BATS AND WIND ENERGY COOPERATIVE: 2008 WORKSHOP PROCEEDINGS

BWEC
bats and wind energy cooperative

Sponsored by Bat Conservation International,
National Renewable Energy Laboratory, the American Wind Energy Association,
and U.S. Fish and Wildlife Service

January 8-10, 2008

Report Prepared by
Energetics, Incorporated

Lake Benton II Wind Site, Minnesota.
Photo Courtesy of FPL Energy.

Bat Conservation International
www.batcon.org

NREL

American Wind Energy Association

U.S. Fish & Wildlife Service

Disclaimer

The views and opinions do not necessarily state or reflect those of the U.S. government, any agency thereof, or BWEC. Priority research actions may be addressed by BWEC or one of its partners. For further details about the BWEC research agenda, please see www.batsandwind.org.

Table of Contents

Chapter 1. Introduction

The Bats and Wind Energy Cooperative (BWEC) is an initiative sponsored by Bat Conservation International (BCI), the U.S. Fish and Wildlife Service, the American Wind Energy Association (AWEA), and the Department of Energy's National Renewable Energy Laboratory (NREL).The objectives of BWEC are to build a scientific understanding about why bats collide with wind turbines and to develop mitigation strategies that reduce potential risks to bat populations. Following the first scientific workshop in February 2004, BWEC shaped a research agenda and conducted field research on pre-construction studies, post-construction fatality monitoring, and deterrent technologies. The management structure of BWEC consists of a Program Director, an Oversight Committee (the founders mentioned above), a five-member Scientific Advisory Committee and a Technical Committee that includes state and federal agencies, private industry, academic institutions, and non-governmental organizations. BWEC meetings and workshop are facilitated by Energetics Incorporated (A full list of individuals is provided in Appendix A).

On January 8th, 9th, and 10th, some of the world's leading bat scientists from the U.S. and Europe, wind industry and federal and state resource agency representatives came together in Austin, Texas, for a workshop to share information about what we know today and what we need to know in the future about bat mortality at wind turbines. The workshop, sponsored by the four founders of the Cooperative, had almost 50 participants in attendance (see Appendix A). Participants are hopeful that this collaboration will yield solutions that support the continued growth of wind energy production in concert with bats & their habitats.

The purpose of the workshop was to:

- Determine the current state of knowledge by identifying potential risks, gaps in knowledge and future directions for bat and wind energy research conducted by BWEC and other research groups in North America and Europe.
- Maximize dialogue between subject matter experts.
- Develop preliminary research plans focusing on knowledge gaps that are essential to solving the greatest risks.

The workshop was not intended to make decisions about specific project proposals or who implements and finances the potential solutions. The expected outcomes of the meeting were:

- A brief report about the state of knowledge and relevant technology based on research by BWEC and others to address the problems identified at the 2004 Workshop.
- An action plan and a list of potential technical solutions best suited to address the defined problem and near term priorities for a BWEC research agenda.

This document is a summary of the workshop proceedings, including the comments and ideas captured during the facilitated sessions and a list of next steps, grouped by priority research tasks.

The workshop began with a participant from the wind energy industry providing a brief overview of wind energy project development and how research results may be incorporated into operational requirements. The rest of the workshop relied on panel presentations on technical topics followed by facilitated discussions on potential significant risks, knowledge gaps, and the near-term action items needed to address these gaps. Facilitation questions, outlined in the agenda (see Appendix B), were used to encourage dialogue on the four topics discussed:

- Post-Construction Monitoring and Risk Assessment
- Pre-Construction Risk Assessment Methods
- Operational Mitigation Studies and Deterrent Research
- Evaluation of Population Parameters and Modeling

For each topic, a panel of experts gave presentations on their research methods and results to date. Following each set of presentations on a topic area, the facilitator posed focus questions and led the group in a discussion to explore the most up-to-date information available. All participants, including industry and agency observers, provided ideas and responses which were collected in real-time on an electronic storyboard. A summary of these discussions are summarized as "Results of the Facilitated Discussion" with a list of issues raised. These lists are provided for background information only and are not intended as a comprehensive list of priority actions for each research topic. The lists are intended to give an overview of a number of the major risks and challenges facing BWEC and their research partners. The questions used to facilitate discussions on the four topics listed above were as follows:

- What are the most significant risks and knowledge gaps?
- What can be done to address the most significant risks and knowledge gaps? What tools, technologies, and protocols are needed to address the solution?

