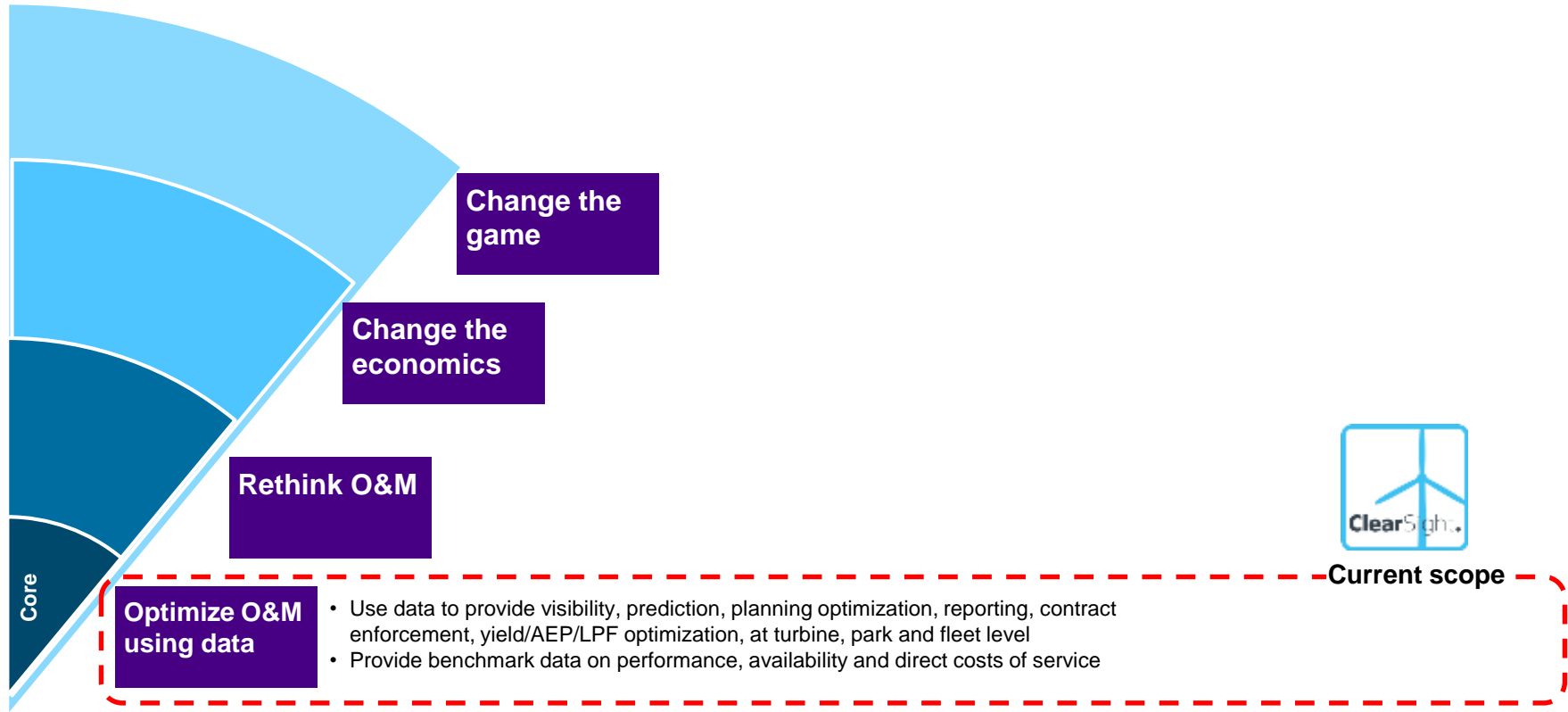# Optimising turbine performance using smart data and tools

Mariel Garrido
Director, Global Asset Management

12-04-2017

Vestas & Smart Data

The ambition straddles four domains of opportunity

Change the game

Change the economics

Rethink O&M

Core

ClearSight

Current scope

Optimize O&M using data
- Use data to provide visibility, prediction, planning optimization, reporting, contract enforcement, yield/AEP/LPF optimization, at turbine, park and fleet level
- Provide benchmark data on performance, availability and direct costs of service

Vestas

Vestas Smart Data & Consultancy Services
Optimizes your business based on data

Vestas has been monitoring, collecting and learning from volumes of data from wind turbines for more than 30 years - now we want to share this knowledge with our customers.

