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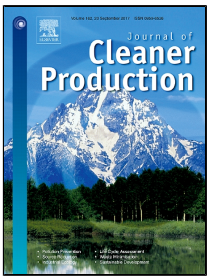

Energy Return on Energy and Carbon Investment of Wind Energy Farms: A Case Study of New Zealand

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Energy Return on Energy and Carbon Investment of Wind Energy Farms: A Case Study of New Zealand

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Abstract

This paper analyses the Energy Return on Energy Invested (EROI) and Energy Return on Carbon Emissions (EROC) of current wind energy farms in New Zealand. The weighted average EROI for a New Zealand wind energy farm over a 20 year life span is 34.3, with the highest achieving 57.7, while the lowest is 6.5. These values are higher than wind energy farms in Europe and America, which average about 20, and higher than many other electricity generation methods reported in the literature with hydropower being the main exception. The above-average capacity factor of New Zealand wind energy farms is the primary reason for the higher EROI values. The average EROC value for New Zealand's existing wind energy farms is 477 GJ/t CO_2-e, which is 56 times the EROC of a combined cycle natural gas power station. The substantial range of EROI values are chiefly driven by two factors: (1) wind speed profile for a given site and (2) the blade diameter of the turbine, where greater values are better. The main drawback of wind energy is variability causing reliability issues and needing hydro power as a renewable buffer to keep emissions low.

Keywords

Wind energy, energy ratio analysis, Energy Return on Investment, Life Cycle Analysis, energy planning, carbon footprint.