

ROMO WIND

WIND KNOWLEDGE IS WIND POWER



Introduction into the Performance Transparency Project (PTP)

Objective:

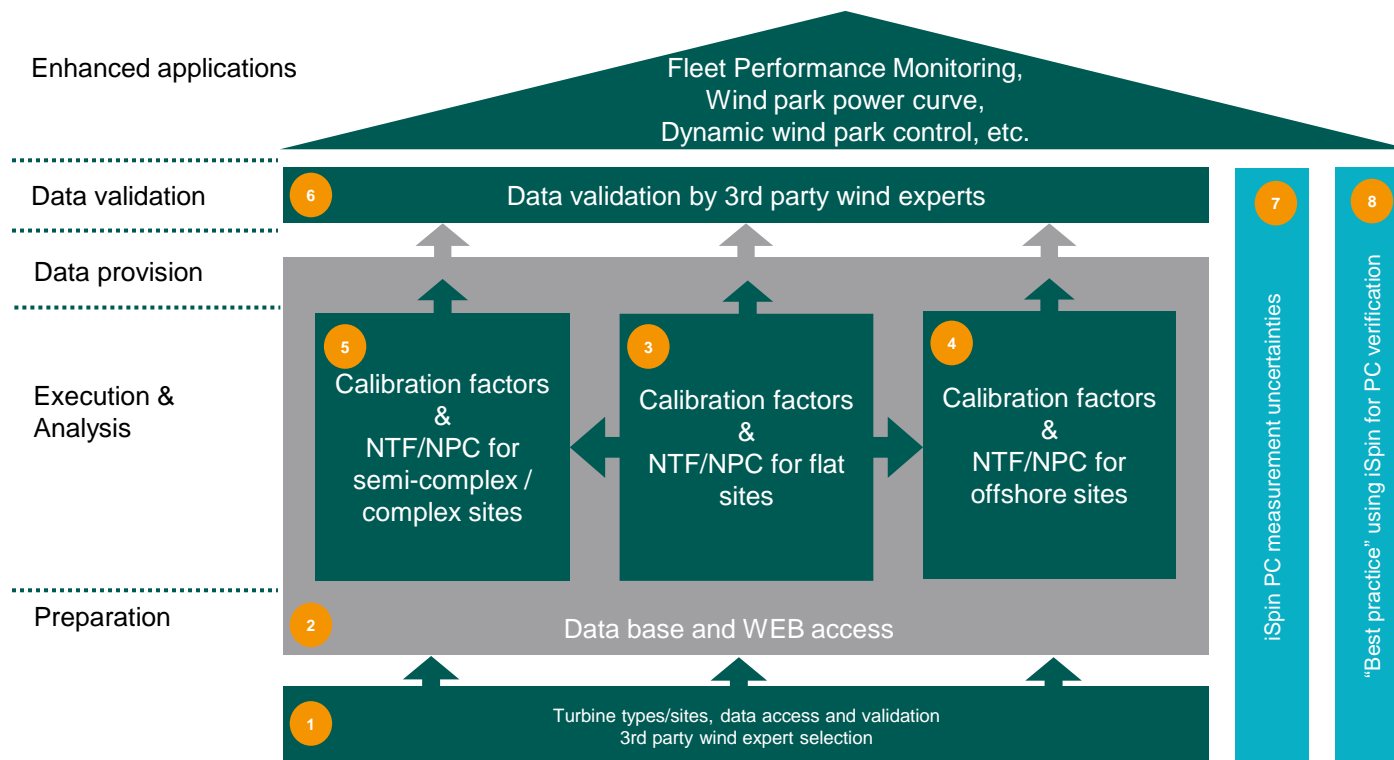
- Evaluate and demonstrate iSpin NTF robustness on the largest possible scale
- Demonstrate iSpin's ability to compare and monitor power curves regardless of terrain and wake effects

Approach:

- Installation of iSpin systems on a total of around 90 wind turbines in 9 different wind farms.
- 3 different turbine types - each of them installed at 3 different terrain classes (flat, semi-complex and complex or offshore) - shall be evaluated.
- Measurement duration at least 12 months to cover full year season
- Measure power curves on turbines of the same type in different terrains classes and in accordance with IEC standard
- Results to be evaluated by 3 independent and renown wind energy consultants + DTU as project partner
- Full transparency: Data and reports will be made public so the wind industry can scrutinize the results

