Lessons learned from Round 1: Improving wind resource analysis

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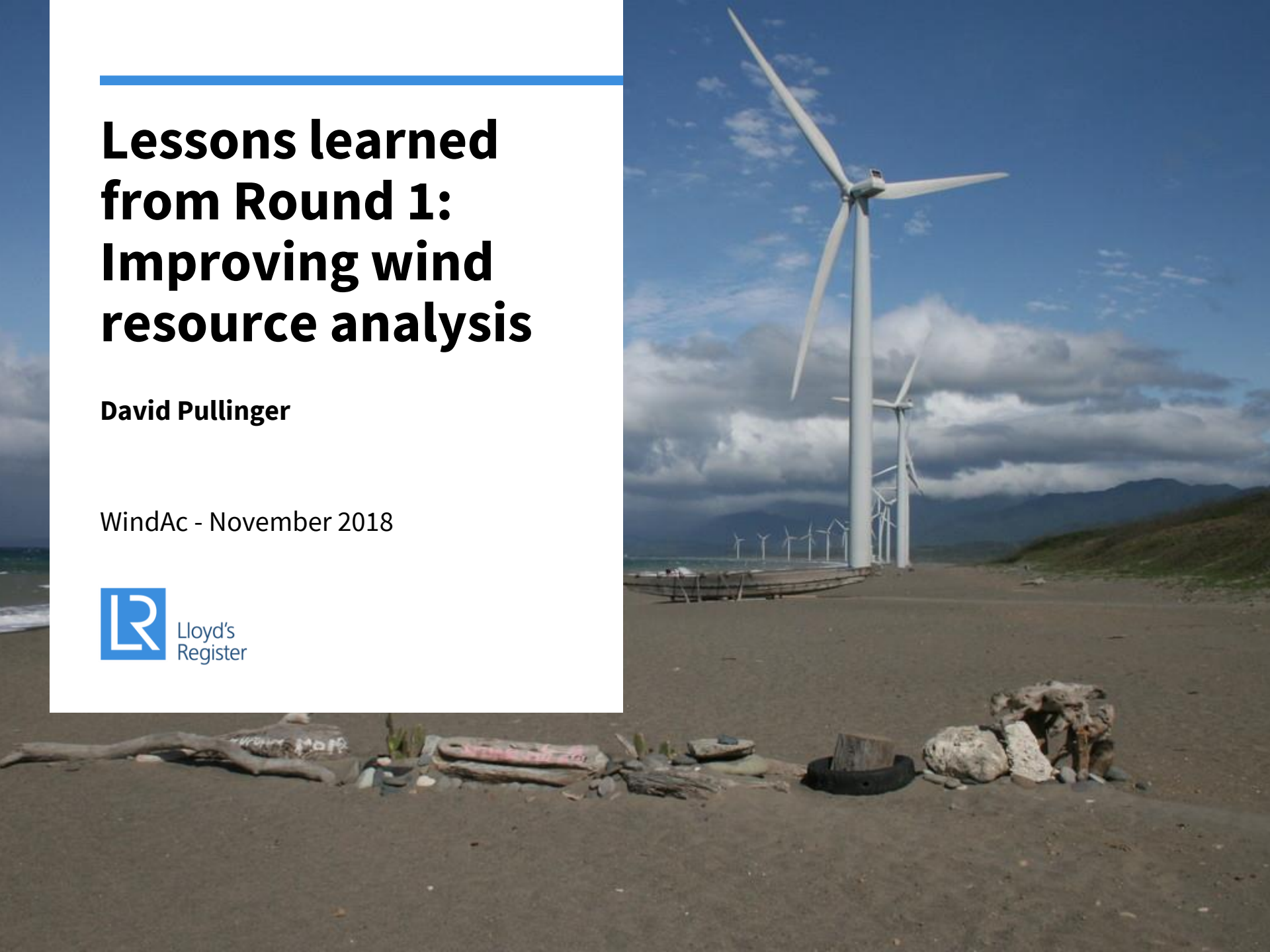
WindAc - November 2018