On the morning of the third day, the participants were divided into four breakout groups, one for each topic area, based on their relevant expertise. Each breakout group was tasked with prioritizing next steps for their appropriate topic area using a research plan template. After the groups finished developing their research priorities, one representative from each topic area breakout group presented the group's findings to all attendees. The research plan templates focused on the following questions:

- What are the immediate next steps associated with implementing the top priority actions/solutions?
- What are the defined tasks, schedules, and involved parties?

The priority research tasks developed at the concluding breakout session as well as the list of risks and knowledge gaps developed at the plenary sessions were submitted for critical review and revised by the BWEC Science Advisory Committee following the workshop. The "priority research tasks" for the four topics are prioritized within each topic area, and offer specific recommendations for BWEC's consideration in their research planning and management activities. The tentative BWEC Work Plan can be found in Appendix C. The Oversight Committee and the Project Coordinator will consider these recommendations for the 2008-2009 research seasons and continue to collaborate with other partners.

Chapter 2. Operational Mitigation Studies and Deterrent Research

A. Priority Research Tasks

Priority Action	Key Technical Tasks	Performers/ Partners	Key Milestones/ Schedule	Resources/ Funding	Immediate Next Steps
1. Develop a study plan and experimental designs for -operational mitigation and -deterrent research	Prepare plan & have reviewed by Science Advisory Committee	BWEC & cooperative scientists	Draft ASAP	About $10K needed	Implement curtailment experiment ASAP Put team & schedule together
2. Conduct mitigation experiments at multiple sites	Standardized protocol Range of geographic locations including high mortality and species	BWEC & cooperative scientists	Ideal Study - one large wind farm with control, deterrent, and feathering treatments.	TBD	Need to recruit industry partners
3. Begin or continue field trials of existing deterrent device (with fatality searches)	Develop proposal		Proposal this spring; field work this summer/fall	TBD	Limit use of thermal imaging cameras to remove problem of reviewing extensive footage
4. Conduct economic analysis and financial assessment of mitigation (What are the costs to industry?)	Use study data to perform financial analysis	Industry analysts		TBD	Need to recruit industry partners

B. Results of the Facilitated Discussion

i. What are the most significant problems and issues with the current techniques and research?

Operational Mitigation Studies

Limited data on the efficacy of mitigation through operational changes (feathering, changing cut-in speed, and curtailing operations)

- Limited data on the costs of feathering, changing cut-in speed, and curtailing operations

Deterrent Technology (Ultrasonic Deterrent)

- First results appear to be positive for the deterrent technology because the experiment worked in lab and it appears to have worked in the field; however, there is a need to finish analyzing existing data on deterrent trials conducted before results are confirmed
- Not certain whether the most effective location for posting deterrents is on the wind turbine blades or towers.
- Other Challenges:
  - If operational adjustments to nacelle are required, lift rental is very expensive
  - Unclear how to ensure deterrent's sound coverage is reaching full wind turbine airspace; full airspace coverage may require deploying deterrents on multiple poles around turbines
  - Unclear if manufacturers will be receptive. Manufacturers may agree to nacelle-mounted deterrents assuming small size, limited drag. Nacelle-mounting is also more practical due to turbine yaw
  - Are deterrents easily maintained?
- Long term effects are unclear
- Deterrents may affect human hearing; would have to turn off during maintenance
- Should other noises be pursued beyond existing technology?
  - Possible synergistic effects on other wildlife;
  - Mass deployment would require complex research on other effects (although currently has a small range of affect as ultrasonic sounds dissipate and should limit problems);
  - Biotic sounds could be more problematic, audible to more organisms

ii. How do we address the problems and issues related to mitigation research?

