

# HOLISTIC PERFORMANCE MONITORING OF WIND FARMS – THE iSPIN GUARDIAN APPROACH

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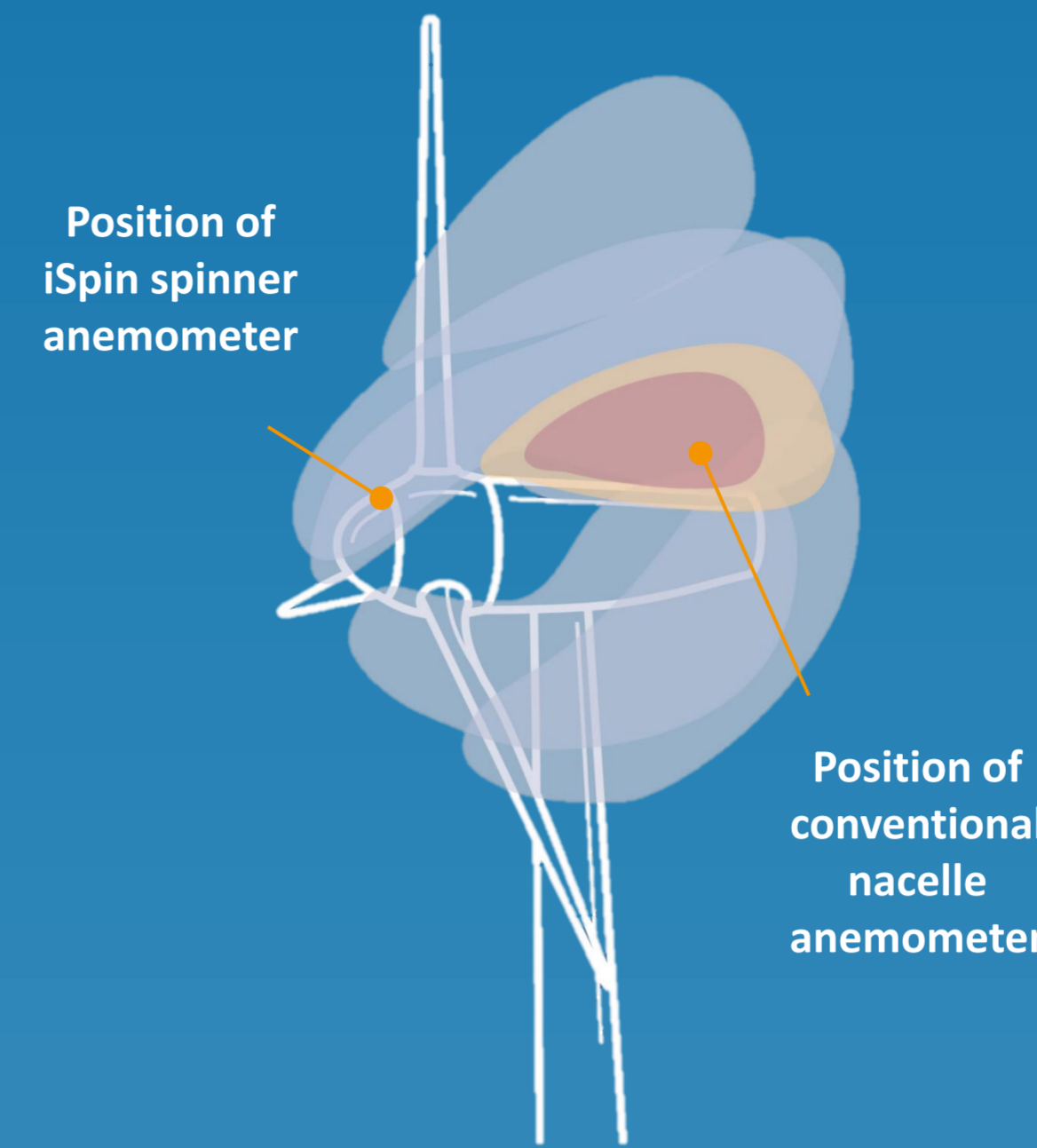
## Summary

Due to the unique position and the measurement principle the iSpin spinner anemometer technology allows to overcome the limitations of the conventional nacelle anemometry when it comes to power performance evaluation of wind turbines. Several field test results show that with the iSpin technology it is possible to assess and compare performance behavior of wind park turbines – even when all wind directions are considered. Transferring this to all wind farm turbines – for the first time – feasible monitoring and identification of underperforming wind turbines becomes possible for the life time of the turbines.

## A common problem in the wind industry ...

Wind turbines are energy producing devices. Hence it is important for the customer and the manufacturer to know if a turbine efficiently converts the kinetic energy from the given wind conditions into power.

Here is where the big dilemma in the wind industry lies so far: On the one hand it should be monitored that every turbine's performance characteristic is within the specification, but on the other hand it is impossible to measure the wind quantities accurately and precisely at all turbines and at all sites.

