

Life extension of wind turbines

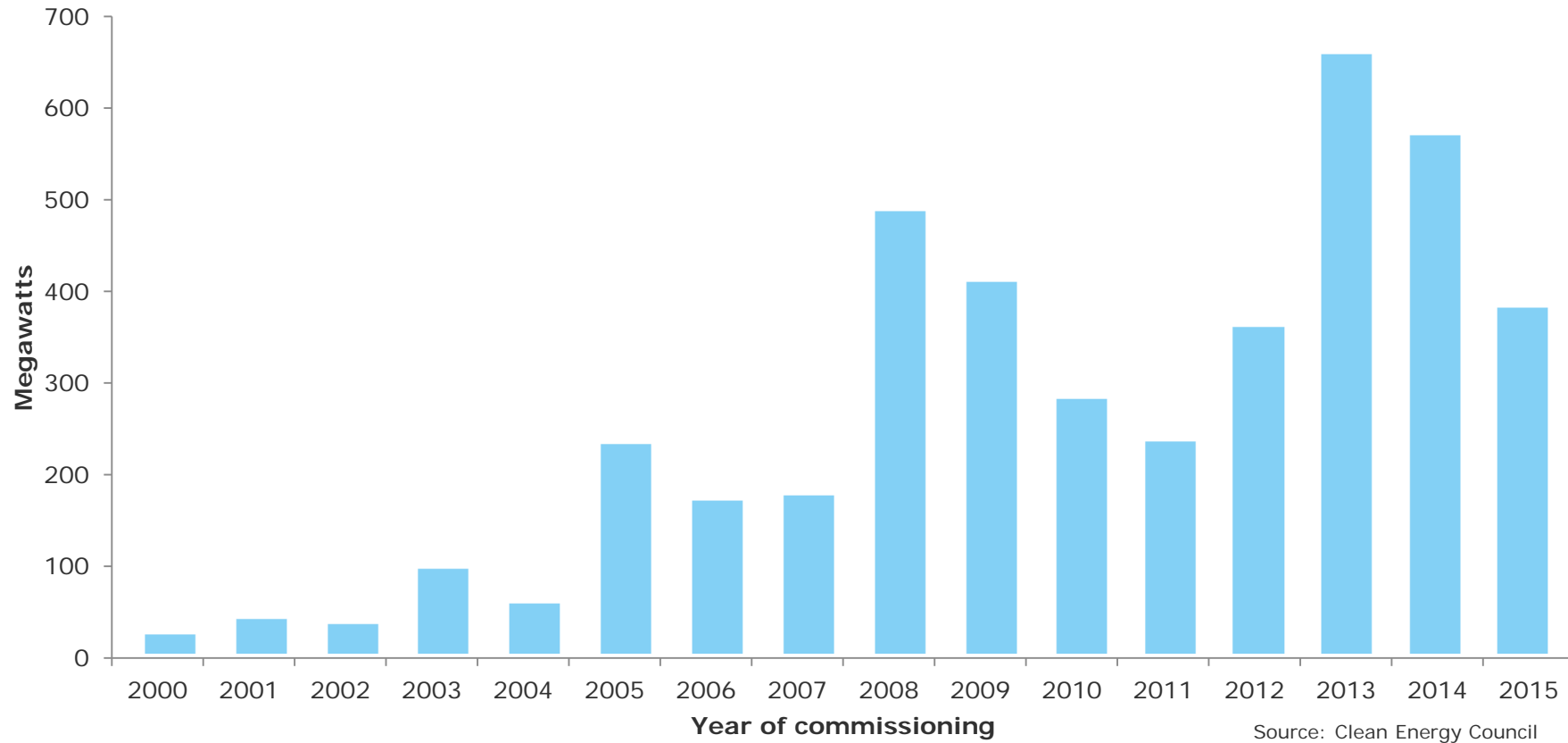
Tim Johnson

Engineer, Renewables Advisory

