PO030

Operational Bat Monitoring Data Use in Pre-Construction & Repowering Energy Estimation Simulations

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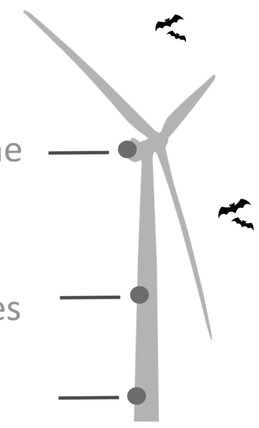
Realistic energy loss estimations can be achieved for pre-construction & repowering wind farm sites by integrating cutting-edge wildlife monitoring technologies into energy simulations.

- **Wind Farms & Wildlife Protection:** Bat environmental impact assessment requirements evolve with the maturity level of the wind energy sector. Repowering requires revisiting wildlife protection measures, as new turbines typically have larger rotor diameters and higher hub heights.

- **Bat Detection & Stop Protocols**

Tower Microphone

Nacelle Microphone



Tower Microphones

Cabinet & Ultrasound Detector at ground level

- **Stop Protocols: 5 Scenarios**

Referance Scenario	No Bat loss
Scenario A	Calendar Based (wind speed < 16.5 & Temp>0, May to October, Sunset to Sunrise)
Scenario B	Calendar Based (wind speed <6 & Temp>0, May to October, Sunset to Sunrise)
Scenario C	Active Shutdown 3 detections within 1- hour trigger a 15-minute stop.
Scenario D	Active Shutdown 3 detections within 30 minutes trigger a 15-minute stop.
Scenario E	Active Shutdown 6 detections within 1- hour trigger a 15-minute stop.

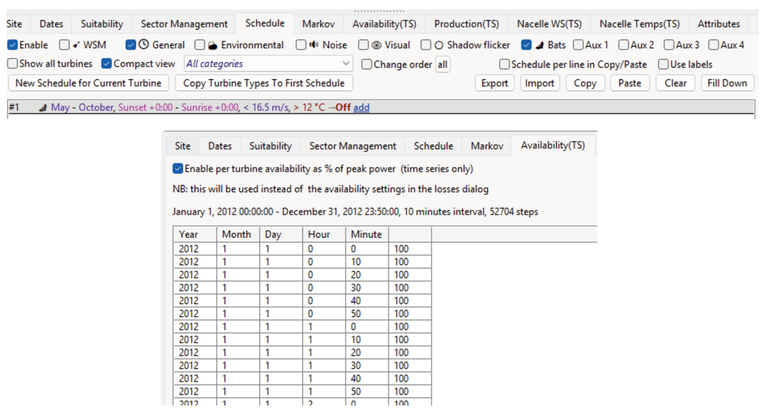
- **Simulation Set-Up & Energy Capture**

Terrain Roughness & Elevation Maps

Virtual Met Mast | Wind Resource Maps

Power Curve Turbine Layout Restrictions

Energy Production Calculation



- **Case 1**

	Loss due to Bat protection stops / Gross obtained in Case 1	% of Bat Activity Covered by Stop Protocol
Referance Scenario	0	72.5
Scenario A	14.6%	approx 99
Scenario B	0.84%	82.4
Scenario C	6.3%	90.8
Scenario D	5.3%	90.3
Scenario E	5.3%	82.4

- **Case 2**

	Loss due to Bat protection stops / Gross obtained in Case 2	% of Bat Activity Covered by Stop Protocol
Referance Scenario	0.0%	16.7
Scenario A	16.1%	approx 99
Scenario B	1.2%	47.4
Scenario C	5.8%	99
Scenario D	5.3%	99
Scenario E	5.5%	97.7

- **Conclusions**

In many regions, bat activity occurs between May and October, primarily during nighttime. Shutting down turbines during bat-active months is a mitigation solution against collision risk, but it leads to energy losses. This study presents how to model dynamic bat detection data (can be obtained from operational site) within the energy estimation process for repowering analysis. The importance of flexibility in updating energy loss estimations using new data sources and technologies is well recognized, particularly for producing bankable energy reports and modeling the minimization of environmental impacts throughout a project's lifecycle. Incorporating cutting-edge wildlife monitoring technologies, such as bat monitoring systems, enables more effective shutdown protocols. These dynamic approaches benefit both wildlife protection and wind turbine availability, offering a superior alternative to static, calendar-based shutdown schedules.

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