Lloyd's Register



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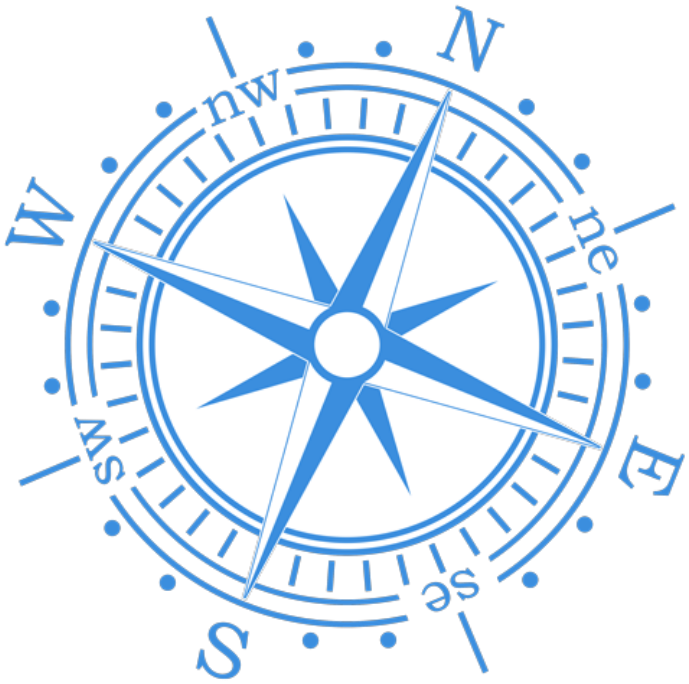
Founded in 1760 as a marine classification society.

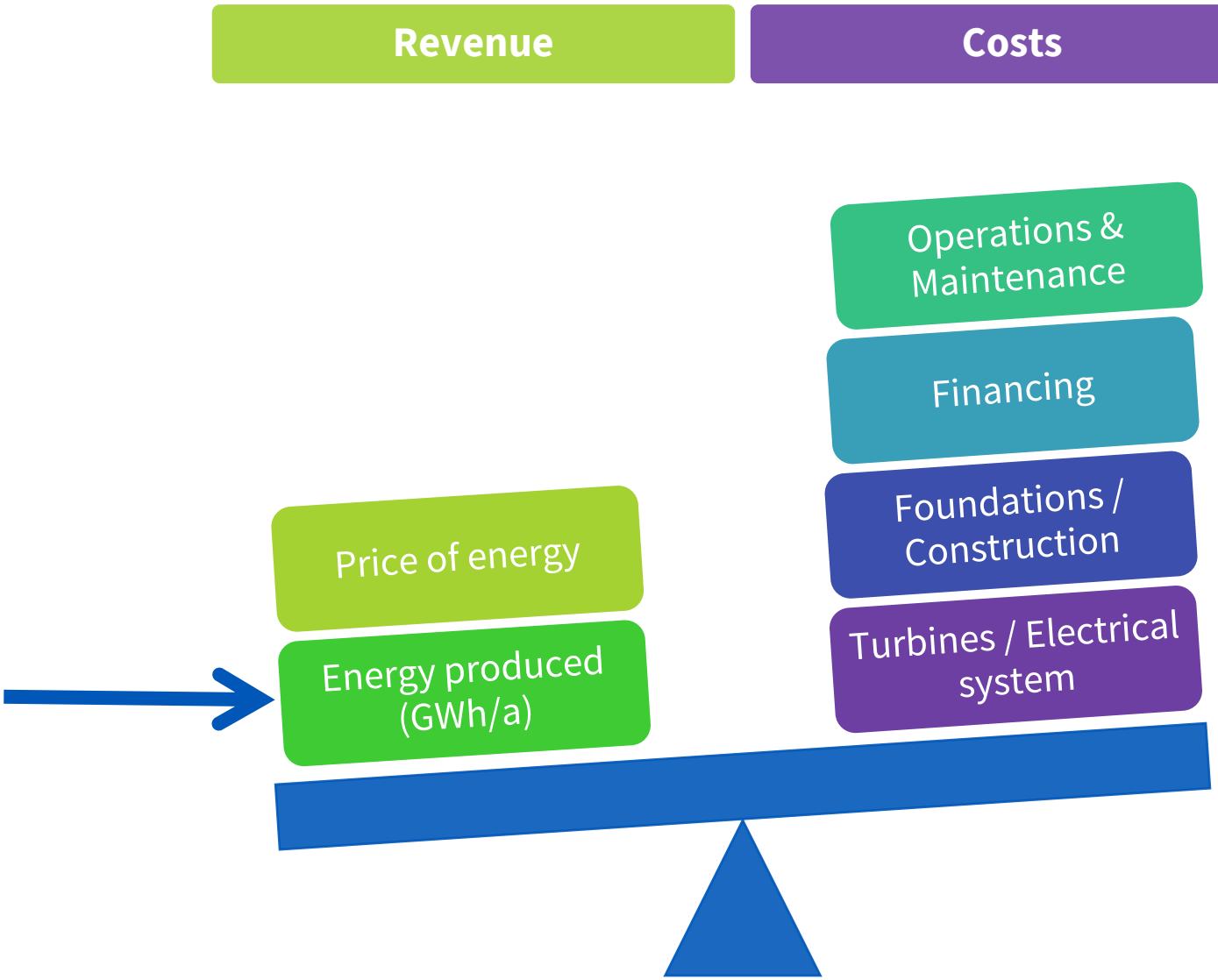
What sets us apart
Social business
Technical expertise
Independence
Breadth of service
Global reach