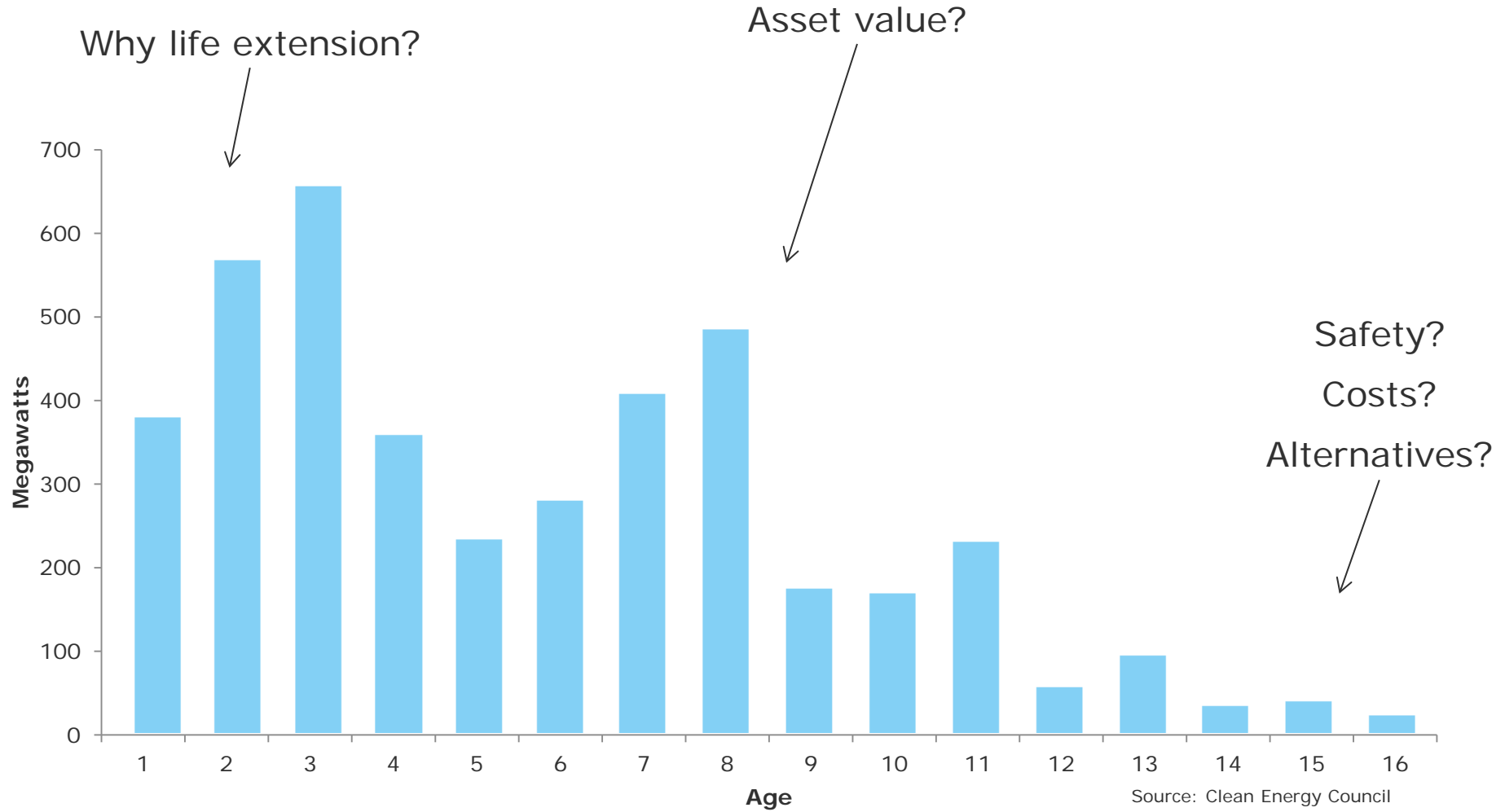
the Opportunity



Australia's turbine fleet