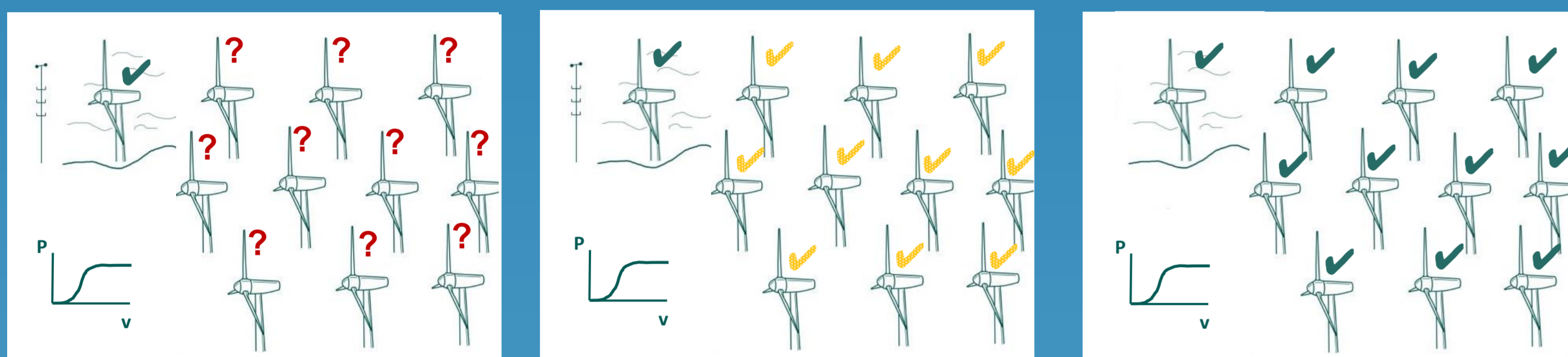


Quantity	iSpin	Conventional nacelle anemometry
Wind speed	NTF shows robustness even in wake	NTF sensitive to different inflow condition
Turbulence intensity	Key capability of iSpin	No possibility to measure
Yaw misalignment	Key capability of iSpin	Indirect measurement, very sensitive to measurement position No possibility to measure
Flow inclination	Key capability of iSpin	No possibility to measure

How to get from here ...

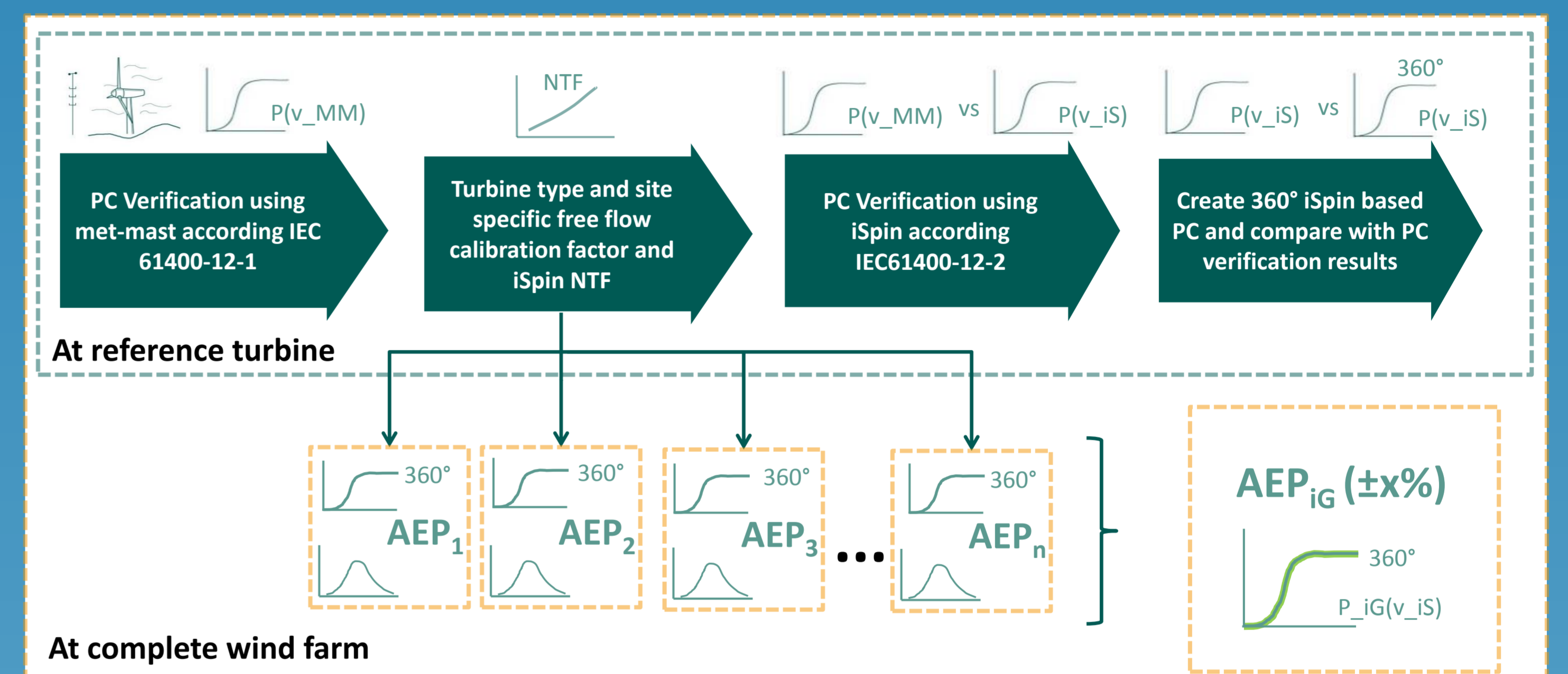
... to here ...

