

Large Area Wind Measurements Using Mobile 3D Scanning LIDAR System

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Wakes Have Adverse Impact in Wind Farms

- Wind turbines are installed in wind farms
 - Limited exploitable areas (environmental, legal and safety) onshore + offshore
 - Onshore: reduction of land leasing costs
 - Offshore: reduction of infrastructure costs
- Low-speed, high-turbulence wakes downstream of wind turbines have negative effects:
 - 20% reduction in output power
 - 80% increase in fatigue loads



Objectives

- Demonstrate measurements of three dimensional wind speed in utility-scale wind farms using LEC's mobile-based LIDAR

Conclusion

- Mobile-based LIDAR system developed to measure wind field in utility scale wind farms
- 3D wind vector calculated from line-of-sight wind speed measurements
 - Measurements validated with met mast, SODAR and drone
- Measurements show
 - 20% decrease in wind speed in near wake ($x/D < 2.5D$)
 - Measured upward migration of wake with up to 50° pitch angles
 - 80% less power generation at downstream turbine due to wake of upstream turbine