POWERING MEXICO

A wind farm suitability analysis

Introduction

Mexico has committed to unconditionally reduce “25% of its greenhouse gas emissions for the year 2030” after ratifying the Paris Agreement. According to the International Energy Agency, fossil fuels represented 90.4% of Mexico’s total primary energy supply in 2015, whereas renewable sources represented 8.3%. The transformation of the energy sector will be crucial to limit carbon dioxide emissions and meet the target set by the Mexican government.

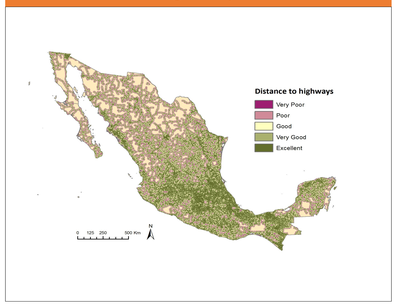
Mexico has set a target of increasing renewable energy in their energy mix. According to its legal framework, Mexico will set a minimum target of renewable energy in energy generation of 25% by 2018, 30% by 2021 and 35% by 2024. In 2013, renewable energy sources accounted for 3% of the energy mix in Mexico. According to the Ministry of Energy since 2012, wind energy power has increased annually by an average of 76.5% and it is estimated that the generation capacity from wind power will triple in the next years. In this context, the purpose of this project is to identify the most suitable areas to develop onshore wind farm projects in Mexico that could also benefit the densest populated areas.

Methodology

There were seven different parameters used to determine the most suitable locations for wind farms; zones with suitable wind speed, elevation, land cover, historic sites, road accessibility, wetlands, and population density. Each constraint was assigned a different weight based on the criteria used in the study “Berkshire County Wind Suitability Analysis: Berkshire County Massachusetts.” The constraints used in this analysis include wind speed, accessibility to roads and elevation, which were considered as first-grade factors and were assigned a weight of 0.5. Other factors include land cover, wetlands, and population second-grade factors which were given a weight of 0.25. Lastly, historic sites location, a third-grade factor given a 0.125 weight. The weights were used to determine the relevance of each factor and obtain a final map that considered all of these factors.

It is relevant to stress that each location faces different challenges. For the specific case of Mexico, there are other factors that should be considered to have a comprehensive analysis such as location of indigenous populations, archaeological sites, or power grid.

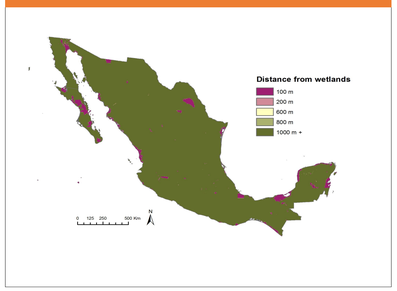
Highways



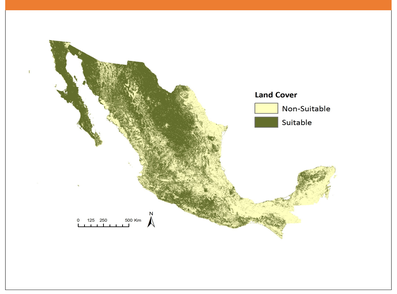
Population

Elevation

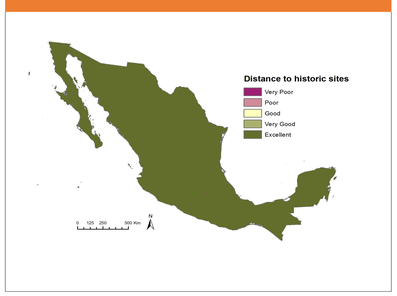
Wetlands



Land Cover

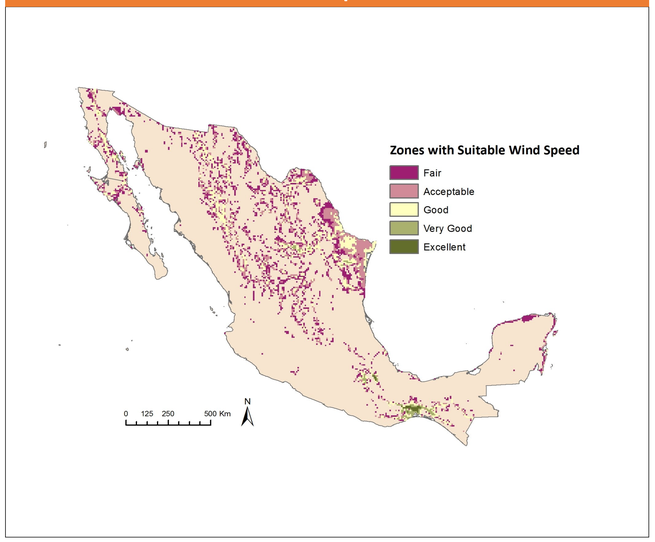


Historic Sites

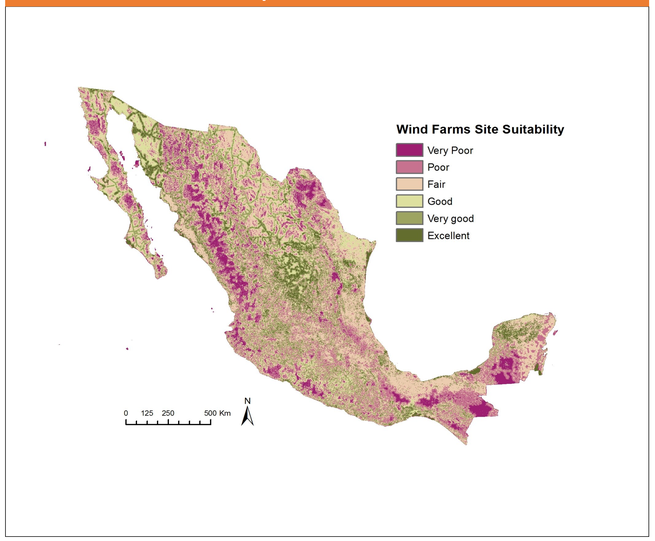


States	Municipalities	Population (Thousands}	Wind Speed Mean (m/s)	STD
Mexico	Coacalco de Berriozábal	278.06	9.21	2.41
Puebla	Santa Catarina Tlaltempan	874	8.35	2.61
Mexico City	Coyoacán	620.41	8.11	2.79
Puebla	San Martín Totoltepec	651	7.98	1.48
Puebla	San Juan Atzompa	872	7.85	2.71
Mexico City	Iztacalco	384.32	7.77	0.56
Hidalgo	Mineral de la Reforma	127.40	7.20	2.48
Mexico	Chimalhuacán	614.45	6.82	2.40
Puebla	La Magdalena Tlatlauquitepec	484	6.51	2.57
San Luis Potosí	Pinos	69.84	6.46	2.29
Mexico City	Benito Juárez	385.43	6.31	0.97
Mexico City	Azcapotzalco	414.71	6.30	0.54
Mexico City	Miguel Hidalgo	372.88	6.22	0.58

Wind Speed



Composite Results



Results

Due to their population density and wind speed conditions the area surroundings Puebla, Hidalgo and Mexico City are the most suitable locations for the installation of wind farms. Yet, these results seem counterintuitive for the urban nature of these locations. Building build farms here would require a change in land use.

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May 9. 2017

Projection: NAD 1983 Equidistant Conic
Data Source: INEGI,
Ministry of Energy Mexico