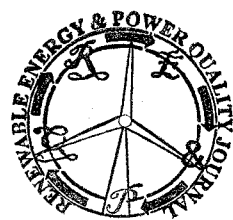


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## Wind potential evaluation in the Canary Islands using GIS

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### Abstract

The Canary Islands (Spain) are highly dependent on external energy sources. For 2015, the Canarian Energy Plan establishes that 30% of the electricity demand will be covered by renewable energy sources, mainly wind and solar (the goal for wind energy is 1025 MW). Therefore, it is crucial to determine the wind potential for each island as a first step for the energy planning. Within this work, a novel methodology based on GIS (Geographical Information System) for the determination of the wind potential is proposed. As a first step, the available land for wind exploitation per island is determined. For this purpose several territorial constraints are taken into account (natural reserves, inhabited areas, roads, etc.). Another type of constraint is the wind velocity (minimum wind speed for wind exploitation purposes). Once all these constraints have been applied, each island's map shows the available land for wind production. At this stage wind farms are located in these areas. Finally the wind energy production per wind farm is calculated. For this, the annual energy yield is calculated as a function of the Weibull distribution.

**Key words:** Wind, potential, GIS, Canary Islands

### 1. Motivation

The Canary Islands are highly dependent on external energy sources, 98% of the primary energy consumption is based on imported oil. Speaking about electricity, this percentage decreases to 91%. The Canary Islands had no conventional energy sources, but they have plenty of renewable resources, mainly wind and solar.

For the Canary Islands it is very important to increase the level of energy self-sufficiency. This can only be done through the deployment of renewable energy sources (RES). Renewable energies are autochthonous energy sources and they can contribute to reduce dependency from energy imports and to the diversification of energy

sources. In the same way, the development of RES can actively contribute to the creation of employment and to encourage regional development. All these facts gain special importance in a region like the Canary Islands.

The electrical power installed in the Canary Islands at the end of 2009 was 2832 MW, the renewable energies came up to 9,8% of the total installed power but in terms of production this percentage was 8,7%. The RES installed on the Canary Islands are mainly wind and solar photovoltaic, 142 MW and ca. 100 MW respectively.

For the year 2015, the Canarian Energy Plan establishes that 30% of the electricity demand will be covered by RES, mainly wind and solar. This plan establishes, for instance, that wind energy will reach 1025 MW, photovoltaic 160 MW and waves 50 MW.

These figures for RES implementation already confront the electrical grid operator with stability issues, among others challenges. Several strategies are under study aiming at reducing the peak load and/or increasing the base load in order to allow the increase of intermittent RES penetration into the electrical grids. The strategies under consideration are, among others, hydro storage systems (wind-hydro pumping stations).

Taking into account this context, it is crucial to determine the wind potential in each island as a first step for the energy planning. For this purpose a methodology based on GIS (Geographical Information Systems) has been used to determine accurately this potential. The evaluation of the wind potential using GIS allows the quantification of the potential wind –energy production and, at the same time, it allows also to locate where this production will take place. This is vital to determine the cost of the resource,