

## Impact of Wind Energy on Cost and Balancing Reserves

**Authors :** Anil Khanal, Ali Osareh, Gary Lebby

**Abstract :** Wind energy offers a significant advantage such as no fuel costs and no emissions from generation. However, wind energy sources are variable and non-dispatchable. The utility grid is able to accommodate the variability of wind in smaller proportion along with the daily load. However, at high penetration levels, the variability can severely impact the utility reserve requirements and the cost associated with it. In this paper, the impact of wind energy is evaluated in detail in formulating the total utility cost. The objective is to minimize the overall cost of generation while ensuring the proper management of the load. Overall cost includes the curtailment cost, reserve cost and the reliability cost as well as any other penalty imposed by the regulatory authority. Different levels of wind penetrations are explored and the cost impacts are evaluated. As the penetration level increases significantly, the reliability becomes a critical question to be answered. Here, we increase the penetration from the wind yet keep the reliability factor within the acceptable limit provided by NERC. This paper uses an economic dispatch (ED) model to incorporate wind generation into the power grid. Power system costs are analyzed at various wind penetration levels using Linear Programming. The goal of this study shows how the increases in wind generation will affect power system economics.

**Keywords :** wind power generation, wind power penetration, cost analysis, economic dispatch (ED) model

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