Agenda

- Background
- The big question(s)
- Methodology
- Results
- Conclusions



Why do wind resource assessments matter?

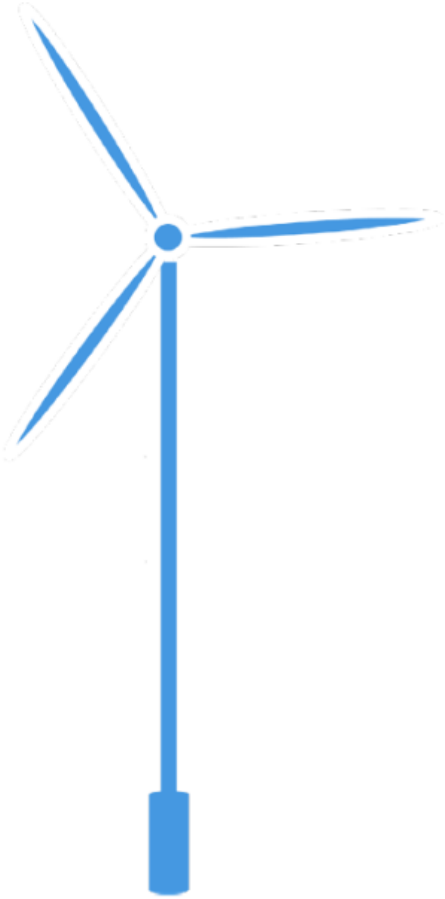


Wind farms in South Africa

Wind Farm	Number of Turbines	Wind farm size (MW)
Cookhouse	66	138.6
Dassiesklip	9	27.0
Dorper	40	100.0
Hopefield	37	66.6
Jeffrey's Bay	60	150.0
Kouga	32	80.0
Noblesfontein	41	73.8
Van Stadens	9	27.0

The big question(s)…

1. Were those (2012) energy yield predictions accurate?
2. Are our new (2018) predictions any better?
3. How are South Africa wind farms performing compared to the rest of the world?