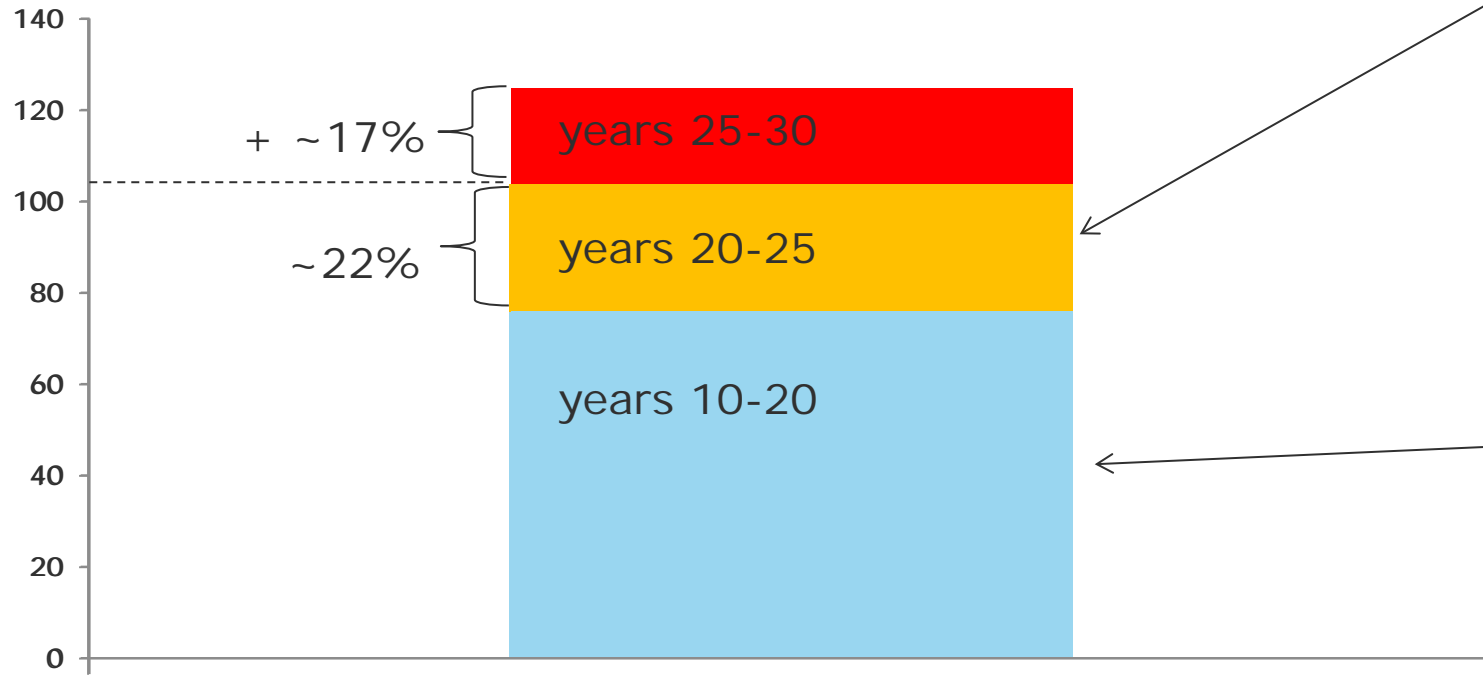


Relevant to all projects



Don't just assume 25 years

Project Value
[\$m, AUD]



