Wind Value

An Opportunity for Climate Action and for Energy Communities

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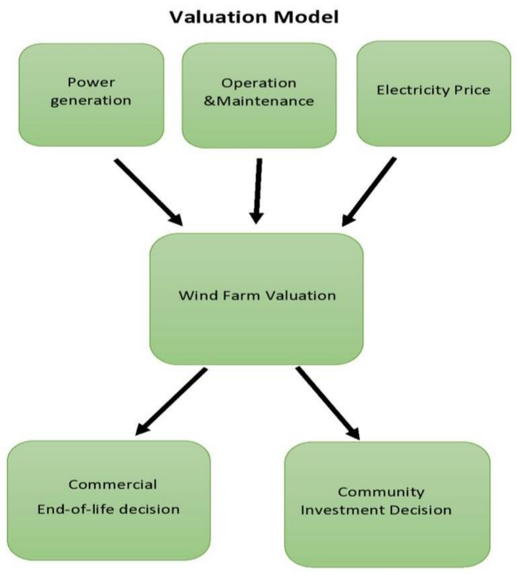
Challenge / Research Question

As wind farms age their value gradually reduces to the point where they can become a liability rather than an asset. This is because the income from recycling a used turbine is less than the cost of decommissioning. Planning for this situation means that owners must decide whether to carry out repowering, life extension or decommissioning. This decision needs careful assessment of the financial implication of these three alternatives. The Wind Value project will produce a decision support tool which wind farm owners can use to estimate the financial outcomes from these three alternatives and assess their risk profiles. The project will also investigate on the challenges of co-investment between local communities and wind farm owners.

End of life of wind a turbine → Decommissioning; Life Extension; Repowering



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Methods

We start by looking at the challenges that operation and maintenance activities cause due to uncertainty of component failures during the turbine's lifetime of 20 to 25 years. We analyse the financial risks associated with the maintenance of turbine blades, generators and gearboxes, and discuss the implications for wind energy projects.

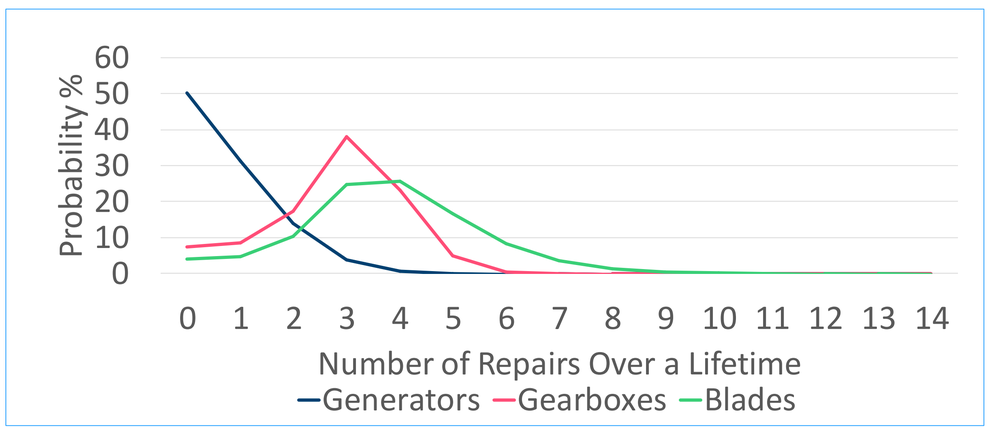
First, we analyse failures according to early, age, and random causes, we then use Monte Carlo simulations to estimate probabilities of repairs for generators, gearboxes, and blades during 20 years. Financial risk analysis involving expected repair costs is then conducted. The data used is from Lantz (2013) and Tazi et al. (2017).

Results

Generators display a high percentage of random failures; gearboxes a high percentage of age-related failures and we see a significant percentage of early failures from blades. The financial analysis shows that there is a 95% chance that a wind project could lose up to €2.7 million in gearbox replacement, €2.3 million in blade replacement and € 0.6 million for generators, per turbine, and 5% chance of losing more than these figures

Turbine Component	Age Causes of failure	Random causes of failure	Early causes of failure	Expected Losses in worst 5% of scenarios €
Generator	24%	76%	0%	577,000
Gearbox	89%	11%	0%	2,705,000
Blade	78%	6%	16%	2,315,000

There is a 50% probability that wind farms operators might not need to replace their generator during the lifetime of a wind turbine. In contrast, for gearboxes and blades, there is a 38% chance of replacing a gearbox on a turbine three times, and 25% of replacing blades 4 times



Impact / Conclusions

Recommendations: Generators – spend more on quality; Gearboxes – spend more on maintenance; Blades – spend more on maintenance and ensure they are installed correctly (and have a good guarantee from the OEM)

It is reasonably easy to estimate the failure rates and costs of component repairs. The contribution here is to provide an estimate of the risk for a 5% worst case scenario which is a useful piece of investment information. This research also estimates what are the possible underlying causes of failures and therefore what actions may be used to address them. This will enable targeted spending on the likely causes of failure.

References

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