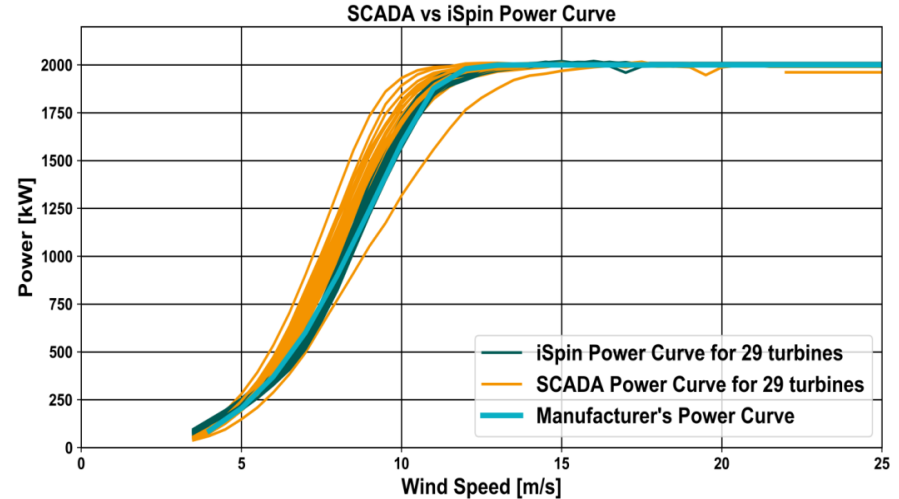
Timeline: Start installations in beginning Q3 2017 with project completion in Q2 2019

Funding: Supported by EUDP (Danish energy innovation program)



Using iSpin NTF robustness to compare Power Curves

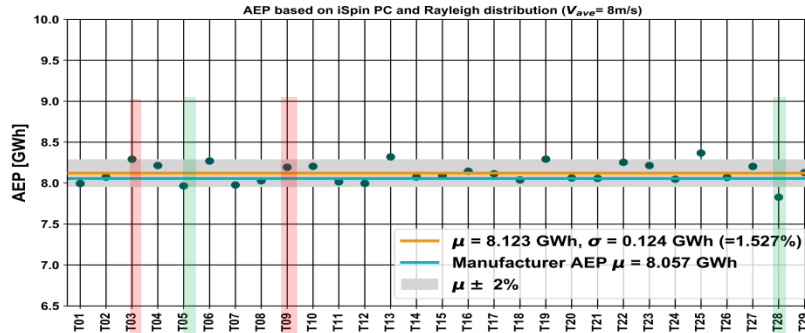
Semi-complex Terrain Case Study



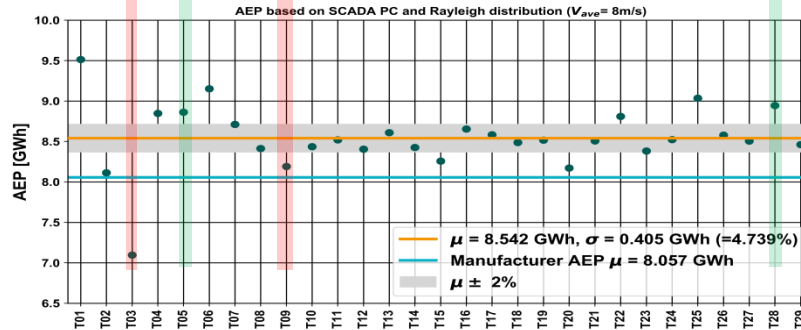
- iSpin NTF created at flat terrain site in Southern-Europe
- 29 2MW in semi-complex terrain in Northern-Europe
- 360° power curves
- 1 year of data
- Comparison iSpin / SCADA power curves