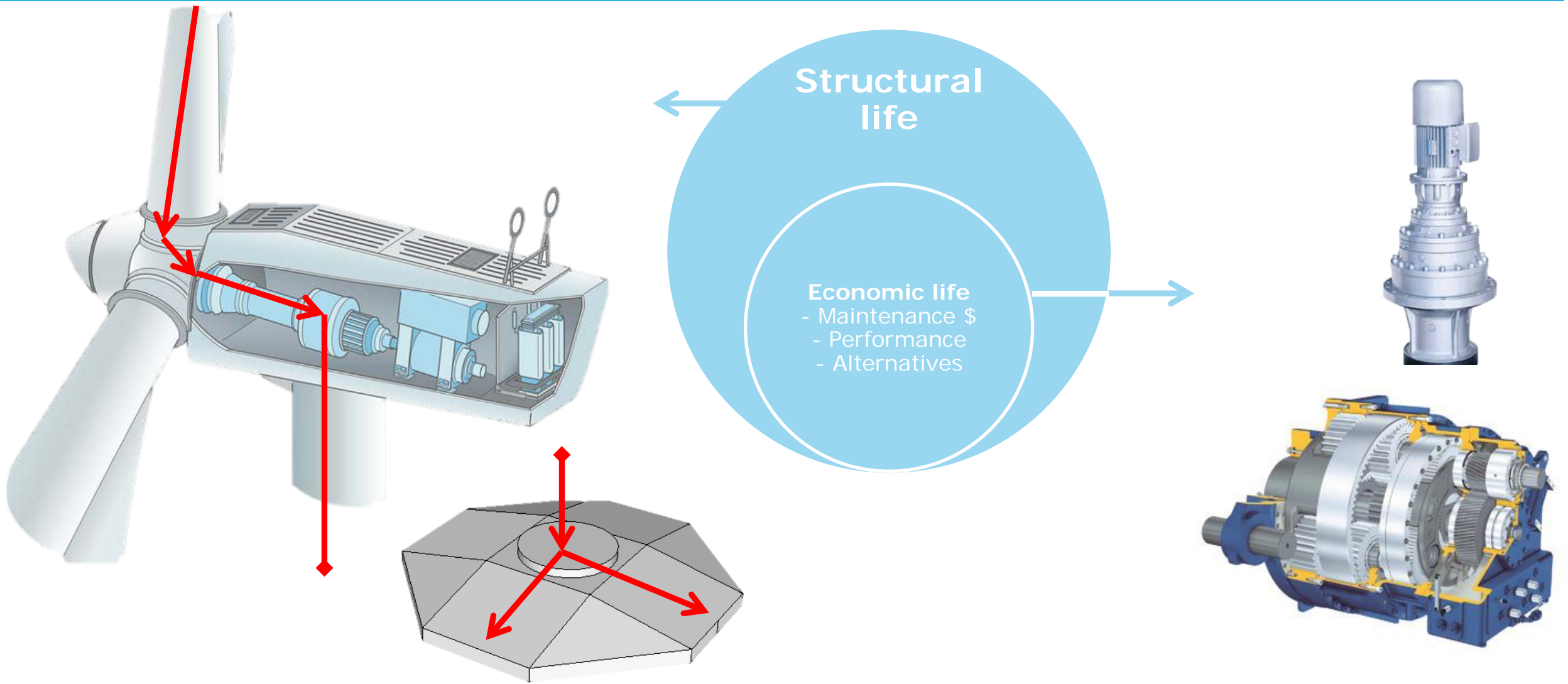
10 year old project



Turbine life



'Structural Life' is not the same as 'Economic Life'

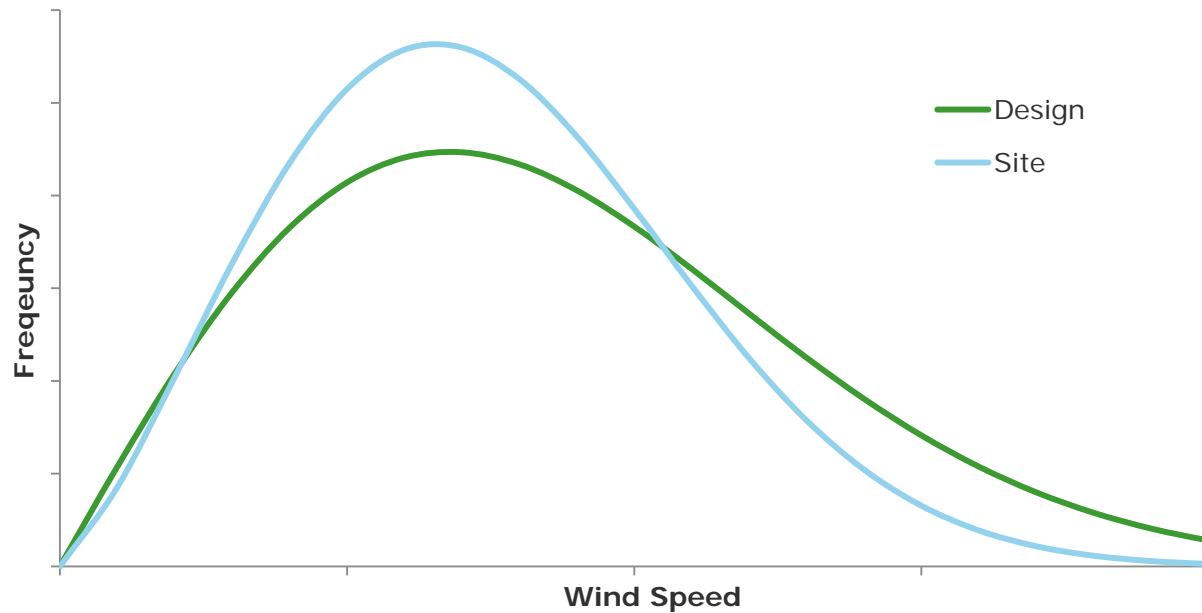


What do we mean by 'Structural Life'?