Operational Mitigation

- Conduct trials of mitigation strategies with operational changes
- Develop cost/benefit comparisons between deterrent technology and mitigations, e.g., feathering; determine if one or both work
    - The more successful an option, the better it is for the funders, industry, etc.; the more successful (and timely) the mitigation technique, the better it is for the bats
    - The industry perception may be that deterrents are equal to capital investment and feathering is equal to lower project revenues. Of these two options, capital investment is preferred because they are predictable, fixed costs.
- Assess effectiveness of mitigation strategies including effects of feathering, changing cut-in speed and curtailing operations
- Develop software for blade feathering or other mitigation strategies
    - Ease of implementation varies by manufacturing company; there may be warranty issues
    - Can shut off parts of project or whole project (if not able to alter cut-in speed)
- Current industry focus is on lower-wind sites; how will this affect operational strategies?

Deterrent Technology

- Determine which is more effective - posting deterrents on wind turbine blades or towers. (With more data on bat flight patterns, deterrents may be able to be placed more strategically on turbines)
- Could expand deterrent tests in Europe to have broader field experiments
- Resist “siren song” of the “magic bullet” – approach deterrent research with caution (Deterrents are an attractive solution because they could be a quick fix, but they may not reduce bat mortalities at all)

Chapter 3. Post-Construction Studies

A. Priority Research Tasks

Priority Action	Key Technical Tasks	Performers/ Partners	Key Milestones/ Schedule	Resources/ Funding	Immediate Next Steps
1. Develop fatality monitoring protocol	Searcher efficiency, search intervals, etc.	BWEC staff and Science Advisory Committee	Spring 2008	BWEC	Science Advisory Committee coordinate
1.a. Make protocol available to a wider audience	Publish on website, press release, and target state agencies	BWEC and agency partners	Ongoing		
2. Expand and continue mortality studies	Follow accepted protocols Various geographic locations		Start in 2008	Various sources	Identify sites and industry partners

B. Results of the Facilitated Discussion

i. What are the significant risks and knowledge gaps?

- Substantial uncertainty exists as to the population impacts of bat mortality and barotraumas from interaction with wind turbines
- There is a need for consistent data (and standardized protocol) to use for modeling
  - How to meet sample sizes/ statistical requirements and develop consistent data
- Similarly, there are geographic knowledge gaps in types of species, habitat, and fatalities
- Need evidence on whether there is a link between pre-construction activity and post-construction mortality
- Need information regarding variations in the timing, weather and topography of collision events (see WV)
- Need to assess the threat and impact from barotraumas; validate or negate this new hypothesis.
  - Bat necropsy may help establish possible cause and magnitude of problem; e.g., stomach contents
- Do strike detectors provide an accurate representation of the number of bat deaths? Are there bat deaths resulting from barotraumas (which are not indicated by strike detectors)?
  - Strike detectors are sensitive microphones at the base of a wind tower that are able to determine when and where animals are striking the turbine (at Maple Ridge site there is work ongoing with NJ Audubon Society)
- There is a need for a strategy to integrate research results into future siting decisions (i.e. when is further study required? when should a project be discontinued?)
- Knowledge gaps exist about the effects of exposure risk due to:
  - High bat concentrations
  - Species-specific behavior and how this contributes to risk
- There is a lot of uncertainty about the effects (if any) of residential scale wind turbines
- Lack of documentation and understanding by the general public on other impacts on bats

ii. What can be done to address these significant risks and knowledge gaps?