Vestas Smart Data & Consultancy Services
ClearSight

a suite of data and analytics driven tools and consultancy services

covers the whole value chain of your wind energy business

combines unique operational insight with industry leading tools

supports your processes, increases production and reduces maintenance cost

changes the way your employees work, smarter decisions leading to more value

Vestas Smart Data & Consultancy Services

Vestas leads predictive maintenance in wind industry by:

#1 TECHNOLOGY

An effective combination of methodologies to detect abnormal behaviors and potential risks in the turbines

Proactive Maintenance

Online data

vibrations

scalar data

oil analysis

Any other data automatically collected

Ad-hoc data

endoscopies

motor tester

Blade care

Any other data

Fully integrated with your business

ERP integration

Vestas

Smart Data on *Failure prediction

With ClearSight.Activator

- We can detect if a turbine has an abnormal behavior
- Performing statistical analysis over more than 140 signals in average
- With +33,000 turbines fleet around the world
- Having the biggest population, the tool is very powerful
- Totally automated
- Obtaining graphs easy to understand
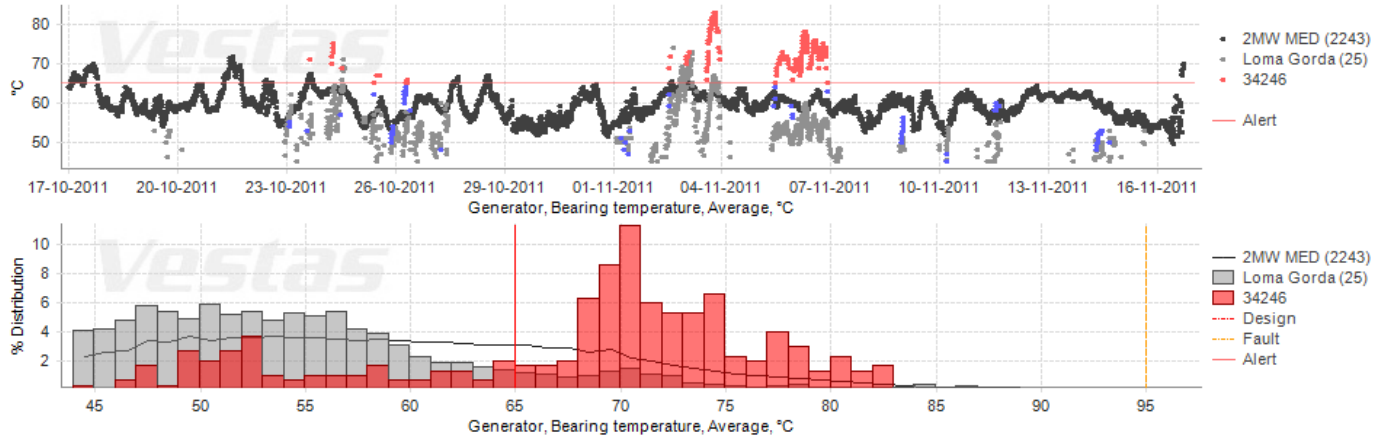
Using data to continuously improve *asset performance

Smart data visible through smart applications ensures easy fast decision making
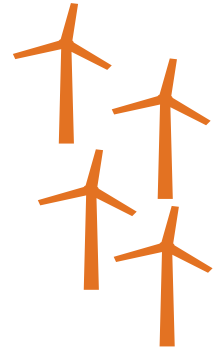
Historic and real-time data