*The number of **years** that a turbine can operate, in a specific **location**, while maintaining some target level of **reliability***

Life is not deterministic – it's about probabilities

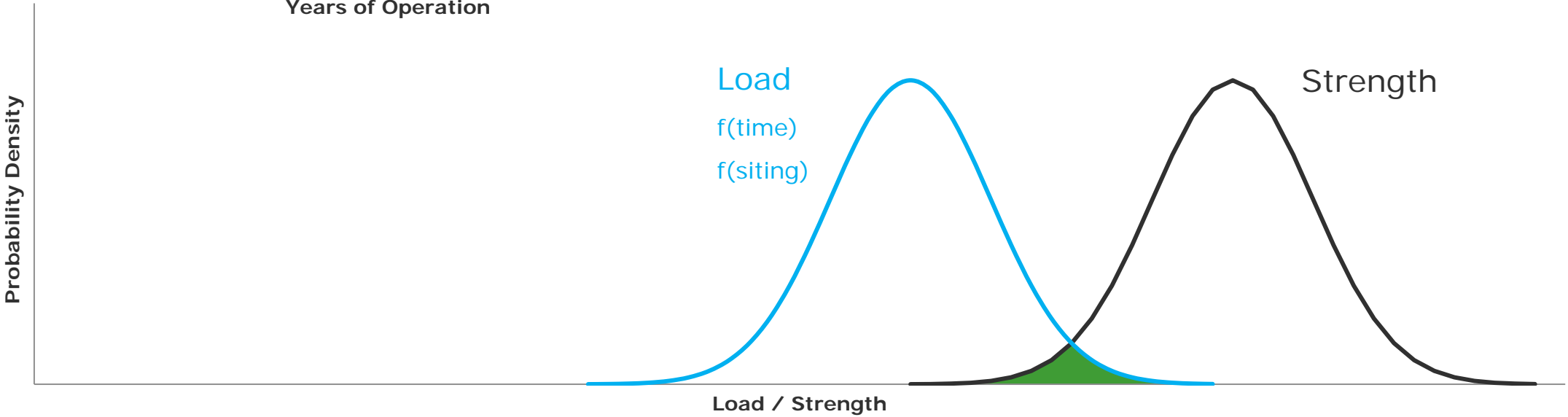
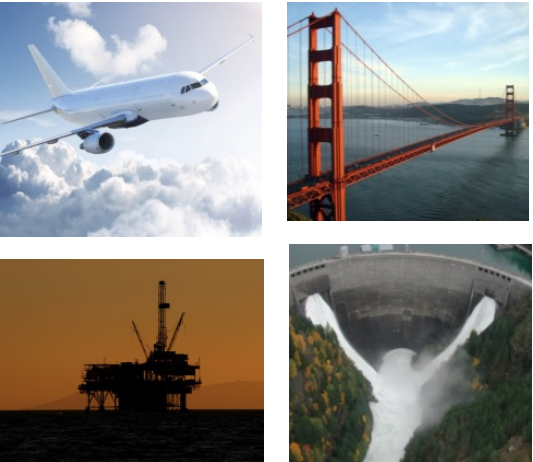
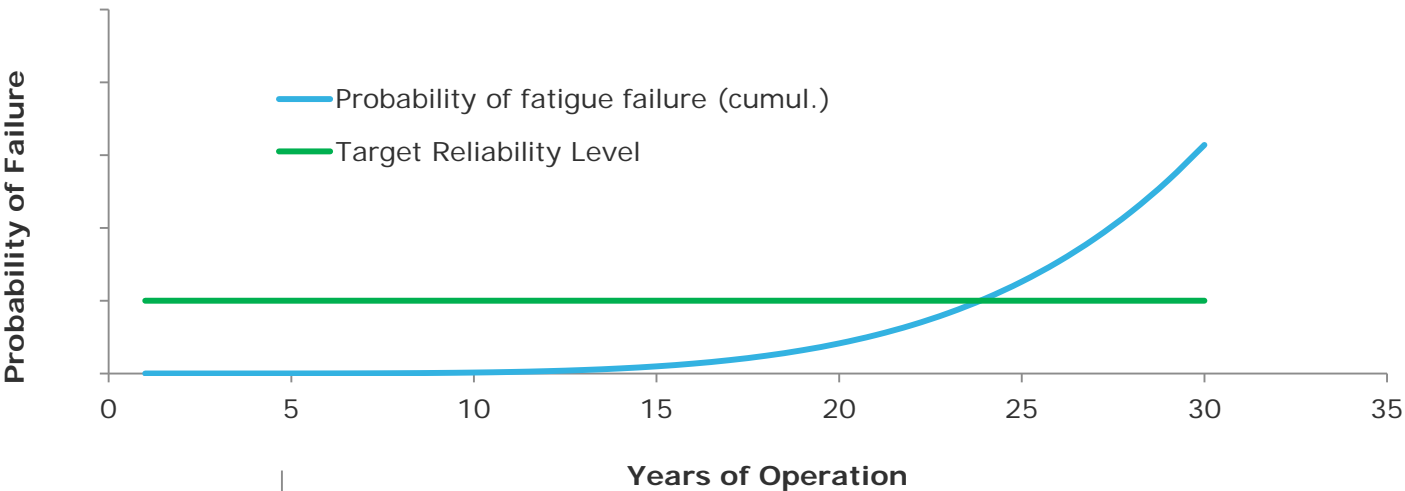
The number of **years** that a turbine can operate, in a specific **location**, while maintaining some target level of **reliability**



