



Wind potential analysis of sea breeze in the Llobregat Delta area (Barcelona, Spain) using FAST and Aerodyn simulation tools

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Sea breeze is a thermal wind produced as a consequence of land-sea thermal difference. This is the most important wind regime for over 6 months in many coastal areas in the Mediterranean basin, like for instance the Llobregat Delta (15 km South of Barcelona city), where from mid March to mid September the sea breeze is the dominant wind.

An automatic weather station of the Meteorological Weather Service placed in this area, 5 km inland to the coastline in a flat terrain, has recorded the average wind velocity and direction hourly since 1993 at a height of 2 m. Based on these hourly data acquired throughout 19 years (1993-2011), a statistical analysis has been realized using the wind potential equation to compute the wind speed at several heights for the months with sea breeze (March to September). Wind speed series have been built based on the hourly data during the sea breeze hours (9 to 19 UTC, between March and September) averaged for the 19-years period from 1993 to 2011.

The obtained wind speed profile is used to determine the wind potential at different heights using FAST and AeroDyn, two coupled aeroelastic simulation tools developed by the National Renewable Energy Laboratory (NREL). For this purpose, the specifications of the IT-PE-100, a 100W wind turbine developed by Practical Solutions-Intermediate Technology Development Group (ITDG), are used. Particularly, hourly energy production series have been obtained for the studied period. The results show that sea breeze in the Llobregat Delta area is significant enough to enable installation of small wind turbines (around 10 m hub-height and 1.7 m rotor diameter) for electric energy supply. The energy production has large variations according the sea breeze behavior. April shows the maximum monthly average power (55 W). The hourly average power has been higher than 100 W in the 4 hours close to noon in many days of some sea breeze months. Several applications have been designed to use this energy production.