+

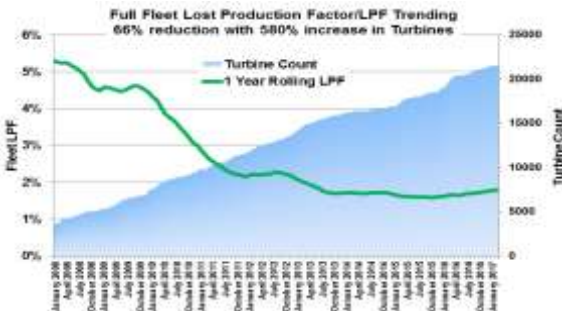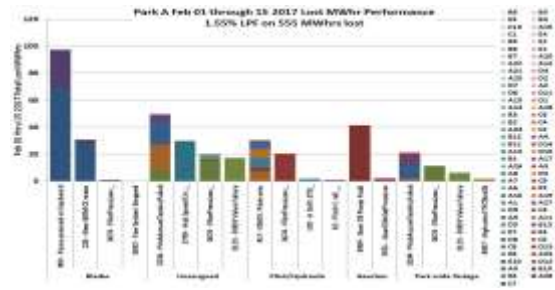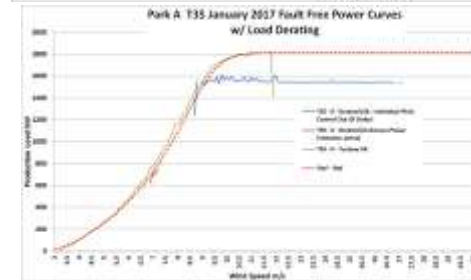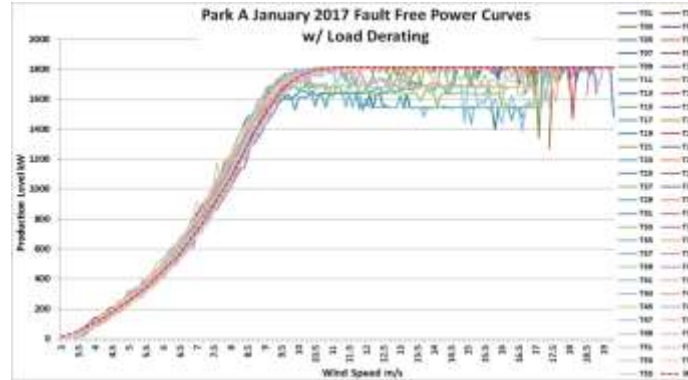New hardware and software technologies

=

Optimised fleet

Vestas®

Smart Data from reducing LPF to *increasing AEP

Optimising turbine performance

Full visibility to drive down Lost Production

…but what about when turbines are running?

Turbine data can be used to identify

- periods of abnormal operation and non-availability
- changes in performance
- potential upcoming failures
- energy losses classification
- the potential to increase AEP through upgrades
- life extension potential

Vestas

Turn smart data insights into more power

Using smart data to implement PowerPlus™ software and hardware technology

Site-specific tuning of operational parameters

Implementation of intelligent software algorithms

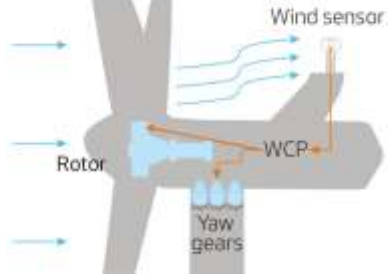Enhanced aerodynamic add-ons

Vestas

# Implementation of intelligent software algorithms

Power Performance Optimisation improves efficiency and output by means of smart data

Wind Estimator

Wind Estimator improves measurement accuracy of the wind turbine. The correct rotor speed and pitch angle is needed to for optimal power production – the more accurate, the more power

Adaptive Wind Sensing
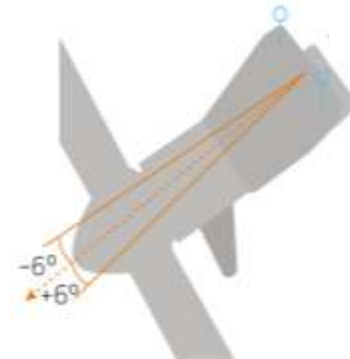
The correct upwind yaw position is needed to for optimal power production, and loads. The algorithm uses the natural variation in wind direction (+/- 6 degrees) to calculate optimum yaw position based on average peak power production

Extended Power Boost
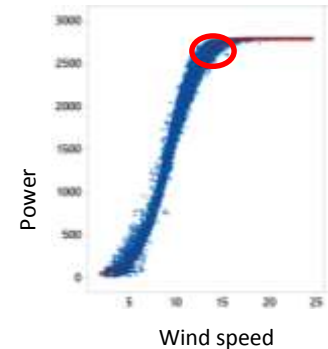
Extended Power Boost improves production by "sharpening the knee" of a power curve through a short boost in the "boost area".The short term boosting of power is carried out when the turbine reaches rated wind speed, and without increasing the name plate capacity of the turbine

