DNV-GL

ENERGY

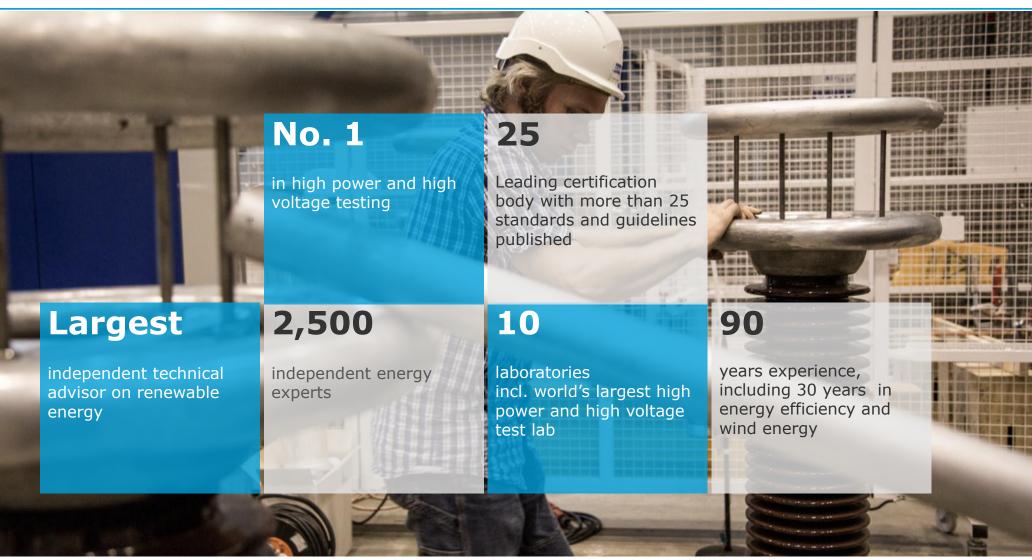
Wind farm benchmarking for improved financial performance

Robert Rawlinson-Smith

26 April 2017

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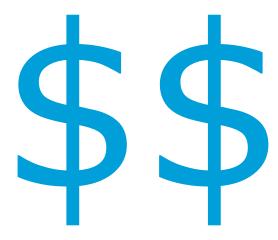
About DNV GL



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Motivation

- To increase financial value from existing wind farms, operational performance must improve.
 - Benchmarking against a reliable data set can help by identifying gaps in performance.
- To reduce financial risk on future assets, need to define realistic and accurate budgets.
 - Benchmarking against a reliable data set can help to define realistic targets for the region / project size / etc.



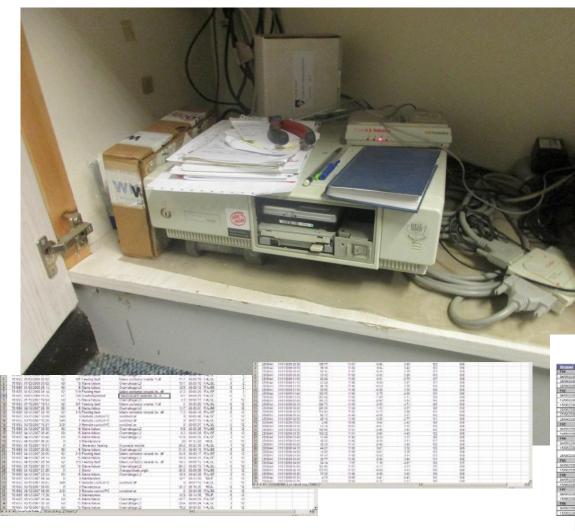
About benchmarking

- Benchmark: (verb) to evaluate (something) by comparison with a standard
 - The conclusions you draw depend on the 'standard' you choose to compare against
- Wind farm benchmarking metrics:
 - Availability
 - Reliability
 - Power Performance
 - Costs

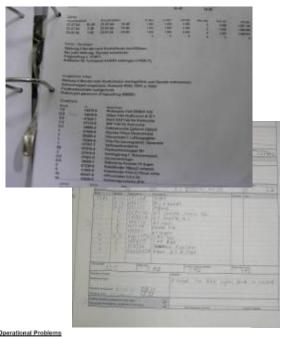


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Common pitfalls in defining an appropriate benchmark



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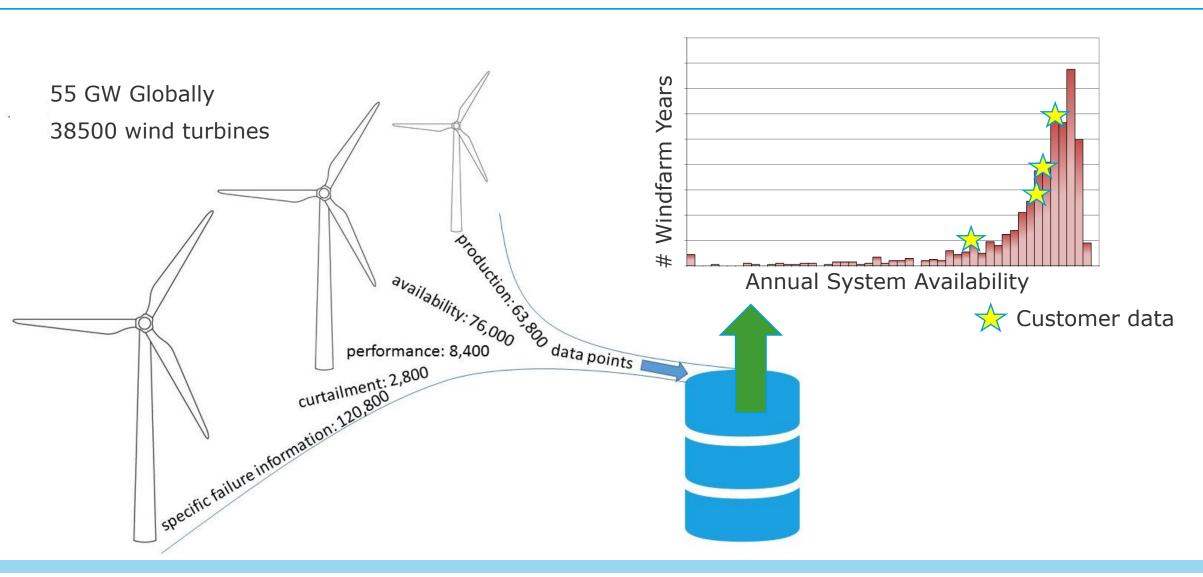
messy, incomplete, in different formats, inconsistent over time, etc.

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Defining an appropriate benchmark

Best Practice	Example			
(1) Choose a measurable quantity (metric)	e.g. Wind farm system availability			
(2) For each metric, choose definition	Time-based or energy-based, including all wind- farm downtime (turbine, balance of plant, grid- related, environmental); or use IEC61400-26			
(3) Gather as many data points as possible(a) Include metadata, or information about the data points(b) Include a quality metric for each data point	Wind farm location, age, turbine type and quantity, High / medium / low confidence level			
(4) Check the data set for bias and statistical significance	Minimum of 20 independent data points for each sub sample			
(5) Be cautious about zeros: does 0 indicate a value (e.g. 0% available or 0 failures), or missing data?	Zeros are important to include with failure statistics, as "no failures" is as significant as "1 failure"			

DNV GL Global Renewables Benchmark



Conclusions

- Project data and industry benchmark statistics can be used to improve performance of the wind farm and reduce financial risks.
- The value of the benchmark depends on whether bestpractices have been used to collect the data.



Questions?

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