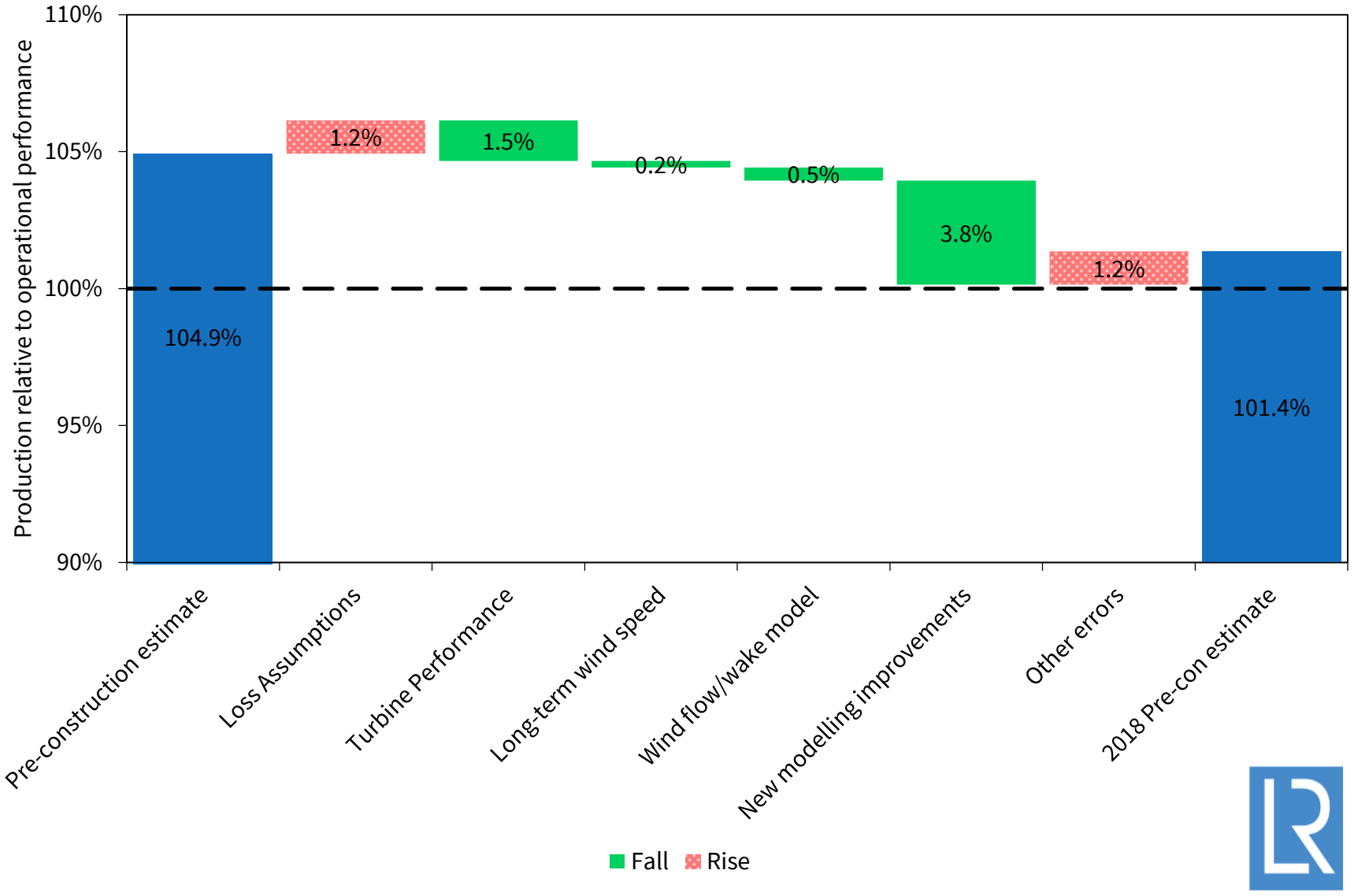


Wind resource vs operational yield assessment

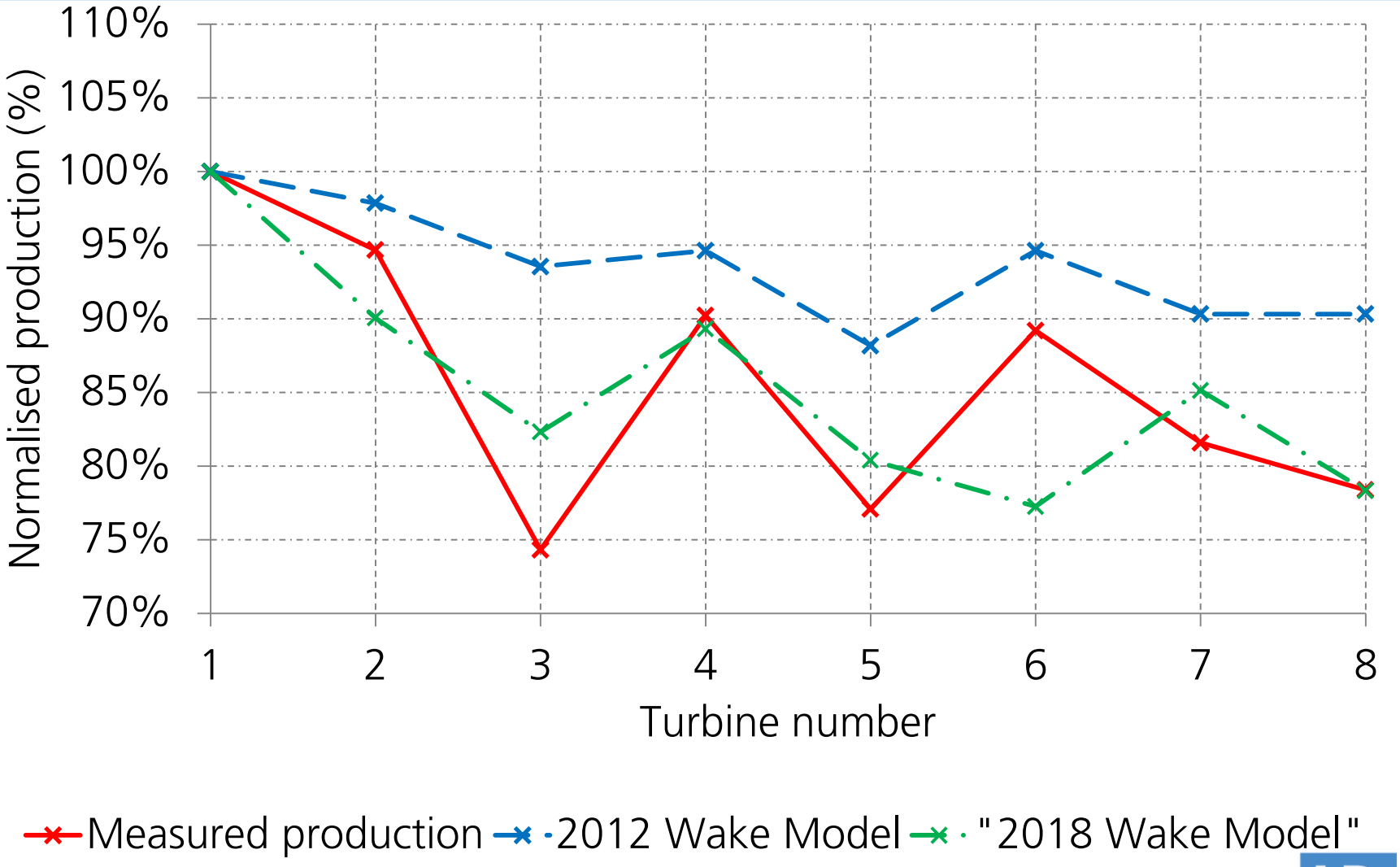
- On-site measurement (short-term)
- Long-term assessment
- Wind-flow modelling
- Energy yield + future loss assumptions
- Long-term project yield