Vestas
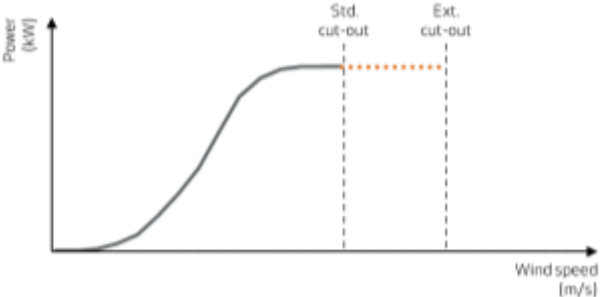
Site specific tuning of operational parameters

Uprate nominal power or extend the cut out speed for optimal production

Based on a detailed post-installation siting study, using a DNV-GL certified process, Vestas may be able to increase the nominal power of the wind turbines, and allow higher production at virtually no risk.
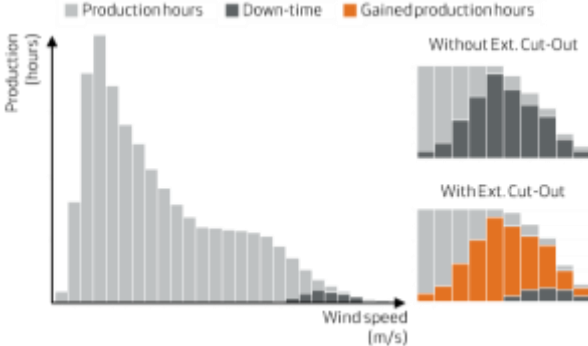
Power Uprate
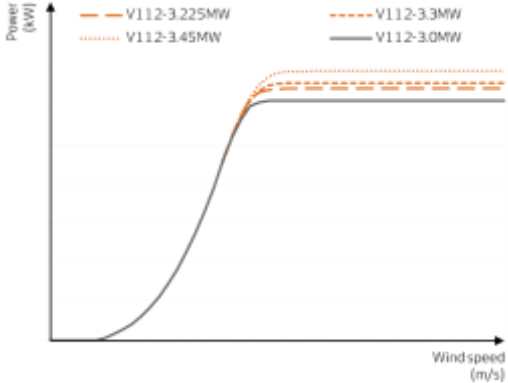
Extended Cut Out

Extended Cut Out

Vestas

Aerodynamic improvements to increase yield

Specifically designed blade add-ons can lift AEP by up to 2%

Based on a detailed post-installation siting study, using a DNV-GL certified process, Vestas may be able to increase power production on the slope of the power curve, and allow higher production at virtually no risk.
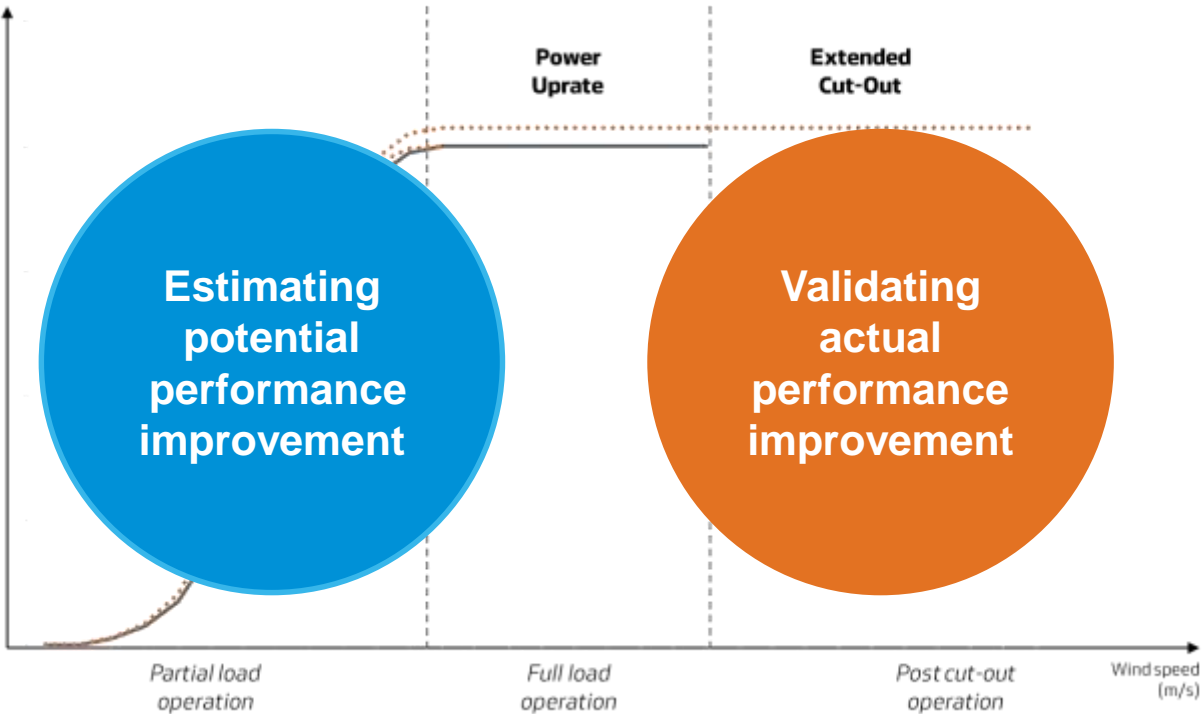
Vortex Generators