- Evaluate relationship between pre-construction surveys and post-construction mortality
- Determine the level of effort, sample sizes and other protocol required for accurate assessment and consistent data.
- Fill in geographic knowledge gaps
  - Strategic vision for filling in knowledge gaps; determine where gaps are; do holes exist in an area or not?
- Develop minimum standards for post-construction mortality studies
- Assess mortality in relation to weather and topographic variables
- Reassess mortality rate in light of potentially skewed estimators (see M. Huso presentation)
  - Develop better estimates and understanding of significance to population
- Develop database of studies
  - Accessible via internet; Canadian Wildlife Service is working on this (though there are attribution concerns)
  - Sensitivity to confidentiality is also an issue.
- Use post-construction monitoring to evaluate population impacts (which members of species are impacted? Young? Old? Male? Female?
- Utilize dead bodies in a variety of ways to help assess migratory patterns over the landscape
- Work with strike detectors to determine when and where bats are striking rotors. Assess efficacy of strike detectors in relation to potential barotrauma-related deaths
- Provide bats to central repository for analysis (See Population Analysis, Chapter 5)
- Determine sites with lowest risk to wildlife
- Publish information to address lack of information on other human-induced impacts

Chapter 4. Pre-Construction Studies

A. Priority Research Tasks

Priority Area	Key Technical Tasks	Performers/ Partners	Key Milestones/ Schedule	Resources/ Funding	Immediate Next Steps
1. Validate efficacy of pre-construction studies by correlating pre- & post-construction data	Replicate studies over a wider geographic and temporal range	BWEC identifies sites with industry and other partners	By spring 2008, identify key regions/sites/partners	BWEC and industry partners	Find additional sites and continue ongoing studies
2. What is the best way to compare and develop techniques?	Employ multiple methods simultaneously (e.g., radar, thermal, and acoustic methods). Exploring new pre-construction techniques.	BWEC, technique experts, universities; bring in new players	Proceed with all methods on one site as soon as funding and site availability allow.	BWEC and industry partners Expensive	Pick existing BWEC site

B. Results of the Facilitated Discussion

i. What are the significant risks and knowledge gaps?

- Is there a correlation between pre-construction surveys and post-construction mortality?
- How does one identify financial risk or uncertainty before construction and potential mitigation requests
  - There is a lack of threshold values for decision points in development and with correlation to mitigation techniques
- Are bats attracted to turbines and, if so, how will that affect pre-construction monitoring?
- Lack of ability to easily compare data or meet a minimum standard
- No consistent methodology for representative sampling of study sites
- Are there species-specific risks? (behavior)
  - Ability to tailor detection technology to species most at risk
- Fill in geographic gaps throughout North America (southwest, other areas)
  - Where and what are the data gaps? (Where do we have reliable information?)
- No region-specific study or technology protocols (radar, acoustic)
- Need more information on timing, weather and topography of migration
- Is risk affected by increased exposure?
  - Results of activity around areas of high bat concentration
  - Species specific behavior and contribution to risk
- Unknown what species and habitats are most likely to be affected
- Lack of vetting and sharing of study plans

ii. What can be done to address these significant risks and knowledge gaps?

- Combine and evaluate different technology methods in a variety of habitats and geographic areas
- Improve access to existing sites for fatality studies (has been problematic at times)
  - Recognize companies which cooperate and positively acknowledge companies involved in BWEC.
- Create “No-fault” follow-through policy to allow companies to learn from pre-construction and post-construction studies.
  - Policy could be similar to voluntary cooperative agreement in Pennsylvania – which includes details on liability, minimum protocols
- Learn more about bat behavior to inform decisions; including evaluating potential bat/turbine attraction.
- Determine why migratory tree bats collide with wind turbines.
- Develop technology alternatives for pre-assessment studies (e.g., acoustic monitoring isn’t always effective as echolocation calls of long-nosed bats are difficult to detect)
- Navigate agency requirements and provide meaningful results
- Circulate bat habitat data at beginning of process (before investment)
- Develop improved probabilistic estimates to differentiate birds and bats.
- Geospatial Patterns of Affected Species - Assemble and generate data with help from Universities and GIS people. (Activity is being discussed by American Wind Wildlife Institute (AWWI) and National Audubon Society.)
- Incorporate geo-referenced data into regional and national spatial database (GIS, etc)
  - Topographic, water sources, weather event, radar data
  - GIS analysis could inform pre-siting decisions (data available in NY)
  - Keep in mind potential variability of bat colonies (bats move, data can get out of date quickly)
  - Continued incorporation of data from large radar (southwest and other locations)
  - Utilize pre-existing data (low-cost) on high-risk biological sites vs. pre-construction data

