# Mechanical Engineering Master's Defense

## Correlation Study for Energy Content ahead of Wind Farm to Predict Wind Power using Doppler LiDAR Measurements

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## abstract

With a ground-based Doppler lidar on the Northwest side of a wind farm in the Tehachapi Pass of California, measurements were collected for repeating sector sweeps to the Northwest, measuring up to 10 kilometers away. The measurement region covered complex terrain, scanning over a valley amid mountains.

The method being explored uses real-time measurements of wind velocity made upstream of the wind farm and models the power output of a turbine in the wind farm as though it were located upstream. This determines the energy content in the wind. A time shift and a linear fit are applied based on correlation studies of the relationship between historical measurements made at the upstream location and near the actual wind farm. In practice, this method can inform operators of the power available in the oncoming wind.

Validity of the techniques applied are discussed to provide a framework for additional work developing wind power predictions with lidar measurements. The Magnitude Absolute Error and Standard Deviation are presented for the predictions based on each selected upstream location.

November 07, 2014; 11:30 AM; ERC 490