

Global potential of solar and wind energy considering proximity to urban areas based on GIS tools

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This research introduces the proximity to urban areas as a new factor in the estimation of the resource availability of solar PV and onshore wind power at global scale. Distance from potential energy supply sites to closest urban areas is determined in order to characterize the proximity or remoteness of the technical energy potential of renewable resources. The introduction of large amounts of solar and wind resources in energy systems involve several challenges. One of them is to match the spatial variability of the resource with the location of energy demand centers. This aspect has been neglected or oversimplified in past studies. Taking advantage of geographic information system (GIS) data and GIS tools, it is possible to introduce explicitly the spatial variability of the resource into assessments of technical energy potential.

This research adopts a gridded approach to estimate distance along the closest path on a cell by cell basis with a spatial resolution of 0.5 arc-degrees (approximately 1 km² at the equator). This approach allows calculating output losses and additional costs derived from electricity transmission. These new factors are included in the elaboration of cost curves to evaluate the economic potential of renewable resources. Thus, it is possible to gain insight on the impact of electricity transmission on the feasibility of disperse renewable resources in a spatial explicit manner. The present methodology can be applied to estimate several new aspects, such as the impact of country borders as a constraint in the allocation of RE sites to urban areas. In order to provide complete image of spatial matching of RE potential, the spatial distribution of the energy demand will be characterized in future studies.

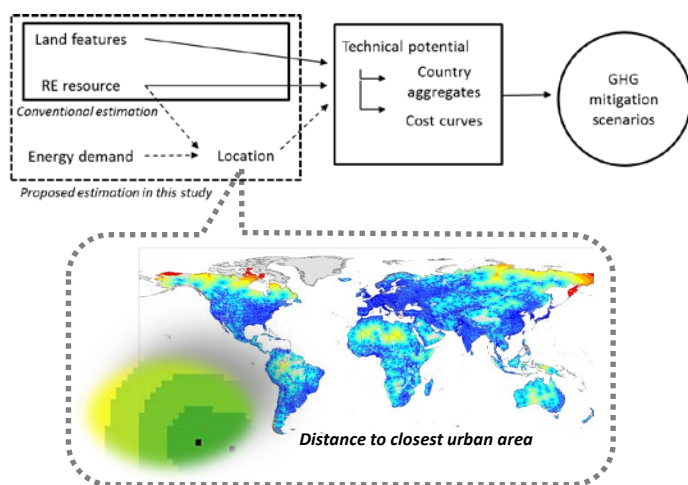


Figure 1 Approach for introducing urban proximity in estimation of global potential of renewable energy

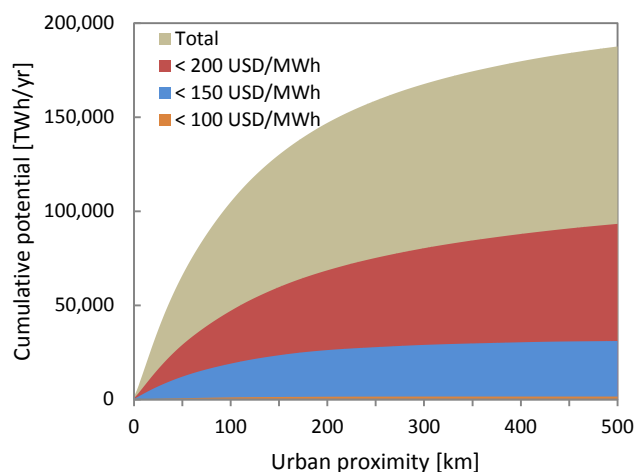


Figure 2 Proximity of global potential of onshore wind energy for different levels of economic feasibility.

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