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Wind energy and landscape in Molise – Legislation, Incentives and Problems

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Abstract. The research has the objective to investigate the wind power energy phenomenon into Molise region and to relate it with other national and European cases. Looking to the most recent legislation about renewable energy and landscape, the research want to give a project's approach to introduce new wind towers into regional landscape.

Key words

Renewable Energy, Legislation, Wind Power Energy, Landscape, Environment.

1. Introduction

In the last 15 years the energy production from renewable energy sources is becoming increasingly within the European Union. In less than 15 years, the generation of wind energy has become one of the main energy options and will continue to be in the coming years. The reports on climate change, the European decision to meet a fifth of its consumption with green energy by 2020 and the contemporary fibrillation in other countries (from the USA to China, from India to Australia) are, in fact, believe that the green energies will become one of the most important solutions to meet the new electricity demand in the world. The main source of green energy is produced by the installation that exploit the wind energy. Between the mayor characteristics of the wind energy farms is the minor environmental impact on CO2 emissions from use this type of energy. In fact it would seem that the wind farms already existing and those already being design in Europe could avoid 200 million tonnes of CO2 each year.

2. Wind energy production

By the report of EWEA (European Wind Energy Association) of 2009 Italy in 2008 was the third nation in Europe for the production of this type of energy. Our country, at the end of 2007, appear to have an installed power of 2,726 MW and at the end of 2008 have been added 1,010 for a total of 3,736 MW.

The total installed power in Europe in 2008 is 64,935 MW. As noted in Figure 1, the major producers of wind energy in Europe are Germany, with the 36.81%, and Spain which produces the 25.78% of the total wind energy. Italy is in third with a production of only 5.75%. In the same report is estimated that annual growth rate of the production of wind energy in Italy is the 37.1% and that in 2020 Italy will produce by 15,500 to 18,000 MW.

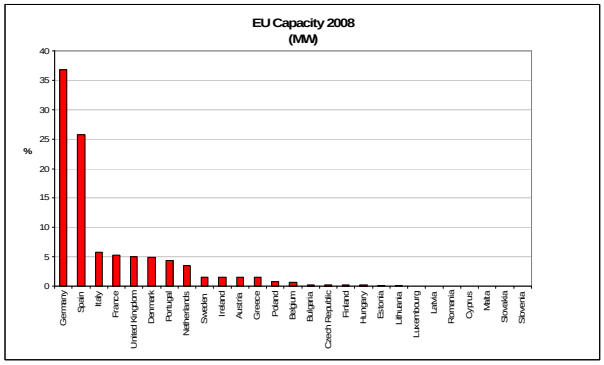

Fig. 1. Wind energy installed in Europe (Font: EWEA, 2009).

As regards the dates relating to 2009 was calculated that in Italy have been installed 1,100 MW and has come to a total of wind power efficient 4,850 MW. These data highlight the significant contribution of wind power to the Italian electrical system, with a growth rate of more than 30% on an annual basis, in accord to the achievement of Community. The dates of the 2009 are in accord to the European objectives, and consolidate the trend for 2008, allowing Italy the third country in Europe and the sixth in the world for wind energy production, despite of the regulation sector that not have been yet definitively completed. The continuous growth of the percentage of cover needs national energy by the wind power draws further subject institutionally responsible to the planning of development plans infrastructure and urgent action, which enable the first to solve the potential criticality that could generate a system that was not all avant-garde in the instruments of support to the

development of this technology to achieve the binding objectives given.

3. Wind energy regulations

At regulatory level enormous efforts have been made to give directions and guidelines for the implementation of wind farms. The first Italian laws date back to the early 90. The Italian law n. 10/91 considers use of wind energy of "public interest and public utilities and the works on are assimilated to works declared action and urgent for the purposes of application of the laws on public works".
In the last decade the Italian and European regulations went focusing on production of green energy. The EU Directive 2001/77/EC provided that the Member States were to identify their objectives of increasing the proportion of gross domestic consumption as to meet with the sources, with a progression for attaining the 2010 with indicative values assigned by the same directive to each State.
This European directive was transposed in Italy with D. Lgs. n. 387 of 29 December 2003 concerning the promotion of electricity from renewable energy sources in the internal market for electricity. With this Decree the State Government gave to Regions the power to adopt measures to promote and increase the consumption of electricity from renewable sources in their territories.
A further step in the Italian legislation for wind energy power pass for approval of guidelines proposed by MiBAC wind power in 2007.