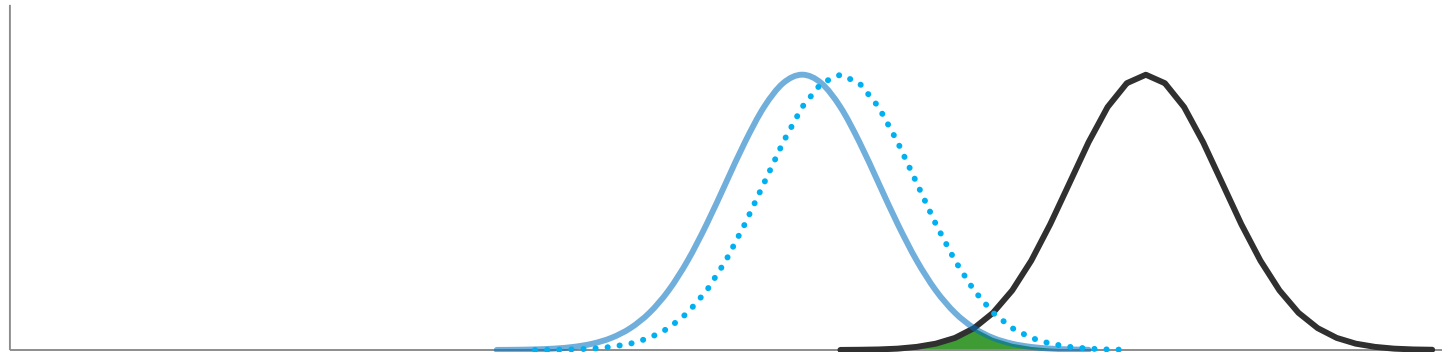
$$\text{Reliability} \propto \frac{1}{\text{Failure probability}}$$



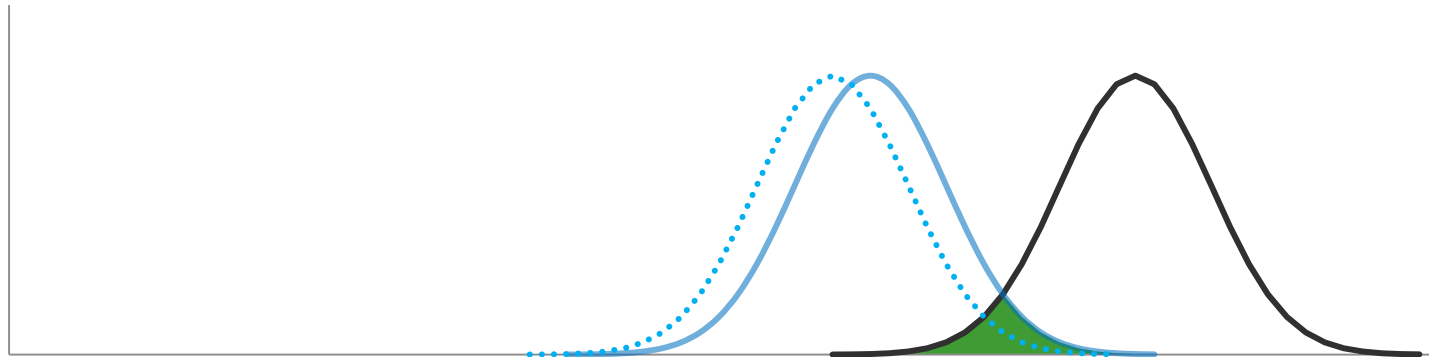
Introducing Structural Reliability Analysis