iSpin vs SCADA AEP – Semi-complex Terrain

iSpin

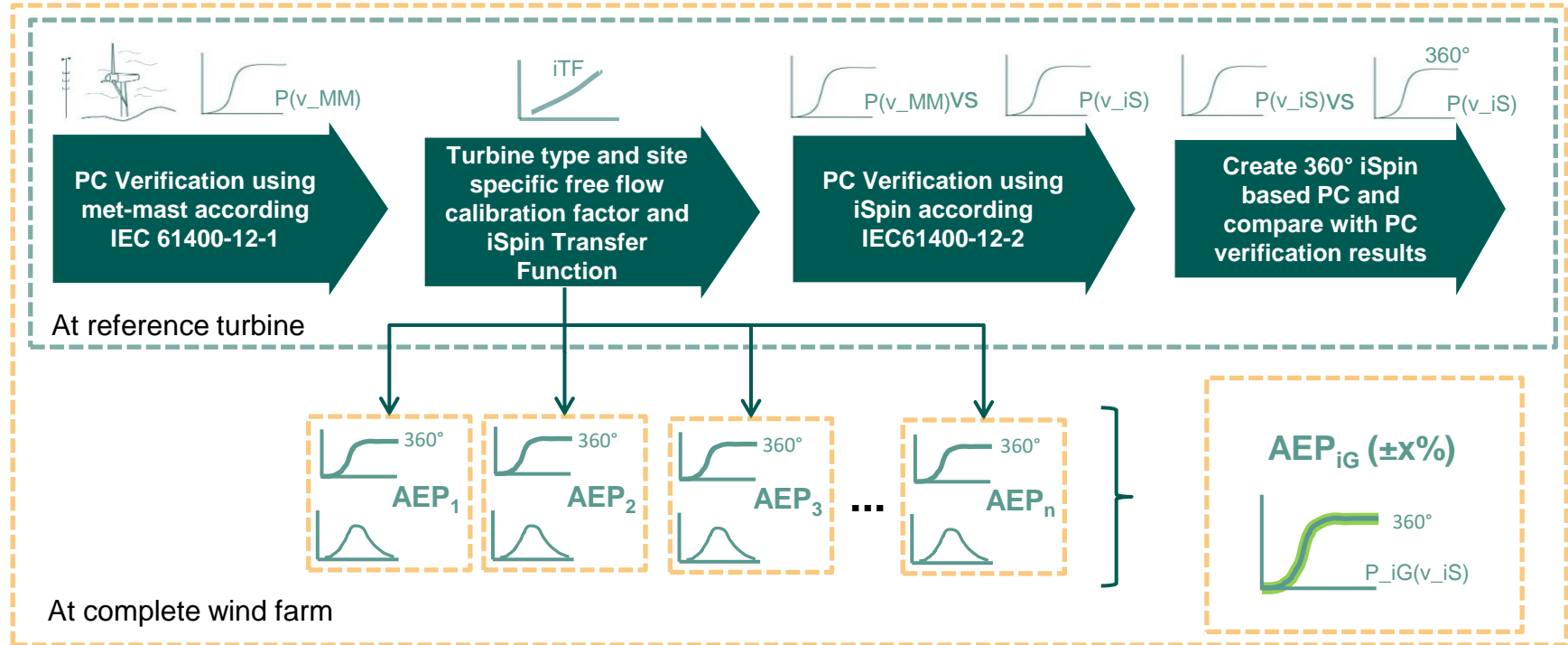


SCADA

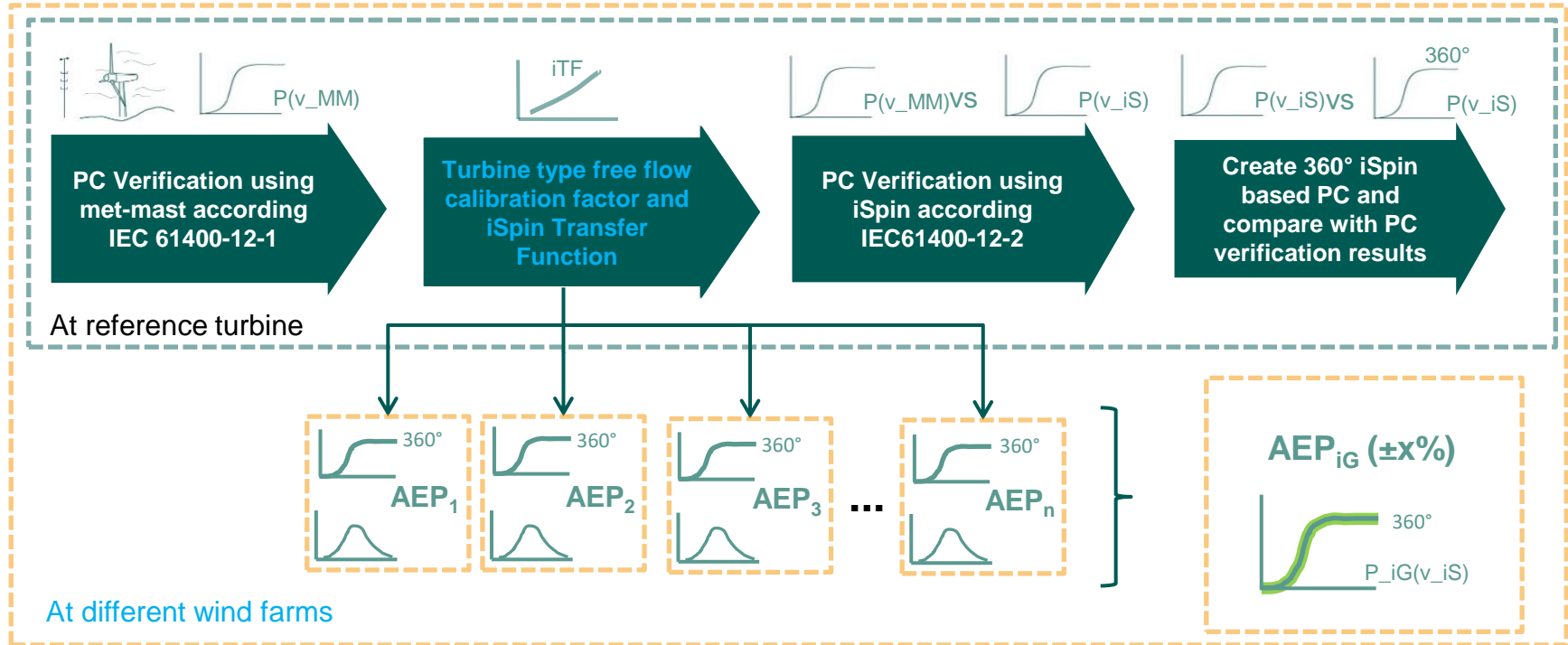


- Out of 29 turbines performing at rated power
 - 2 turbines slightly over perform $\pm 2\%$ AEP band
 - 2 turbines slightly under perform $\pm 2\%$ AEP band
- Out of 29 turbines performing at rated power
 - 7 turbines over perform $\pm 2\%$ AEP band
 - 5 turbines under perform $\pm 2\%$ AEP band

Process Flow for PTP Sites



Process Flow for PTP Sites



Wind farm nomination – Targeted terrain types

Flat terrain



Total 3 sites
(2 sites installed)

Semi complex terrain



Total 2 sites
(1 site installed)

Complex terrain



Total 3 sites
(2 sites installed)

Offshore



Total 1 site
(1 site installed)

Requirements to be fulfilled for PTP Sites

- Site must have **IEC compliant met mast** (or met mast which can be made IEC compliant)
- Installation of iSpin on the relevant turbines must take place within the **strict time-table** of the project
- Participants must provide **time synchronised SCADA data** from the relevant turbines and met mast data and get the **approval from the OEM** / service company to install iSpin in the spinner and the compass on the nacelle roof
- Anonymized **data**, reports and data analysis to be made **publically available** to the wind industry.
- **Participation** in the project will be made **publically known** (project reports, press releases and on the PTP website).
- Participants support with adequate **human resources dedicated** to the project at their own cost
- iSpin will **remain installed** and ROMO Wind will **keep collecting all data** from the site also after project completion. The data will be used in references, product development and improvement. The data will be kept secure and anonymized.