Chapter 5. Population Analysis

A. Priority Research Tasks

Priority Action	Key Technical Tasks	Performers/ Partners	Key Milestones/ Schedule	Resources/ Funding	Immediate Next Steps
1. Genetic studies on determining effective population size	Protocols for sampling genetic & isotope data Calibrate estimates of actual population to effective population relative to the total Develop appropriate markers	State agencies for permitting All project contractors	Obtain short term Ne Come up w/ estimates Creation of centralized collection and protocol guidelines/ document	NSF? BWEC (samples) AWEA Federal Agencies?	RFP Distribute materials (biopsy kits, etc) to appropriate folks
2. Data collection- Estimating Population Size/Trend	Density estimates- (HSM) Establishing long-term (i.e. 10 yrs) consistent post-construction monitoring – Kill rates = Counts Calibrate Actual (Nc) to effective (Ne)	Consider releasing a Request for Proposal (RFP)	Come up w/ estimates Creation of geodatabase of existing information	BWEC AWEA Federal Agencies? In-kind federal and state, plus collaborations	Identify appropriate funding and partners? Draft RFP Solicit proposals

B. Results of the Facilitated Discussion

i. What are the significant risks and knowledge gaps?

- Lack of population size estimates complicates determination of significant losses and risks
  - Do not know the significance of mortality and/or the effects of mortality on total population
  - How to estimate cumulative impacts of wind development
- Need better understanding of bat migration (determining local vs. migratory populations)
- What data is already available?
  - Survival estimates or unbiased kill rates from other species
- Develop protocols for dealing with collected carcasses
- Unclear if effective population size can be used to monitor population trend over the coming decades

ii. What can be done to address these significant risks and knowledge gaps?

- Develop baseline for populations and quantify uncertainty
  - Develop indices of population size to define significant losses, etc.
- Employ genetic methods for assessing population structure
  - Determine if populations are well-mixed or do they show geographic structure?
  - Define effective (Ne) and actual (Nc) population sizes of the affected species
    - Calibrate Ne to Nc using species like Myotis grisecens, Myotis sodalis, Corynorhinus townsendii, Rhinolophus ferrumequinus (species for which we have population estimates and genetic data)
- Need sensitivity analysis to determine if effective population size can be used to monitor population trend over the coming decades
- Review of available information from Tom Kunz's synthesis of migratory tree bats (Fecundity estimates?)
- Designate a central repository for population analysis (American Museum of Natural History?)
  - Develop protocols for dealing with collected carcasses; Send to Nancy Simmons, central depository, etc.
  - Determine what level of precision is needed (in relation to total population impacts)?

- Use Count Data sources for Estimating Population Trends
    - Kills = Counts for Count Based PVA; acquire spatial replication through commitment for multiple years at same sites to collect carcass counts; May need to use sites that aren't built yet to get industry support
    - Determine if rabies collection data would contribute to this assessment.
- Get Density Estimates of Roosting Red Bats, then coupling with GIS and Habitat Suitability Models to get rough estimate of population size exposed to turbines (Area of Susceptibility). Density estimates provide information on bat distribution while mortality events are not occurring when bats are evenly and predictably distributed.