Think in terms of structural reliability

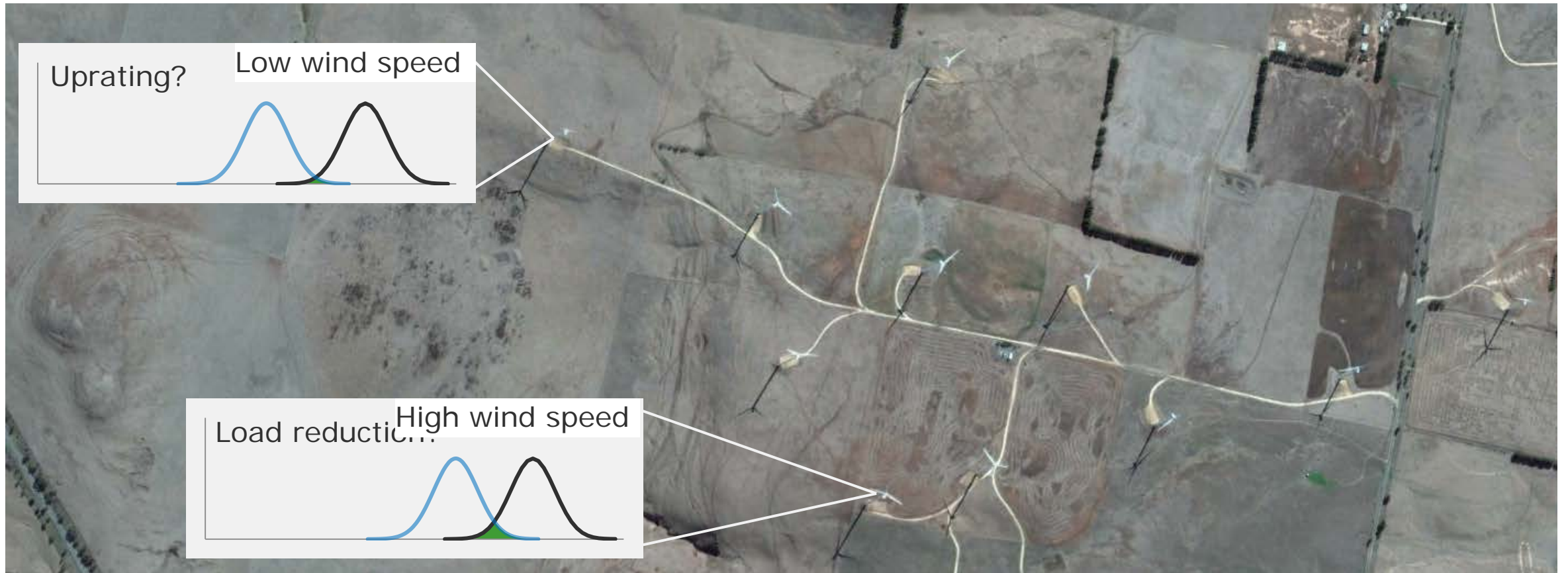


Conservative siting (low wind speeds)
Advanced controller modes (load reduction)
Wind sector management
= **reduce probability of failure**



Aggressive siting
Advanced controller modes (increase yield)
Continued operation
= **not achieving target reliability**

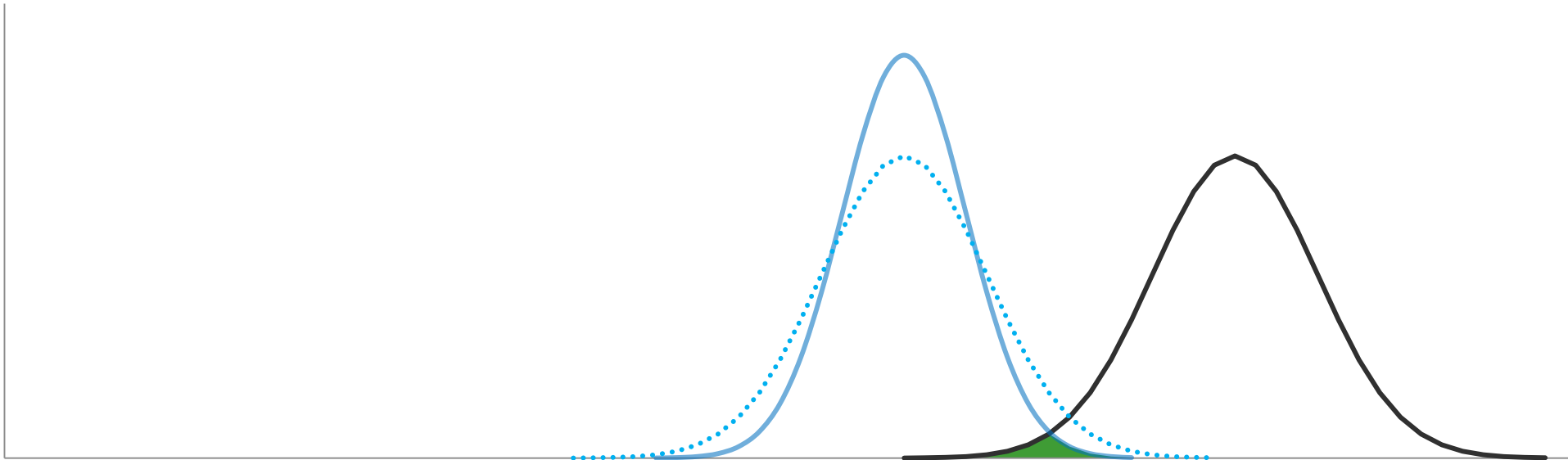
Understanding structural reliability can allow site optimisation



