

Planning a Wind Farm in Oaxaca-Mexico

E. M. Khomartash¹, E. Klupsch², C.M. Gallardo³ L.A. Gonzales³

¹DTU Mechanical Engineering, Technical University of Denmark

²DTU Environmental Engineering, Technical University of Denmark

³DTU Wind Energy, Technical University of Denmark

INTRODUCTION

The Oaxaca region, located in the south-east of Mexico between the Mexican Gulf and Pacific Ocean, is well known due to its incredible strong winds, able to overturn more than 30 trucks every year. The idea to take advantage of this energy source is analyzed by designing a 200 MW onshore wind farm in this area.

WIND RESOURCE ANALYSIS

The main reason of this windy resource is the presence of a mesoscale phenomenon that is related with the natural corridor "Civela Pass" through the mountains in "Sierra Nevada" in the middle of the Atlantic and Pacific oceans, this especial geography leads the behavior of the "Trade winds" that come from the Atlantic to the Pacific, where they are constrained and speeded up, occasioning a quasi-unidirectional (70% of times came from the North/North-West) and bimodal Weibull distribution of the wind stream (mean wind speed of 11m/s).



Figure 1. Wind resource data

WIND FARM PLANNING METHODOLOGY

Referring to the existing wind resource data including: topographic, orographic and climate analysis information, all the inputs files for WAsP software were given in order to estimate the Annual Energy Production (AEP) and Sensitivity to some parameters like roughness and air density in two different wind farm layouts; however, besides the technical aspect, the local conditions such as: environmental impact, grid access, visual impact and noise production were considered.

RESULTS AND CONCLUSION

Finally, after analyzing the wind resource data and accomplishing all the technical and environmental restrictions for the best layout alternative, it was obtained a net AEP of 1193.8 GWh and a Net Present Value (NPV) of 92,639,550 EUR for a 20 years life time project. Additionally the payback period is only 9.33 years. In conclusion, the Oaxaca Wind Farm becomes very profitable due to its excellent wind resource; furthermore, by implementing this project 8,300,000 tons of CO₂ will not be emitted to the atmosphere, reducing global warming effect.