ADAPTIVE MANAGEMENT SCENARIOS TO ADDRESS IMPACTS TO BATS AT PROPOSED WIND FARMS

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Introduction

Wind has been shown to be one of the least overall environmentally detrimental forms of commercial energy production.

Impacts of wind turbines on bats has received a lot of attention. However, little is known about the cause or magnitude of effects of wind farms on bats, but bat mortality is relatively high at some sites. Concern for bats, coupled with a lack of information is hindering wind energy policy & management decisions.

Bottom line… we need to conserve bats and increase renewable power generation.

There is a clear need to bring bat conservation and energy production into the same conversation. In order to do that, a common understanding of terms, issues and technical concepts is needed.

How do we reconcile, in a timely manner, the conflicting need for renewable energy and conservation of bats? Through the **Adaptive Management** process.

Adaptive Management

- Works when there is inherent conflict and goals can clearly be stated
- Can be initiated with minimal empirical data
- Learn as you go
- Corrections until you reach an agreed to endpoint (the devil's in the details…)

We've developed **Adaptive Management Scenarios (AMS)** to predict and compare the impact of various bat conservation requirements on wind power production and revenue.

BHE's Fictitious "Demo" Wind Farm

- Relatively flat, agricultural setting
- Wind data from 90m tall-tower study
- 100MW nameplate capacity
- GE 1.5 MW turbines
- Turbine layout optimized for number, terrain and wind resource
- $0.054/kwh (low retail rate)
- Capacity factors calculated with WindPRO® computer modeling

Adaptive Management Parameters Modeled

Cut in wind speed

- 4.0 m/s to 9.0 m/s
- All wind speeds

Seasonal Mitigation Period

- 15 Aug – 30 Sep ("A")
- 1 Jul – 31 Oct ("B")
- 1 Apr – 15 May and 15 Aug – 30 Sept ("C")
- 1 Apr – 30 Nov ("D")
- 15 Jul – 15 Sept ("E")

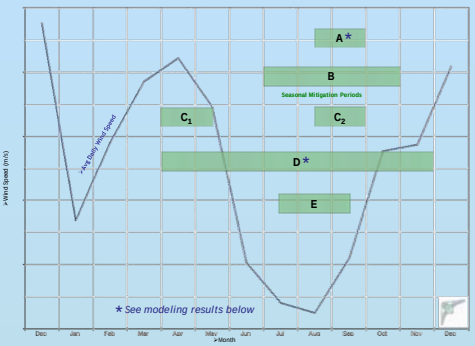
Time of day

- Civil sunset ("CSS") to CSS plus 4 hrs ("CS4")
- CS4 + Civil sunrise ("CSR") minus 2 hrs to CSR ("CS4CR2")
- CSS to CSR ("Dark")

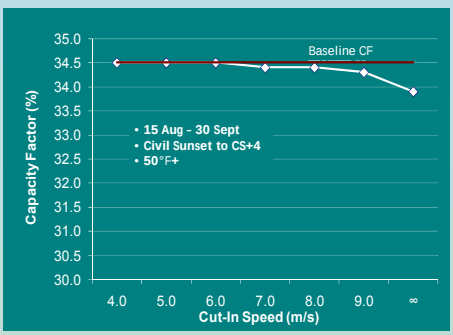
Temperature

- only above 50°F

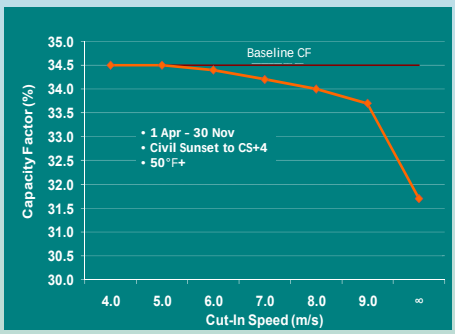
Average Daily Wind Speeds and Seasonal Mitigation Periods



Capacity Factor vs. Cut-in Speed Season "A"



Capacity Factor vs. Cut-in Speed Season "D"

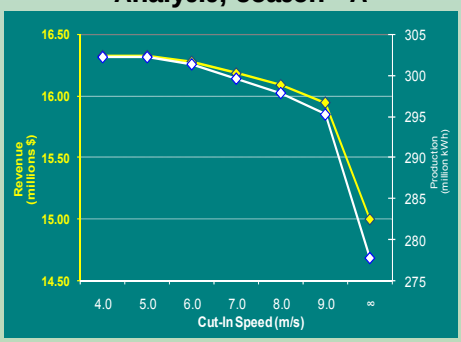


Other AMSs

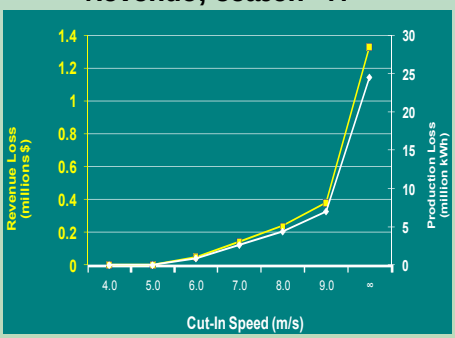
- CF as a Function of Cut-In Speed for other Seasons
- Seasonal Series (Cut-In, Time of Day and Temperature constants)
- Time of Day Series
- Other Parameters (e.g., barometric pressure, rainfall, storm events)

A variety of **AMSs** can be run for comparison, for example:
AMS1 = 4.0-A-CS4-50+
…
AMS9 = 7.0-D-Dark-50+

Revenue and Production Analysis, Season "A"



Effect on Power Production and Revenue, Season "A"



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