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# Geospatial Assessment of the Wind Energy for an Onshore Project in the Caribbean Region of Colombia

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**Abstract**

Colombia is setting a national renewable energy target providing a clear indication of the level of renewable energy development and the timeline envisioned by 2020 with almost the 7% of the energy production excluding large hydropower plants shall be generated from renewable energies.

In Colombia the wind potential is outstanding, the Northern Caribbean region of the country alone has almost 20.000 MW of capacity (Huertas L., 2007) but the real wind energy potential of all Colombia´s regions has to be defined, for this reason, this study is a useful start to generate research findings to uncover suitable sites for developing wind energy. This study provides a more precise and differentiated assessment for an onshore wind energy farm in the Northern Caribbean region of Colombia selecting study areas of three Colombian's departments (Atlantic, Magdalena and La Guajira).

Likewise, wind energy potential assessment integrates socio-political, environmental and techno-economic criterion in a geographic information system (GIS) combining with a multi criteria decision making (MCDM) with its analytical hierarchy process approach.

The purpose to find potential sites for build wind farms combining geographic information systems (GIS) and multi criteria decision making (MCDM) with the analytical hierarchy process (AHP) approach. Since onshore wind energy siting is inherently multifaceted, an approach capable of evaluating several criteria simultaneously must be used.

Geographic information system(GIS) have the ability to assimilate, analyse, and visualise multiple spatial data sets that pertain to the different factors used for site selection, but GIS is limited in its capacity to assign values to these factors. Thus, a multi-criteria decision-making (MCDM) must be generated since this approach has been shown to be an effective technique for assigning values to different criteria, and it is compatible with the functionality of GIS.

Generating three models, the restriction model, which will indicate the areas excluded to develop wind farms, the rated model performing an evaluation of the different criteria used to develop a wind farm.

The result of these models can be easily displayed on the web to provide free, quick access for those interested in onshore wind energy siting, and increasing access to this type of information has been shown to enhance public participation in the siting process,

Following the result of the suitability model, 3.1% of the total study area is characterized by very high suitability (value score 5), 37.73% by high suitability (value score 4), 2% medium suitability (value score 3), low suitability (value score 2), and the rest 55.24% is excluded area (value score 0). Based on these findings, there is sufficient space available for developing a wind farm in the north Caribbean region, especially in the selected study area.

This study can have an extraordinary impact on the public through the production of interactive web-based maps, promoting wind energy planners and renewable energies students to develop wind farms with different constraint and criteria.

*Keywords: Affordable and clean energy, climate action, onshore wind farm, wind potential, geographic information system (GIS), multiple criteria decisions, MCDM, analytical hierarchy process (AHP).*