VAISALA / SUCCESS STORY

WEATHER ENERGY

Wind Resource Assessment North of the Arctic Circle

Finnish wind power company Puhuri develops and operates wind parks in the far northern reaches of Finland. Using Triton is the only workable way to gather hub height wind data, which allows the company to reduce uncertainty in annual energy projections and improve margins in project development.

Measuring wind to assess potential energy production is not a trivial undertaking anywhere, but the northern reaches of Finland pose special challenges. Harsh winter weather complicates the installation of measurement masts and can damage mechanical sensors. Off-grid locations, freezing temperatures which routinely reach –40°C, and low solar availability during the polar night make it difficult and expensive to keep instruments functional and powered-up.

Finnish company Puhuri Oy is overcoming these challenges by using the Vaisala Triton® Wind Profiler as an essential part of its wind development process. Triton is a ground-based remote sensing system that measures wind at hub heights without the lengthy permitting requirements, construction processes, or power and maintenance issues posed by other systems.

Puhuri Oy is a developer, builder, and operator of wind parks in Finland. Owned jointly by several Finnish utilities, the company's goal is to fight climate change by producing eco-friendly electricity. The company uses Triton for wind measurement because it provides accurate hub-height data and worry-free operation in extreme northern latitudes.

Challenge

- To reduce uncertainty in annual energy projections, Puhuri needs to conduct multiple wind measurement campaigns.
- Aviation permitting requirements and need for infrastructure mean that using measurement masts is difficult, time-consuming, and costly. Once installed, measurement masts cannot be easily moved.
- Cold weather and harsh winter conditions create technical challenges for measuring wind, including icing events that may interrupt data collection or cause mechanical failures in instruments.
- Remote, off-grid locations and low solar availability during the winter make it difficult to keep instruments powered-up.
- The Arctic climate pushes weather measurement equipment to its limits; winter equipment failures can cause unexpected high costs and long periods of data interruption.

Solution

- Use Vaisala Triton to measure wind on sites for periods of time ranging from 6 months up to 14 months before committing to measurement mast installation, then rely on Triton mobility for increased spatial coverage.
- Use Triton in extreme cold climates without worrying about maintenance; Triton's rugged construction stands up to harsh winter weather, and daily, proactive monitoring and easy field service allow speedy resolution of problems.
- Low power requirements, on-board solar panels and the optional methanol-powered external power unit allow Puhuri to use Triton in remote locations with rare visits to refuel.
- SkyServe's online web-based dashboard, daily monitoring, field service, and optional technical training for in-house staff allow Puhuri to keep their Tritons operational at a fixed cost with minimal interruptions.

Benefits

- Accurate hub-height data enables Puhuri to make decisions about further development on new sites.
- Convenient installation eliminates costly delays in site measurement process.
- Prospective wind sites can be investigated with lower investment and less financial risk.
- Worry-free maintenance.

"Using Triton helps us stay profitable even though we are working in some of the world's most challenging weather conditions. Triton works better than any of the alternatives. It's much easier to use, more compact, and requires less maintenance. It's so light you can tow it with a normal passenger car. Triton's power consumption is so low that we can easily keep it running for three or four months in extreme northern latitudes with solar power and methanol cartridges. Best of all, it's accurate – when we checked it against a nearby met mast, the measurements correlated very well. Triton has become an essential part of our standard site development practice."

Teppo Hilakivi
Technical Expert, Puhuri

Remote Locations, Cold Climate, Snow

Puhuri manages 60 megawatts of wind power in Finland and is developing additional projects worth several hundred megawatts. Many projects are in extreme northern areas, including locations inside the Arctic Circle. One planned project is in the same latitude as Rovaniemi, billed as the 'official hometown of Santa Claus.'

Teppo Hilakivi, Technical Expert at Puhuri, conducts wind measurements, data analysis, availability calculations, engineering, and other technical tasks for Puhuri's wind development and operations activities. "We have been doing wind measurement for a long time with measurement masts, using a standardized method. But we needed a system to provide us accurate measurements at hub height. Currently, one of the wind turbines we are using has a hub height around 140 meters. Turbine manufacturers seem to be planning to go even higher in the future, so we need to be prepared for that with good measurements."

Met masts are still an essential part of project financing, but they are more time-consuming and costly to install, especially in remote locations. "To install a measurement mast, first you have to get aviation permits, then you can apply for a building permit. You have to build a road, make a foundation, and get cabling for the power if that's available; otherwise you have to use batteries or solar panels. So it's quite a time- and money-consuming task," says Hilakivi.