Appendix A. Final Participant List

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Appendix B. Agenda

BATS AND WIND ENERGY COOPERATIVE (BWEC)

Sponsored by Bat Conservation International, U.S. Fish and Wildlife Service, National Renewable Energy Laboratory, and the American Wind Energy Association

January 8 – 10, 2008
Radisson Hotel on Town Lake
111 Cesar Chavez at Congress , Austin Texas 78701 , USA

Agenda

Purpose and Objectives

- Determine current state of knowledge by identifying potential risks, gaps in knowledge and future directions for bat-wind energy research conducted by BWEC and other research groups in North America and Europe.
- Maximize dialogue between subject matter experts.
- Develop preliminary research plans focusing on knowledge gaps that are essential to solving the greatest risks.

Background Materials: http://www.energetics.com/BWECWorkshop2008/index.html

Afternoon of Day One – Tuesday, January 8, 2008

1:00 pm – 1:30 pm	**Welcoming Remarks and Overview**
1:00 pm – 1:10 pm	Opening remarks from Bob Thresher, NREL
1:10 pm – 1:30 pm	Bonnie Ram from Energetics Incorporated will serve as the facilitator and review the agenda and afternoon activities
1:30 pm – 1:45 pm	Integrating Research Results into Wind Plant Siting, Sam Enfield, PPM Energy

1:45 pm – 3:15 pm **Expert Panel: Post Construction Monitoring and Risk Assessment**

Ed will provide a brief overview presentation (5 min) and will lead panelists in discussion. Each panelist (*) will have 15 minutes to present findings.

Panel Participant	Presentation title
Ed Arnett, BCI	BWEC research and patterns of bat mortality at wind sites
Robert Barclay, University of Calgary*	Bat fatality and curtailment experiments in Canada
Lothar Bach, Freilandforschung*	Summary of bat fatalities in Europe
Oliver Behr, University of Erlangen –Nuremberg*	Acoustic monitoring studies and curtailment experiments in Germany
Manuela Huso, Oregon State University*	Fatality estimators and findings from statistical simulations

3:15 pm – 3:30 pm **BREAK**

3:30 pm – 5:30 pm **Facilitated Discussion: Post Construction Monitoring and Risk Assessment**

The facilitator will lead a discussion on what has been learned from post-construction studies and will pose two focus questions to be addressed.

3:30 pm – 4:15 pm What are the most significant ***risks and knowledge gaps***, data needs, and limitations with regard to post-construction studies?

4:30 pm – 5:30 pm What can be done to address the most significant risks, knowledge gaps, and/or challenges? What tools, technologies, and protocols are needed to address the solution?

5:30 pm – 5:45 pm **Wrap-Up**

5:45 pm Adjourn

5:45 pm – 6:45 pm **Happy Hour (Cash Bar)**

6:45 pm **Dinner on your own (Oversight Committee Working Dinner)**

Day Two – Wednesday, January 9, 2008

8:30 am – 9:00 am **Coffee and Recap of Day One**

9:00 am – 10:00 am **Expert Panel: Pre-Construction Risk Assessment Methods**
Ed will provide an overview presentation and will lead panelists in discussion. Each panelist (*) will have 15 minutes to present findings.

Panel Participant	Presentation title
Ed Arnett, BCI*	Pre-construction acoustic monitoring studies in the U.S.
Ron Larkin, Illinois Natural History Survey*	Pre-construction radar studies at wind facilities
Robert Brinkmann, Leibniz Universitat Hannover*	Pre-construction monitoring at wind facilities in Germany and other European countries

10:00 am – 12:00 pm **Facilitated Discussion: Pre-Construction Risk Assessment Methods**
The facilitator will lead discussion on what has been learned from pre-construction studies and will pose focus questions to be addressed.

10:00 am – 10:45 am What are the most significant ***risks and knowledge gaps***, data needs, and limitations with regard to pre-construction studies?

10:45 am – 11:00 am **BREAK**

11:00 am – 12:00 pm What can be done to address the most significant risks, knowledge gaps, and/or challenges? What tools, technologies, and protocols are needed to address the solution?

12:15 pm – 1:30 pm **Lunch: Presentation by Ingemar Ahlen, Swedish University of Agricultural Sciences**
Ingemar Ahlen will present a review of ongoing and completed studies at offshore wind facilities (30 min.).