Gurney Flaps

Vestas

Estimation and validation of performance improvements

Proof of value is highest priority, both for Vestas and our customers

Estimation and validation of performance improvements

Proof of value is highest priority, both for Vestas and our customers

Estimating potential performance improvement

Validating actual performance improvement

Wind Power Plant Assesment, including:

- SiteCheck analysis
- Turbine-specific forecast
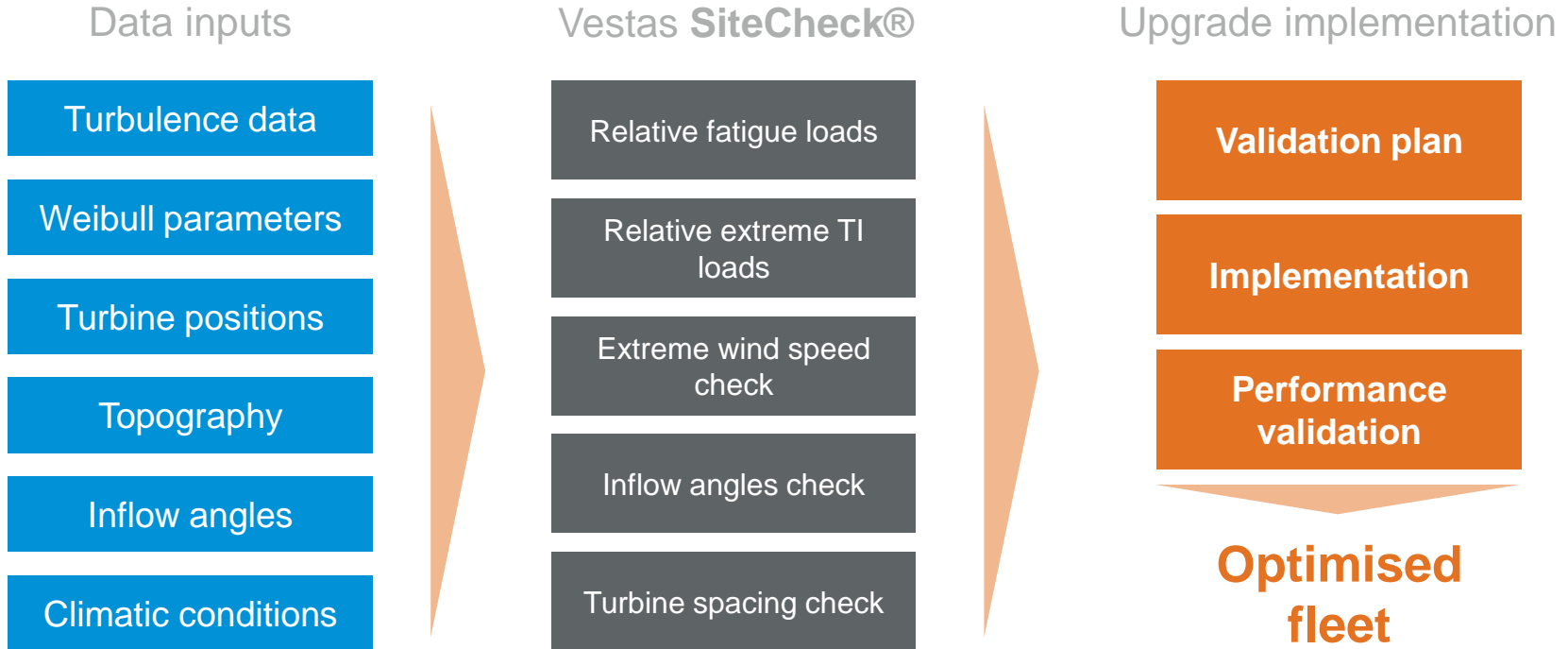- Gain tables over wind bins

