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TECHNO-ECONOMIC FEASIBILITY STUDY OF A SOLAR-WIND HYBRID ENERGY SYSTEM USING HOMER PRO: A CASE STUDY FROM TURKEY

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Abstract

Growing instability in global energy markets has intensified the need for reliable, efficient, and sustainable electricity solutions. Renewable energy sources—particularly solar and wind—have emerged as key alternatives, offering environmental and economic benefits while ensuring local availability. Universities play a critical role due to their continuous and high energy demands. However, despite their considerable energy use, many university campuses still rely entirely on conventional energy sources, often lacking comprehensive renewable energy integration strategies. Integrating hybrid systems into such settings can significantly reduce operating costs and environmental impact.

This study aims to assess the techno-economic feasibility assessment of a solar-wind hybrid energy system designed for the Environmental Engineering Department building at Bursa Uludağ University, Turkey. Using HOMER Pro software, both off-grid and grid-connected configurations were modeled and analyzed. The grid-connected system was found to be the most economically viable, yielding a net present cost of $37,310.56, an electricity unit cost of $0.006, and an operating cost of -$12,960.55. The system's payback periods were calculated as 5.71 years (simple) and 7.16 years (discounted). These findings underscore the viability of hybrid renewable systems in promoting institutional energy autonomy and cost savings.

Key words: HOMER Pro, hybrid renewable energy system, techno-economic analysis, university building

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