4. Wind energy in Molise

In this national and European context there is the small region of Molise. With a territorial extension of 4,438 km^2 and a little more than 300.000 inhabitants is attested as one of the first Italian regions producing wind energy. In the top of the first 100 Italian municipalities that produce wind energy fifth place is for Rotello, one of Molise municipality. This small town that has little more than 1,300 inhabitants produces 90,00 MW. In the same top is known as 23 of the first 100 municipalities are of Molise for a total production of 287 MW, about 7% of the total of wind power generated in Italy in 2008 (Figure 2).

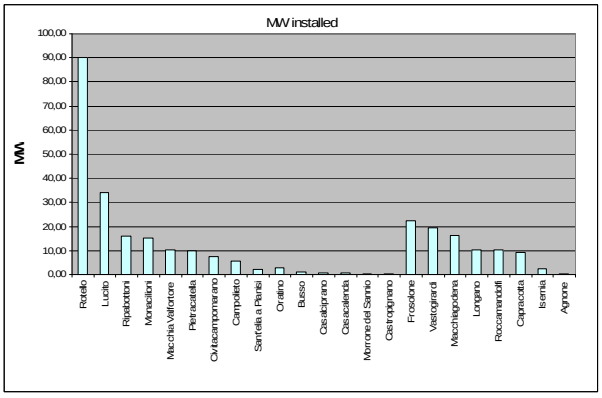

Fig. 2. Wind power installed in Molise municipalities (Font: Legambiente, 2008).

From the relationship GSE of 2008 is known as the relationship between the wind power installed and the number of inhabitants show values very low in northern Italy. The phenomenon is explained if one considers the high population density of the regions concerned and the limited presence of plants and of installed capacity. Speech opposite is true of the Molise region which has the values higher per capita (509.4 WATTS per inhabitant), essentially due to the low population density.
In Molise guidelines were introduced through the regional law no. 15/2008 that in some aspects appear contradictory and not appropriate for the needs of territorial region. The article 2, which identifies the areas not suitable for the installation of the wind farm meeting the directions of the European Union because explicitly prohibits the off-shore wind farms in favour of a high number of wind turbines within the regional territory. In addition, the guidelines do not express in any way the actions that will be necessary to the wind farms visual impact (Figure 3).
It's for this reason that the research on a sample area proposes directions to the design wind power installations.

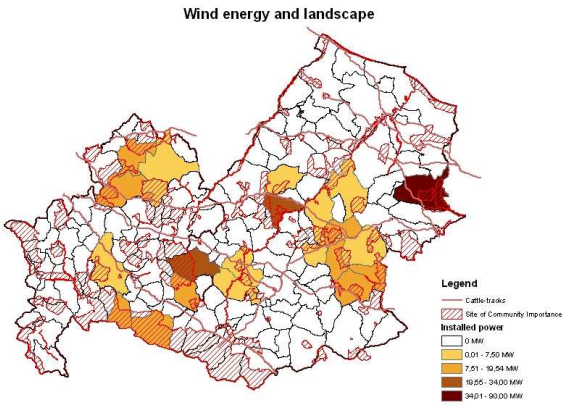

Fig. 3. Wind energy and landscape in Molise.

5. Wind energy and landscape

From 2000, year in which it has been ratified the European Landscape Convention, European countries are equipped with guidelines to mitigate the environmental and visual impacts of wind farms.
The guidelines and the rules of the different countries and, in Italy of the different regions, are very different between them. This is the result of a different interpretation of the landscape and "*the different aspects, cognitive and evaluative instruments that may be taken into account in the design of a wind power plants*".
Many countries in assessing the landscape impact of wind plants have taken into account not only the environmental effects (quality water, air, flora and fauna) but also the visual impact of wind turbines. In Italy the priority attention is instead on the environmental aspects even if in recent years some regions underline the landscape aspects. The visual impact is to affect not only on sensory perception, but also on the complex of values associated to the places and on social aspects of a framework landscape.

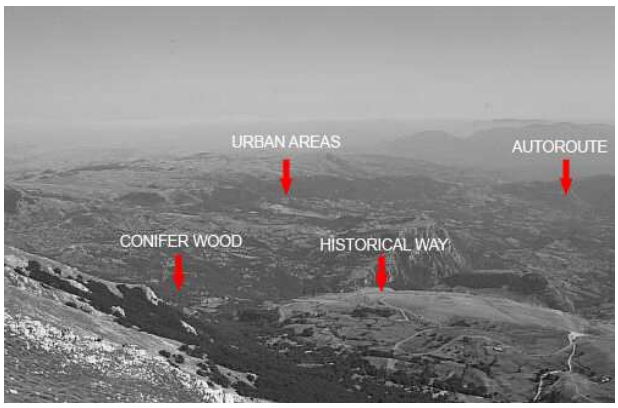

Fig. 4. Analysis of the landscape characteristics on its various natural and anthropogenic components.

