

ABSTRACT

The Indonesian government's efforts to achieve the national energy mix target of 23% from renewable energy by 2025 emphasise the important role of environmentally friendly energy development, one of which is wind. This study evaluates the wind energy potential in Padang City using an analytical approach combined with HOMER simulations. Reanalysis data from ERA-5 ECMWF satellite measurements were analyzed to assess wind characteristics, including wind speed, variability, and dominant directions. HOMER simulations focused on station 2 in the coastal area of Padang City, selected due to its higher wind speeds compared to station 1, with an annual average of 3.02 m/s and seasonal variations ranging from 1.38 m/s to 3.59 m/s. Seasonal analysis revealed that westerly winds dominate during MAM, JJA, and SON, shifting to easterly winds during DJF. Windrose diagrams, wind power density maps, and wind speed analyses served as essential references for determining input parameters for HOMER simulations. The simulations demonstrated that Padang City's southern coastal areas have promising potential for small- to medium-scale wind energy systems, with results showing an annual electricity production of 9,803 kWh/year using AWS HC 1.5 kW turbines and a capacity factor of 8.29%. This study provides actionable insights for renewable energy planning, highlighting the feasibility of wind power development in Padang City and contributing to Indonesia's renewable energy goals.

Keywords: *wind speed, wind direction, wind energy potential, HOMER simulation*