... and finally here?!

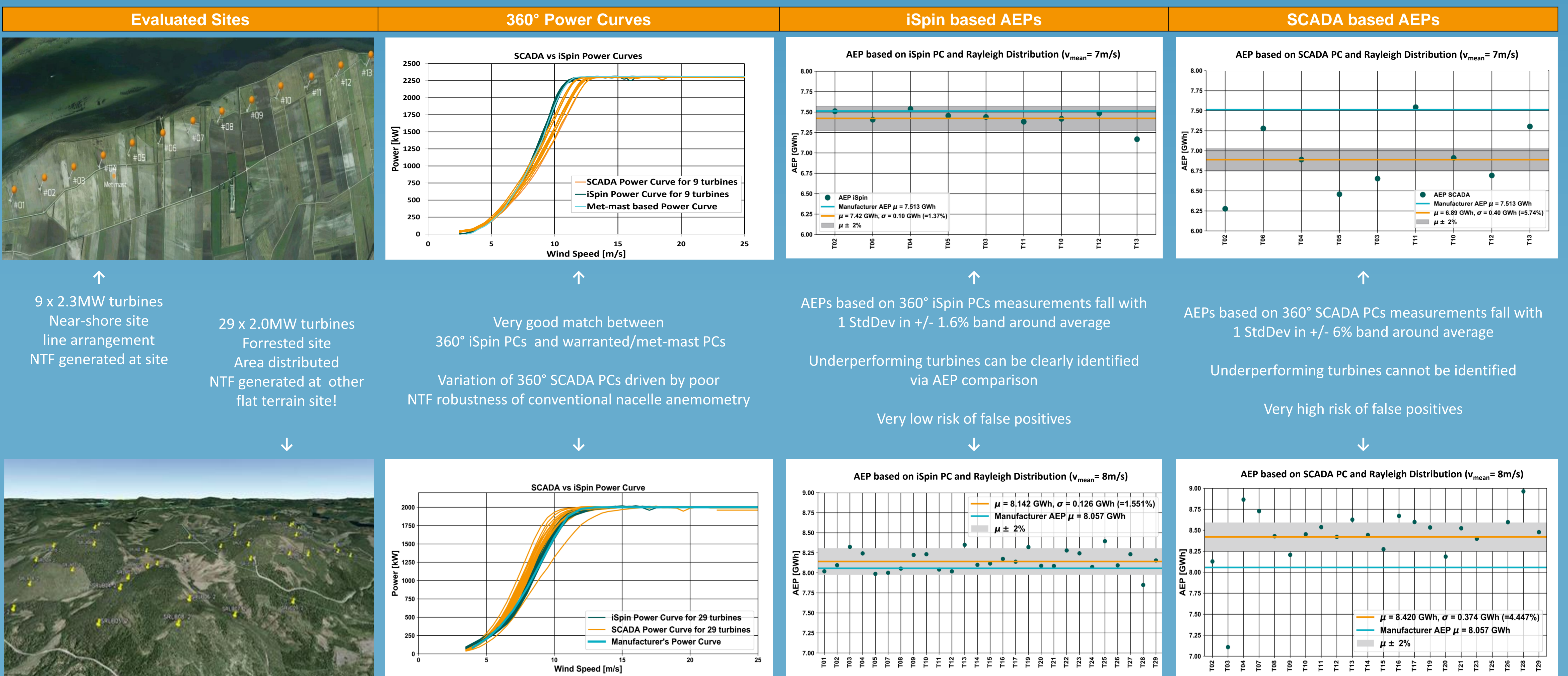


## ... and its solution - The iSpin Guardian Approach

The iSpin Guardian Approach uses the robust Nacelle Transfer Function (NTF) and the unique measurement capabilities of the iSpin spinner anemometer technology. This enables to enhance the evaluation of Power Curves (PCs) and Annual Energy Productions (AEPs) from free inflow conditions to 360° and from individual turbines to all wind farm turbines.



## Field Test Results



## References

- IEC 61400-12-1:2017; Power performance of electricity producing wind turbines
- IEC 61400-12-2:2013; Power performance of electricity producing wind turbines based on nacelle anemometry
- Spinner Anemometry – Uncertainty Analysis; Pedersen, Arranz; DTU report I-0384; March 2016
- Holistic performance monitoring of wind farms – the iSpin Guardian approach; Hohlen; VGBPowerTech Journal; September 2016
- Evaluation of the ROMO Wind iSpin Guardian approach; Wouters, Wagenaar, Warnaar; ECN report ECN-E--16-050; September 2016
- Performance Monitoring on all Wind turbines at any Time; Hohlen; WindTech Journal; November 2016