Development and test of a method for estimating the long-term energy production
of operating wind turbines

Graduate

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Introduction: This bachelor thesis aims to improve the estimation of long-term energy production in wind farms, which directly affects project profitability. It focuses on exploring existing methods and utilizing the OpenOA tool from NREL. The objectives are to conduct a comprehensive literature review, gain proficiency in OpenOA, and to develop robust code for wind farm operation calculations.

Result: The findings of this thesis encompass the following results for the Penmanshiel wind farm:

- Power curves of the turbines presented in graphical form.
- Distribution of energy production at the target site (Penmanshiel wind farm - Turbine Nº5), considering various wind speed step sizes.
- Calculation of Annual Energy Production (AEP) using different methodologies.
- Determination of P50, representing the expected energy production.
-Utilization of linear regression to estimate wind speeds at the target site.
-Corrections made to the wind speed measurements' height.

The AEP calculation involves the application of the following methods:

- Utilizing a Weibull distribution, which represents the frequency distribution of measured wind speeds.
- Leveraging SCADA data and the power curve of the wind turbine.

Conclusion: This thesis developed a method for estimating long-term energy production in operating wind turbines. By leveraging existing methods, utilizing the OpenOA tool, and developing robust code, the research enhanced the long-term gross energy production tool. Rigorous testing validated its accuracy and reliability. The findings contribute to wind energy project success by enabling informed decision-making, optimizing resources, and improving performance.
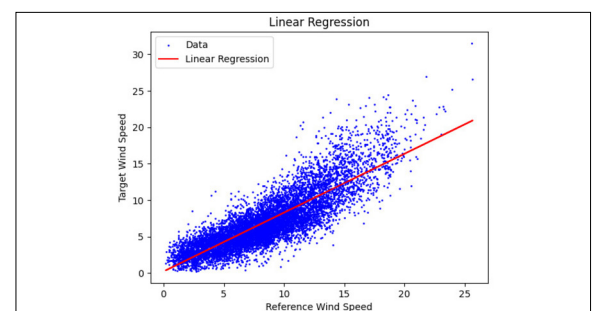
Energy distribution (Penmanshiel wind farm - Turbine nº5 2018)
Own presentment
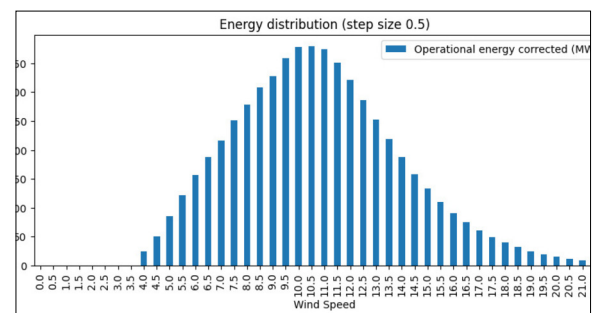
Wind speed map - Data ERA5 (Penmanshiel wind farm)
Own presentment
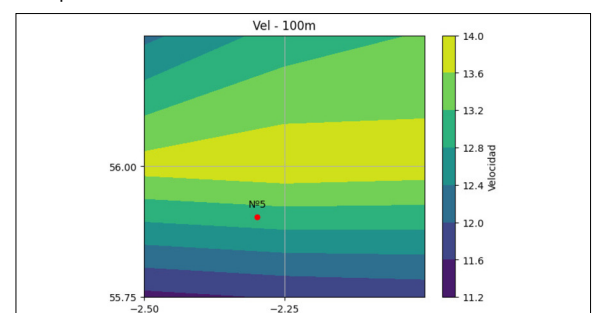
Linear regression for the estimation of long-term wind speed in turbine nº5 location
Own presentment

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Subject Area
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