Scientific summary:
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A GIS assessment on the feasibility of onshore solar and wind energy development in Hong Kong.

The government of Hong Kong has acknowledged the need to increase renewable energy contributions in its fuel mix, as outlined in its climate action plans (Hong Kong 2050) and development strategy (Hong Kong 2030+). However, the implementation of renewable energy projects in the region is constrained by complex topography and limited land availability. As Geographic Information Technologies (GIS) enable efficient spatial analysis of a region, the utilization of GIS can prove an effective solution to address these challenges, and a site suitability analysis leveraging this technology would identify optimal locations for renewable energy developments in the region. However, despite the widespread utilization of site suitability analysis' in numerous globally located wind and solar studies, its application has been notably absent within Hong Kong. This paper seeks to rectify this and presents the development, implementation, and results of a site suitability analysis aimed at identifying feasible rural solar and onshore wind energy sites in Hong Kong.

The development of a suitability model stands as a cornerstone of this study, enabling rapid and effective analysis of potential locations throughout Hong Kong. This tool was designed to allow users to incorporate various constraints on the suitability of sites and also calculate a 'suitability score' to enable sites to be ranked in order of attractiveness. In order to maintain consistency with existing standards, the model parameters applied for each constraint, were derived from benchmark values sourced from the Lamma Island Wind Turbine and Living Spring Renewable (Solar) Energy Station. Additionally, this study explored the degree to which the various criteria restrict the suitability of sites and consequently impede the progress of solar and wind energy development in Hong Kong.

The findings signify the potential to extend the existing utilization of rural onshore wind turbines and solar farms within Hong Kong. Notably, it is estimated that Hong Kong can accommodate an additional 117 wind turbines. However, when considering construction cost, logistical challenges, and the relatively limited contribution of these turbines to Hong Kong's wind energy goals, the perspective emerges that prioritizing offshore wind energy is a more effective approach. Conversely, suitable sites for rural solar farms were found to be extremely prevalent and hold the capacity to surpass Hong Kong's solar energy targets. Nevertheless, the considerable spatial requirement of solar installations and the necessity to consider Hong Kong's spatial and societal constraints suggests that alternative solar energy strategies, which possess greater spatial efficiency, might be preferable. In conclusion, this study identifies the potential of rural solar farms and onshore wind turbines to lie in their capacity to complement existing and future alternative energy sources and so foster a diversified and comprehensive energy portfolio for Hong Kong.

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