THE IMPACT OF CLIMATE CHANGE ON WIND ENERGY GENERATION OF "THAMBAPAWANI" WIND POWER PLANT

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Abstract

The Sri Lankan northwestern coast has been identified as having significant wind power potential. Higher electricity generation from wind has been influenced by favorable terrain and geographic location. The government of Sri Lanka is currently encouraging the creation of wind power throughout the nation. The goal of this research is to determine how climate change would affect wind power generation in the Thambapawani wind power facility. Climate change affects wind resource variations. The Coordinated Regional Climate Downscaling Experiment and General Circulation Models (GCM) model can predict wind speed variation trends in the region due to climate change. In this study, wind data were collected in Mannar and predicted wind data based on Cordex and GCM forecasting baseline. The generalized wind climates in the future years for the region were developed considering ground roughness, topography, and elevation details in the area and assumed to remain these conditions unchanged in the predicted period of the study. Commercial wind turbines erected were micro-sited by applying a generalized wind atlas to specific wind turbine areas with the influence of ground roughness and topology in order to assess the cost to be utilized of wind electricity production in Mannar. By taking into account the features of wind turbines and the anticipated wind capacity of the areas, WAsP was utilized to forecast the production of wind power. Reso, a Danish company, created the software application WAsP to assess the wind energy production of wind farms for micro-sitting. For a specific wind farm architecture, the wake effect is computed in the micro-sitting. This study assesses the utilization of wind electricity production and the impact of climate change on wind yield in Mannar for the next 22 years, taking into account the economically feasible cost of wind electricity production.

Keywords— wind potential; cost of wind electricity production: climate change; Commercial wind Turbines: Cordex; General Circulation Models (GCM)

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GHG	Green House Gases
CORDEX	Coordinated Regional Downscaling Experiment
RCP	Representative Concentration Pathway
CEB	Ceylon Electricity Board
WAsP	Wind Atlas Analysis and Application Program
CFD	Computational Fluid Dynamics
IBZ	Built-in linear flow model
ADB	Asian Development Bank
WCRP	World Climate Research Program
RCD	Regional Climate Downscaling
GCM	Global Climate Model
CCCR	Center for Climate Change Research
AEP	Annual Energy Production
LCOE	Levelized Cost of Energy
CGCM	Canadian Global Climate Models