Different methods for different applications

- Validation accuracy depends on sample size and quality
- Different methods for on-slope and rated power upgrades
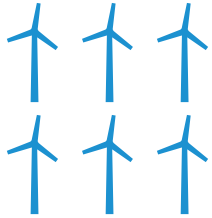- Validation plan made together with customer

Vestas

Using data to evaluate potential performance improvements

Vestas uses DNV-GL certified tools in SiteCheck® to estimate production benefits

Data inputs

Vestas **SiteCheck®**

Upgrade implementation

Data inputs	Vestas SiteCheck®	Upgrade implementation
Turbulence data	Relative fatigue loads	**Validation plan**
Weibull parameters	Relative extreme TI loads	**Implementation**
Turbine positions	Extreme wind speed check	**Performance validation**
Topography	Inflow angles check	
Inflow angles	Turbine spacing check	
Climatic conditions		

Optimised fleet

Vestas

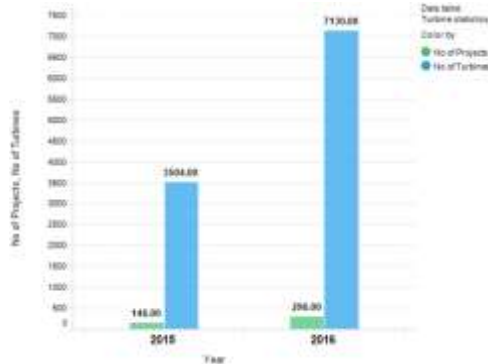# Track record and data experience

PowerPlus™

More data and experience than anyone

- 50.000+ turbines installed world wide
- 35.000+ turbines continuously monitored
- Data from 60.000+ turbine years in the Vestas data lake

■ Parks

■ Turbines
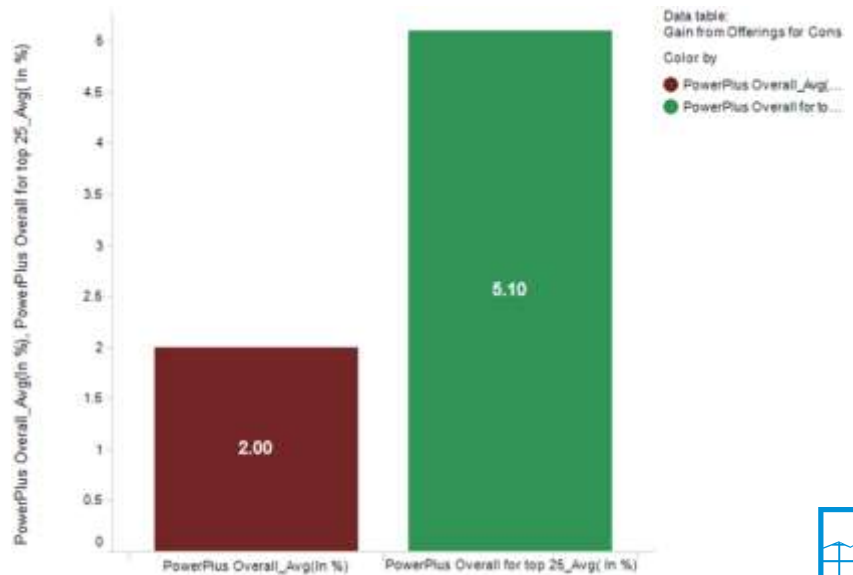
Unrivalled capacity

360° Asset Performance Reviews conducted

Analysis that creates value

Average AEP improvements (%) identified

Vestas

Learn more

Visit Smartdata.vestas.com