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Reliability implications of diversifying wind power resources

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Fossil fuel is presently the major source for electricity production and is believed to be a major contributor to greenhouse gas emissions. Enormous effort has therefore been put on the development and application of green energy sources. Wind is a promising alternative, which has the potential to be a major power source in future power systems. Huge investments are being made in this sector, which has led to considerable advancement in wind power technology. It is expected that wind power installations will grow substantially to produce clean energy in electric power systems. Wind penetration, which is defined as the ratio of the installed wind capacity to the total installed capacity of a power system is currently about 5% in the Saskatchewan province of Canada. It is expected to increase to over 20% by the next decade. This trend is seen in many jurisdictions around the world. The characteristics of wind power generation is significantly different from that of other conventional generating plants which dictates a need for wind models and techniques appropriately responsive to these characteristics. An increasing number of wind farms located at different sites with varying geographical terrains are being connected to power systems as the wind power penetration continues to grow. The diversity in the wind speed at the various sites can have significant influence on the variability of the overall system generation. This in turn affects system performance and reliability. The wind generation models required for system reliability assessment should therefore appropriately represent the diversity in wind generation profiles. This becomes more important especially at high penetration levels expected in the near future. Time-synchronized data from all the wind farms are generally required to incorporate this correlation in the analysis and hence to accurately model the combined wind generation characteristics. This paper uses an analytical technique to create wind generation models of diverse wind farms and quantifies the reliability benefit to the power system in terms of wind capacity credit and the increase in peak load carrying capability of a wind-integrated power system.

Biography

Rajesh Karki (S'98–M'00–SM'04) received his BE degree from the National Institute of Technology, Durgapur, India and an MSc and PhD degrees from the University of Saskatchewan, Saskatoon, SK, Canada. Currently, he is an Associate Professor in the Department of Electrical and Computer Engineering, University of Saskatchewan. He was a Lecturer for Tribhuvan University, Nepal. He was also an Electrical Engineer with Nepal Hydro & Electric, Udayapur Cement Industries, Nepal Tele- communications Corporation and General Electric Canada, Peterborough, ON.

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