational methods are widely applicable, a survey method based on these techniques will be used in this paper.

A key point observed in our literature review was the lack of reference to project management (PM) or other strategic issues in the development of small wind energy production projects. This absence urged us to define a framework able to represent a