**Improving wind farm and wind turbine performance with the LiDAR nacelle**

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**LiDAR technology installed in the nacelle of a wind turbine measures turbine wind speed. The advantage? A higher yield and reduced wear and tear. Together with TU Delft, XEMC Darwind and Avent Lidar Technology, ECN conducts research into the application of LiDAR technology.**

LiDAR stands for *light detection and ranging*. It is a laser technology for remote wind speed measurements. “We already knew that LiDAR had great potential. The technology was quite unstable at first, but we find that it has really come of age”, says Jan Willem Wagenaar, researcher at ECN. “It is also affordable and can be installed quickly. Today, a mast with a cup anemometer is still installed next to the turbine to monitor performance according to international guidelines. Such a mast is expensive, especially offshore, and a licence is also required. This is not the case with LiDAR.”

**Quick and affordable**LiDAR technology is used, among other things, to measure and validate the performance of the turbine. The device emits laser beams and measures the wind speed based on the change in frequency of the light reflected back from particles in the air. Jan Willem: “It looks like a pair of binoculars placed on top of the turbine. Two laser bundles scan 80 to 400 metres directly ahead from the top of the nacelle, behind the rotor. The bundles diverge, so that both wind speed and wind direction can be determined.” The set-up can be done very quickly. After the device is placed on the turbine, you can start measuring to determine, say, the ideal alignment.

**Proactive adjustments**The fact that the LiDAR can measure the wind speed in front of the turbine is a great bonus, according to Jan Willem. “Better knowledge of the wind eventually leads to a reduction in the Cost of Energy. By proactively adjusting the settings of the turbines and possibly even wind farms to reflect wind changes, we can increase their yield and reduce wear and tear. Correcting a tilt of 10 degrees already produces an additional yield of 3 percent.” In addition to the measurements taken directly ahead, measurements are also being performed with a LiDAR facing backwards. “Among other things, this allows us to determine the extent to which one turbine is affected by the wind generated by the other as a result of, for example, turbulence. The LiDAR shows the extent of this wind effect.”

**More information?**The LAWINE project demonstrates how LiDAR technology is applied to reduce wind energy costs. Would you like to know more or maybe perform a LiDAR measurement? ECN will gladly help you. Please contact Jan Willem Wagenaar for more information.