The design of a system wind power becomes a design of the landscape. So that wind power plant becomes one of the characteristics of the landscape and shall establish a good relationship with the context.

A. The surveys

To make that we can achieve a correct contextualization of wind plants must necessarily to read the different aspects that composed a landscape and territorial context. However, the interdisciplinary approaches of the landscape it brings us to detect a high number of elements but not all are needed for the desired aim. Therefore the analysis to play, in agreement with the technical annex DPCM 12-12-2005 are:

- analysis of the levels of protection: relief through the landscape, urban and territorial Planning tools and through the legislation that protects elements or portions of the territory. Moreover it should be detected the presence of cultural heritage protected by the Code of cultural heritage and the landscape.
- analysis of the landscape characteristics on its various natural and anthropogenic components: are to be collected in addition to the geomorphology all anthropogenic features of the landscape. Among these is a duty include the presence of the historical systems (historical centres, historical buildings widespread), agrarian landscapes (cultural typical landscape, farms, etc.), weavings territorial historical (historical traffic regulation, roman centuries,…), scenic routes, presence of areas to strong symbolic significance (trails of worship) (Figure 4).
- analysis of historical development of the landscape: highlight the changes that the places have been suffered in the past. This study must be conducted for significant stages and should show the presence of urban areas and/or suburban historical infrastructure systems and their relationship. All this to identify the historical and symbolic values;
- analysis of the intervisibility of the wind farm on the landscape: this analysis should be made through photographic representation which highlights the landscape composition. Photos are to be made by significant points and always with a visual due to the optical human cone. Through the photomontages we can consider the accommodations of turbines in landscape context (Figure 5).

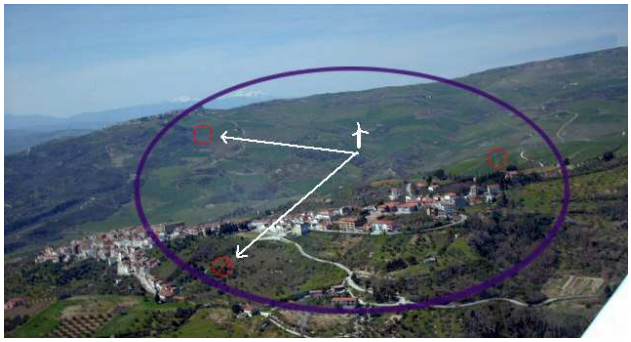

Fig. 5. Intervisibility analisys. The scheme underline the point in which is possible the see the wind farm (O) and ones in which isn't possible to see its.

These analysis must be carried out to different areas and scales depending on the type of analysis that it wants to play. The used scales, in agreement with the technical annex to DPCM 12-12-2005, are:

- wide scale area: is the scale at which the wind power plant becomes a visual element of the landscape. This is the scale to be analysed the potential places of installation considering the intervisibility between the various wind farms. At the same time must put light all natural and anthropogenic elements of particular importance that in some way strongly characterize the landscape. This scale allows to study the wind plant project in relation to its context. The scale of representation of the wide area usually corresponds to 1:100.000. However, given the small territorial size of the Molise Region, the scale of representation used was used a scale mid-term 1:50.000.
- intermediate scale area: allows us to analyse the characteristics of that part of the landscape in which it is located the wind farm project stating the landscape characters. The scale of the representation of this area can be, according to the cases, 1:50.000, 1:25.000 or 1:10.000. In our case study, the scale of representation are 1:10.000.
- detail scale area: is the one that is located near the turbines. This scale will study the provisions to the feet of turbines, but also the access system and technical rooms. This representation part on a scale of the representation of 1:5.000 and reaches at detail scale.

B. The design landscape of a wind energy farm

Assess the visual impact of a wind power farm means measuring variations in height, form and colour of the turbines, the lighting and weather conditions, the background and other features.

C. Structure of a wind power farm

The visual impact of a wind energy farm is for the most affected by turbines and by the works to support the plant, such as the cabins of processing, the access roads and the line for the connection to national transmission network. However, the more influence in visual impact is the structure of the installation. In the first place the choice of a plant in pole to the detriment of the ticking appears as one of the choices less impacting for landscape. Another one element is represented by the choice of the number of Poles rotor (all the guidelines of Great Britain in this field shall note as the rotors to three blades are more friendly to the human eye).