Source: Google Earth

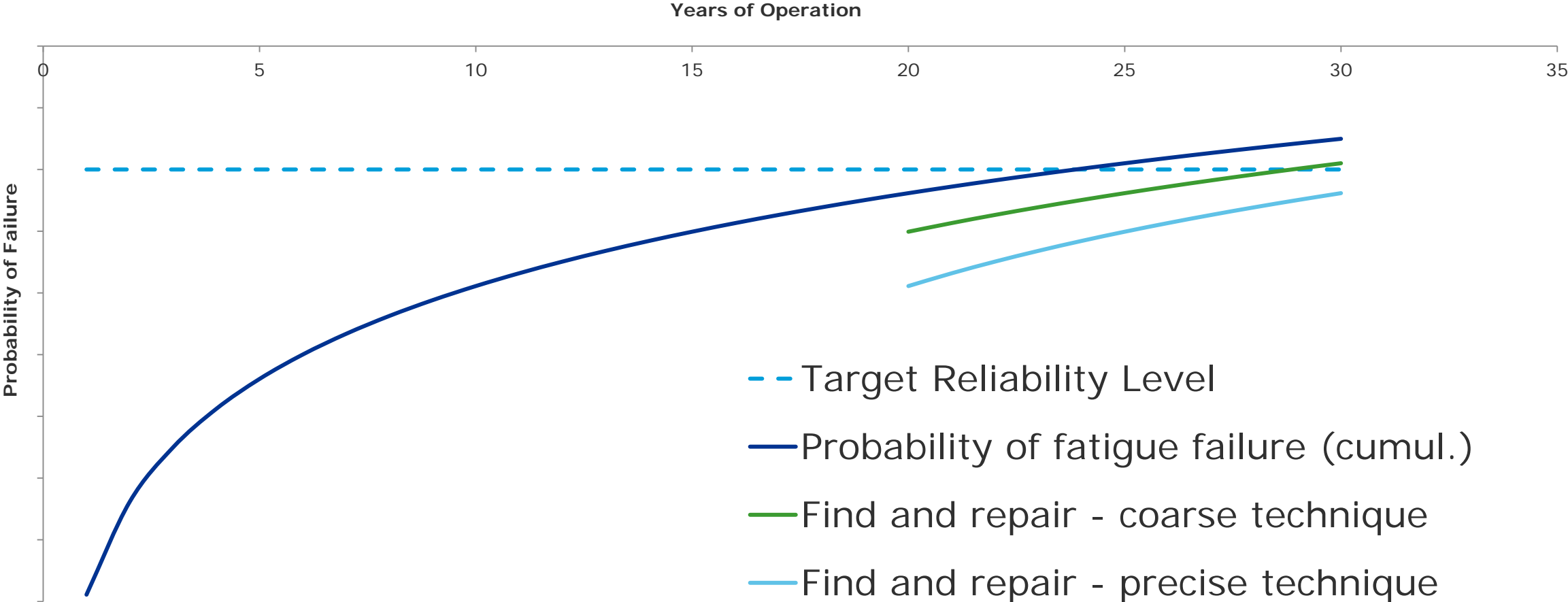
Reduce uncertainty

- Additional mast data and SCADA data
- Maintenance records
- Risk based inspections



Reducing level of uncertainty improves with higher P50 loading (longer life)

Inspections can reduce risk



What should I do



High value actions

Owner

- Use **structural reliability analysis** techniques to predict reliability levels
- Use **SCADA data** and **mast data** to update predictions and **field inspections** to reduce uncertainty
- Introduce **cost models** to optimise decisions

Developer

- Document **design margins**
- Consider **30+ year** design life for **foundations**

Purchaser

- **Escrow** design information

Thank you

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