- SCADA data processing
- Data tagging and cleaning
- Production normalisation
- Long-term assessment
- Future loss assumptions
- Long-term project yield

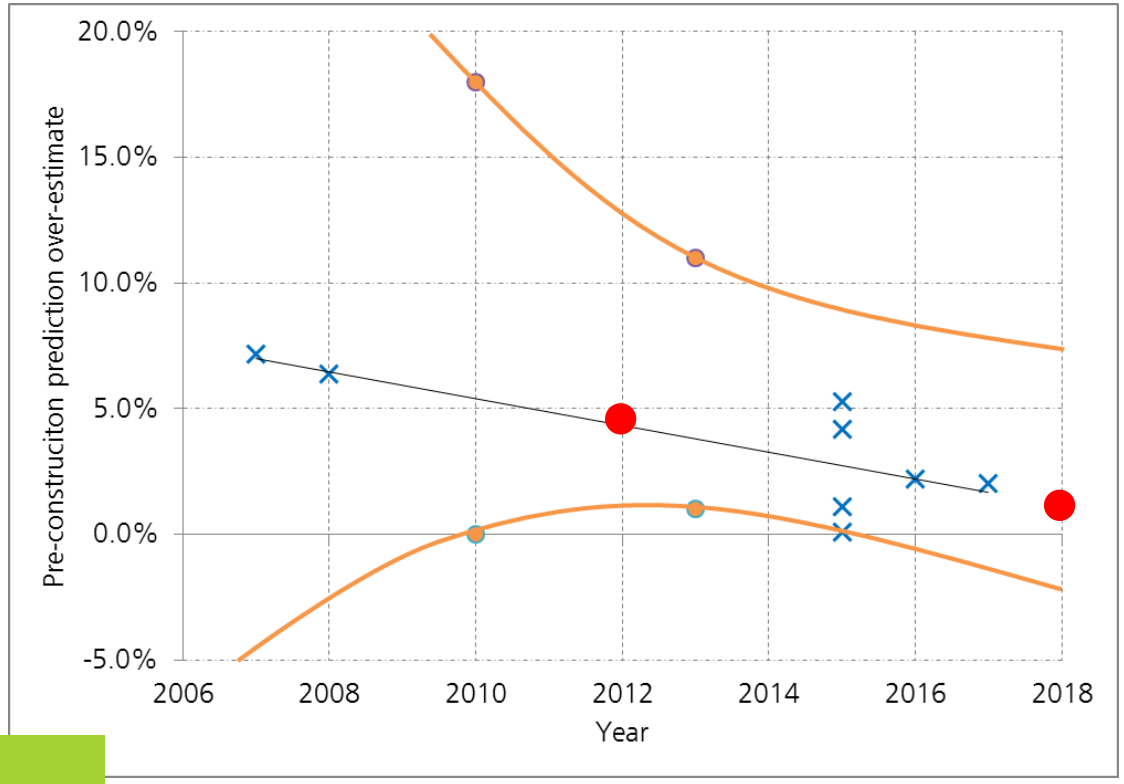
Results – how accurate are the yield predictions?



