Wind Measurements: Are they worth it?

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Intro

The economic benefit of wind measurements is often not clear. Industry best practice can help, but often the developer is left to decide how many measurements to make, and short term cash flow concerns can lead to minimal measurement campaigns that do not optimize project economics. In this example, we explore the economic value of deploying one or two buoys for a small offshore wind farm, and whether to use one or two lidar units per buoy.

Methods

In order to quantify the economic benefit of wind measurements, the uncertainty reduction of each measurement is estimated. As the uncertainty is reduced, more of the project can be financed with debt and less with equity. This creates economic value due to the lower interest rate on debt. The net benefit is calculated by subtracting the cost of each measurement. Similarly, the Benefit/Cost ratio is calculated.

Results

Figure 1 shows that each incremental measurement adds economic benefit and cost. However the benefit is much larger than the cost, so net benefit is created. Each option has similar net benefit, but two buoys and four lidar are shown to have maximum benefit. The Benefit/Cost is highest for one buoy with one lidar, but the Benefit/Cost is greater than 1.0 for all options, showing the value of additional measurements.

Discussion

The value of measurements is clearly shown in this example. Table 2 shows the assumptions for this case study. In this case, a very small (60 MW) offshore wind farm is being studied. As the size (and cost) of the wind farm increases, the economic case for additional measurements scales accordingly. In the end we find that additional measurements pay for themselves by allowing a greater debt/equity ratio and reducing financing costs.

Uncertainty Source	Mesoscale model only	One buoy, one lidar	One buoy, two lidar	Two buoys, two lidar	Two buoys four lidar
Modeling	10.0%	6.0%	5.5%	3.5%	3.0%
Wind shear	5.0%	3.5%	2.8%	3.0%	2.4%
Measurement	N/A	2.50%	1.75%	2.50%	1.50%

Table 1 Uncertainty for measurement scenarios

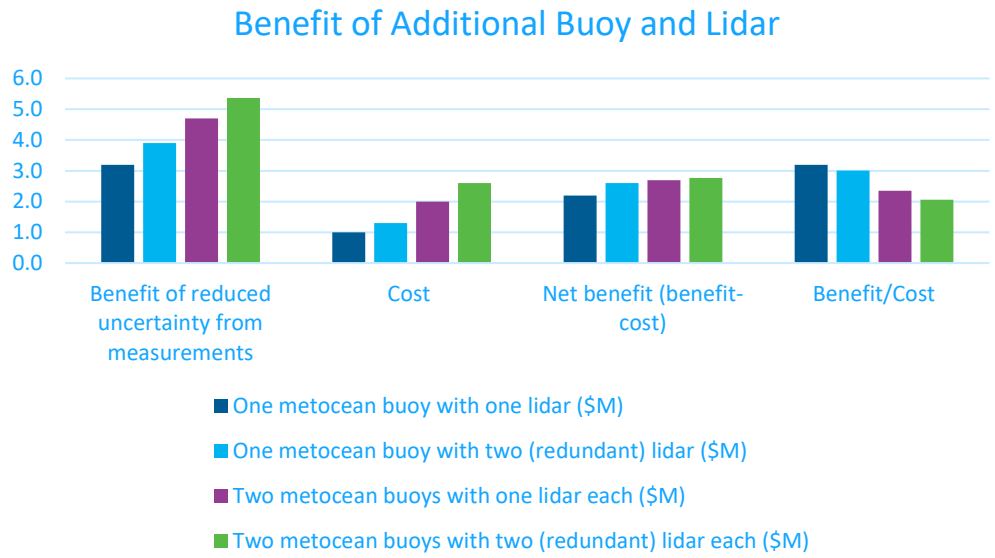

Figure 1 Benefit and cost of measurement scenarios

Project Size (MW)	60
$/MW	3,000,000
Project cost ($)	180,000,000
Finance period (years)	15
Levered IRR (Debt)	6%
Unlevered IRR (Equity)	8%
Inflation	3%
Energy/wind speed ratio	1.39
P-Value	P99
Uncertainty Ratio	2.327
DSCR	1.0
Evaluation Period (years)	1

Table 2 Project Financing Assumptions

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