D. Location and position of the plant

The impact of a wind energy power is also measured by its location and in the position of the plant. It appears entirely wrong position lines of wind turbines on the top of ridges because change significantly the skyline of very broad areas. A minor impact appears the plant location on the ridges with a provision of the machines riding the ridges themselves. In this way the height is covered from the side of the relief. The compact arrangement, in not built-up areas, is preferred to a linear or scattered arrangement in the territory (Figure 8). In the built-up areas the location of new farms is preferable in areas where already exist infrastructure (industrial areas, highways, railways, etc.) because the number of present elements influence positively the visual impact of wind turbines. Location also take account of the presence of pre-existing wind farms studying the relationship between old and new turbines in relation to their shapes, sizes and colours. The location of a wind energy farm not be made near to strong naturalistic areas or historical-archaeological sites. As regards the number of turbines, in some cases it's important to reduce the crowding to have a reduction of the visual impacts. However a reduction of turbines number it could decrease the installed power, but if the reduction of the turbines number correspond with an increase of power of each one, can reach a fair compromise. Always, with reference to British guidelines, a smaller number of large machines has less impact of a large number of small turbines, which produce the so-called Wood effect. However the guidelines of various Italian regions put in evidence how the Wood effect is to be avoided. Finally, it brought out the minimum distance of two turbines because of the aerodynamics influence. In this case the Danish guidelines suggest *"to take a minimum distance between the turbines of 3-5 diameters on the same row and 5-7 diameters on parallel lines"*.

E. The colour of the turbine

One of the characteristics that may have positive repercussions on visual impact of wind power plant on the landscape is the turbine colour. Although the aeronautical rules fixed colours and therefore restrict the use of colours more keeping with the environmental peculiarities, you can find through trials a fair compromise. For example, you can colouring the turbines with a shade of colour that starts from the colour characterising the context up to reach the summit to a colouring consistent with the rules aviation (Figure 6).

Fig. 6. Colour effect. The shade of colour starting from the characteristic colour is a good example to integrate wind farm into landscape.

F. The social perception

In most cases, the construction of a new wind power plant generate in Molise and in the others Italian regions many polemics. However, this negative perception can change with some measures. In the first place the installation of a new farm gives birth to a number of occupations that is one of the first factors that can be change the social perception. However are some shrewdness in the design phase that may change totally the social perception. Place the turbines in strategic points and link through a series of routes from which it is possible to enjoy the landscape around can become a tourist resource exploited. From to highlight is also the curiosity that the ordinary people has against the wind energy farm (Figure 7).

Fig. 7. .Social perception. People come to visit new wind farm in Low Molise

G. Disposal/replacement of the plant

A wind power farm is not a permanent structure, but it has a life time that goes by the 20 to 30 years. After this period there are two possible options: the replacement of the turbines or its dismantling. At present the trend is to replace the turbines, but this replacement means some measures. At first have been evaluated the forms and

dimensions of turbines to install with the arrangements mentioned above, it must also assessed the simultaneous presence of any other turbines of different shape and size if not properly related with the new machines can create disorder landscape. The dismantling of the machines give rise to different problems linked, in particular, to the activities of support. In fact, the turbines once dismantled there are no more, it is, however difficult cancel routes and articles used for technical rooms. The prediction on what it of the places members to the installation must be provided necessarily in the design phase.

6. Conclusion

Molise is a region with an high energetic production compared with its territorial extension and with its inhabitants number. Molise wind farms are capable to satisfy the regional energetic requirement. But in front of Molise coast, in the middle of the Adriatic sea, exist a project to build a big off-shore installation. but the opposition of local administrations is delaying the start of works. A EWEA study said that the wind power energy come from off-shore installations can supply 10% of european electricity requirements. This is why many Northern European countries are making large offshore wind farms to adapt well to the production of green energy targets for 2020. Italy, however, continues the controversy for the realization of this type of wind farm. Molise also fall into this political tendency to oppose off-shore facilities. The regional guidelines, in fact, prohibit the construction of a facility off-shore grounds that the environmental and landscape impact. As result of all these controversies the project has not yet been realized and there is not even the certainty that sooner or later will be realized. Alternatively, however, has suggested the creation of a nuclear plant on the soil regardless of Molise rural character of the area, hazard and, most importantly, the environmental impact of this type of plant. The region, therefore leading to the production of green energy, would be to make huge steps backwards in a view of a sustainable energy production.

Fig.8. A different way to locate wind towers. The second image underline that a localization riding the ridges is better than a linear one on the top of the ridges.

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