Example – wake model accuracy



Results – international comparison



Wind farm availability	
South Africa average	Global LT average
97.6%	96.3%

Conclusions

1. Were those (2012) energy yield predictions accurate?

4.9% over-prediction

2. Are our new (2018) predictions any better?

Yes – mean over-prediction of 1.4% remaining

3. How are South Africa wind farms performing compared to the rest of the world?

Wind resource assessments just as accurate as the rest of the world

Wind farm availability compares favourably to international benchmarks

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  - Kouga Wind Farm;
  - Dorper Wind Farm RF (Pty) Ltd;
  - Globeleq South Africa Management Services (Pty) Ltd;
  - Africoast Energy (Pty) Ltd;
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  - Cookhouse Wind (Pty) Ltd.
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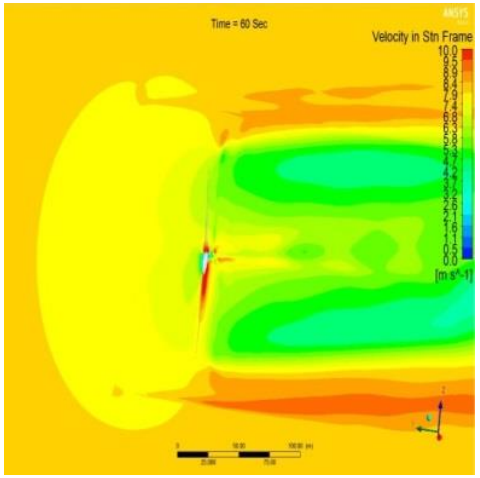
Methodology – wind resource assessment

- On-site measurement (short-term)
- Long-term correction
- Horizontal and vertical extrapolation
- Power production & wakes
- System losses
- Uncertainty assessment



Methodology – operational analysis

- Get hold of performance data
- Import and process operational SCADA data
- Normalise for missing time periods
- Flag data for unavailability/power performance issues
- Adjust for windiness
- Calculate ideal energy yield

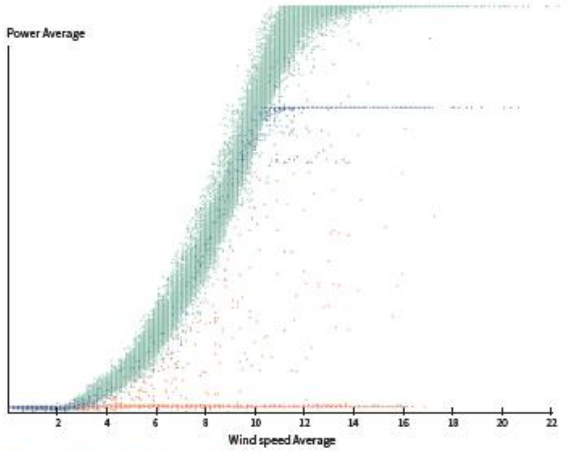


Figure 1: SCADA data analysis

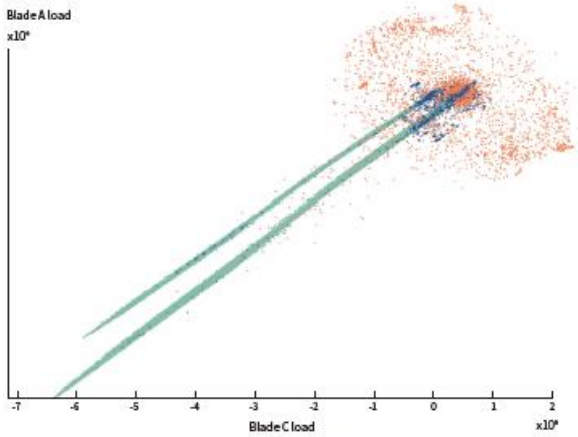


Figure 2: Correlation of the loads on two blades, indicating step changes in darker Green colour, data points in Orange are flagged unavailability