- IEC 61400-12-2 compliant power curve measurements on the reference turbine and close to compliant power curve measurement on the remaining turbines → Benefit: approx. €0.8m, market rate
- Yaw misalignment monitoring during the duration of the project
- For PTP turbines full year data of wind speed, turbulence intensity, yaw misalignment, flow inclination enabling owner to check real site conditions against initial site evaluation data. This allows for:
 - Adaptation of wind farm operation according to real site conditions
 - Improvement (more accuracy and precision) of the simulation of the residual lifetime of wind turbines
 - Reduction of loads of the WTGs and therefore potential reduction of service and maintenance costs for the rest of the lifetime
 - Improved planning of new wind farms with the same WTG type and for transferring the experiences to other sites
- privileged access to the project team, project data and reports with performance data to benchmark against other (onshore)
- to be associated with the most systematic and largest performance transparency project in the wind industry
- to work with like-minded companies to better use power curves when assessing wind turbine performance
- an option to purchase or rent the iSpin equipment after the project is completed or to buy monitoring services from ROMO Wind at special rates
- access, as appropriate to high frequency wind speed data to explore the potential for improved wind, turbine and fleet performance analysis, e.g. measured turbulence intensity data for wake analysis
- Precise site condition data for further R&D/operational analysis

Thank you!

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