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Modeling of Ethiopian Wind Power Production Using ERA5 Reanalysis Data

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Abstract :

Ethiopia has huge wind energy potential. In order to be able to simulate the power system operation, hourly time series of wind power is needed. These can be obtained from ERA5 data but first a realistic model is needed. Therefore, in this paper ERA5 reanalysis data were used to model wind power production at two topographically different and distant regions of Ethiopian wind farms: Adama II and Ashegoda. Wind speed was extracted from the ERA5 nearest grid point, bi-linearly interpolated to farms location and statistically downscaled to increase its resolution at the site. Finally, the speed is extrapolated to hub-height of turbine and converted to power through farm specific power curve to compare with actual data for validation. The results from the model and historical data of wind farms are compared using performance error metrics like hourly mean absolute error (MAE) and hourly root mean square error (RMSE). When comparing with data from Ethiopian Electric Power (EEP), we found hourly MAE and RMSE of 2.5% and 4.54% for AdamaII and 2.32% and 5.29% for Ashegoda wind farms respectively, demonstrating a good correlation between the measured and our simulation model result. Thus, this model can be extended to other parts of the country to forecast future wind power production, as well as to indicate simulation of wind power production potential for planning and policy applications using ERA5 reanalysis data. To the best of our knowledge, such modeling of wind power production using reanalysis data has not yet been tried and no researcher has validated generation output against measurement in the country.

Biography:

Kena Likassa Nefabas is an electrical power engineer by profession and works as a PhD student at Addis Ababa University Ethiopia and Royal institute of Technology Sweden.He has worked as lecturer at Adama Science and Technology University Ethiopia for more than 5 years. Now, Kena is doing his PhD degree on the area of balancing and grid integration study of wind power in the case of Ethiopian power system.

Note: - This work is partly presented at Webinar on Renewable Energy and Resources on April 30, 2021.