The Arctic winter poses additional expensive challenges for measurement with masts. "Of course we use heated measurement devices, but even they can freeze in winter conditions. If the data quality goes bad, what can you do when you have a 120 meter measurement mast – wait for the ice to go away?" says Hilakivi. "With the hub heights we're using in Finland, we saw the advantage of remote sensing systems."

Remote Sensing Systems – Key Considerations

Puhuri chose to use remote sensing systems because "we needed some wind assessments and measurements before going further. You don't want to build a mast straight away and then after six months realize that you have to take it down because the site is not worth developing further."

Puhuri already owned one SoDAR, but Hilakivi was somewhat dissatisfied with the system's performanace. A large trailer system and burdensome power requirements made it challenging to use. "We were looking for a system that was easier to keep up and running," says Hilakivi. "The old SoDAR we had needs to be deployed on a big, heavy trailer. It weighs around 1,300 kilograms. The electric consumption is maybe ten times that of the Triton, so you have to carry at least 200 liters of diesel for refueling during the winter."

The company also considered LiDARs, but decided against using them because of concerns about power consumption, installation and refueling requirements, and maintenance. Hilakivi says: "During the wintertime, I would not trust a LiDAR to provide quality data during heavy snow or icing events. The lasers are behind a windshield which is kept clean with a mechanical windshield wiper. Everyone who drives a car during the winter in Finland knows that these wipers freeze no matter how much alcohol you spray on them."

Puhuri first chose to try Triton primarily because of its convenience and low power consumption. "Triton is much better than any of the alternatives," says Hilakivi. "It's much more maintenance-free, much easier, and it's a more compact unit. We bolt it on a simple, lightweight trailer and it's so light you can tow it with a normal passenger car."

Triton Applications

The Puhuri team finds it cost-effective to use the Triton, instead of a measurement mast, to measure new sites they are considering. Hilakivi says: "When we've measured the wind at the site with the Triton for a few months, we can make the decision whether or not to build a wind park there. Then we will build a measurement mast. The mast will stay there for the wind park's lifetime – 20 to 25 years. We can measure simultaneously with the Triton and the mast for some time, and then we will move Triton to our next site."

"More than once, we were able to quickly rule out a proposed location for a wind turbine and quickly and easily move the Triton to a more promising site. This simply would not have been possible with a mast," says Hilakivi.

Triton Accuracy

Part of Puhuri's standard measurement practice involves correlating Triton measurements to mast data before deploying to other project locations. "When we checked our Triton against a nearby mast it was very accurate," says Hilakivi. "In addition to our development uses, we see good potential for using Triton to measure wind shear on working wind farms in order to analyze turbine behavior."

Triton Performance

Puhuri installed Tritons on two different sites and used them during the winter of 2015–2016. Hilakivi says they were extremely satisfied with the performance of Triton. "The auxiliary power system is very compact. The Triton itself uses so little electricity that you can easily leave it for three or four months in severe cold – or even longer, depending on how much sun you have. I was surprised by how long the fuel cartridges last," Hilakivi commented at the time. However, in early 2016, Puhuri's Tritons experienced outages because the external power supplies froze after long exposure to temperatures below –40°C.

Hilakivi says, "This was very discouraging to us. But we worked with Vaisala to solve the problem." Vaisala's product team worked to deliver a firmware solution, so that now Hilakivi can monitor the fuel levels of the external power supply simply by looking at SkyServe, Triton's secure online dashboard. Daily monitoring by Vaisala's technical support team provided Puhuri the additional security they needed.

"In the winter of 2016–2017, our Tritons have worked extremely well," says Hilakivi. In one incident, the exhaust fan of the external power supply became clogged with ice. Vaisala's technical support team noticed right away that the external power supply had failed, and alerted Hilakivi to the problem. "We were able to make the necessary adjustment within 24 hours, with no data loss," said Hilakivi.

SkyServe

The final aspect of Triton performance is the service provided by Vaisala's team through the SkyServe service agreement. "When we took delivery of our first Triton, the Vaisala guys conducted a small training session with us, showing us how to install the Triton. Now we are able to install it ourselves. We decided to take technical training so that we could maintain the equipment ourselves and control costs. If something breaks, Vaisala lets us know immediately, and we can fix it. The SkyServe yearly amount is a fixed cost, and you get all the spare parts and technical support you need. You have no worries about it."

"The Only Practical Way..."

"We build and operate wind parks in some of the world's most challenging weather conditions," Hilakivi adds. "Vaisala's Triton is the only practical way to reduce the uncertainty in our annual energy projections, allowing us to improve the profitability of our development process."

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