1:30 pm – 2:30 pm **Expert Panel: Deterrent Research and Preliminary Findings**
Ed will provide an overview presentation (5 min) and will lead panelists in discussion. Each panelist (*) will have 20 minutes to present findings.

Panel Participant	Presentation title
Ed Arnett, BCI	BWEC and Humbolt State University collaboration
Mark Jensen, Binary Acoustic Technology	Binary Acoustic Technology
Joe Szewczak, Humboldt State University*	Lab and field tests of acoustic deterrents
Jason Horn, Boston University*	Results of thermal imaging deterrent experiments

2:30 pm – 3:30 pm **Facilitated Discussion: Deterrent Research and Preliminary Findings**

2:30 pm – 3:00 pm What are the most significant problems and issues with existing deterrent research?

3:00 pm – 3:30 pm What can be done to address the most significant problems and issues with deterrent research?

3:30 pm – 3:45 pm **BREAK**

3:45 pm – 4:30 pm **Expert Panel: Evaluating Population Parameters and Modeling**

Panel Participant	Presentation title
Winifred Frick, Central Coast Bat Research Group	Modeling population dynamics of bats (20 min.)
Maarten Vonhof, Western Michigan University	Genetic analyses of bat populations (20 min.)

4:30 pm – 5:00 pm **Facilitated Discussion**
Facilitator will lead a discussion on future needs for evaluating population impacts and modeling bat population dynamics.

5:00 pm - 5:15 pm **Wrap-Up & Adjourn**

6:30 pm **Group Dinner**

Day Three – Thursday, January 10, 2008

8:30 am – 9:00 am **Recap and Outline of the Day Ahead**

9:00 am – 10:30 am **Breakout Groups to Develop Preliminary Research Plans**
The group will split up into four groups and each will be asked to create a preliminary research plan for BWEC for the different areas of research --- pre- and post-construction studies, deterrents and population modeling.

10:30 am – 10:45 am **BREAK**

10:45 am– 11:45 am **Breakout Groups Reconvene to Report Results**
Each group will spend fifteen minutes reporting on their discussion.

11:45 am – 12:00 pm **Facilitated Wrap-Up**
This discussion group will summarize the main points of the two days of discussion and will compare their results to BWEC's existing research agenda.

12:00 pm – 12:15 pm **Wrap-up and Final Thoughts**
Members of Oversight Committee provide closing comments.

12:15 pm **Adjourn**

Appendix C. BWEC Tentative Work Plan for 2008

(revised by Ed Arnett, January 2008)

Program Administration

Objectives: The duties of the Program Coordinator and Administrative Assistant include, but are not limited to: 1) administering all activities of the BWEC; 2) facilitating actions of the scientific and technical advisory committees; 3) conducting and monitoring research on the influence of wind turbines on bats; 4) ensuring scientific peer-review of protocols, research proposals, and other related documents as needed; 5) disseminating information among BWEC partners and diverse audiences; 6) coordinating workshops and symposia as needed to disseminate information and/or facilitate training; 7) preparing annual reports, popular articles, and peer-reviewed/refereed publications as needed; 8) managing program budgets and fundraising.

Schedule / Deliverables:

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Steering Committee Conference Calls	■			■			■			■		
Progress Updates	■			■			■			■		
BWEC Technical Experts Meeting	■											
Conference Call with Committees			■									
Conference Call with stakeholders												■
Budget update and review			■							■		

BWEC Tentative Work Plan for 2008 (continued)

Existing Pre-/Post-construction Studies:

Two proposed sites will be monitored with acoustic detectors in 2008; one in Massachusetts (Hoosac) and one in Pennsylvania (South Chestnut). We will initiate the first year of post-construction fatality searches at the Casselman site in Pennsylvania in 2008 beginning in April; we also will continue acoustic monitoring at this facility.

Objectives: 1) Determine activity of different bat species groups using proposed wind facilities prior to and after construction; 2) Determine if indices of pre-construction bat activity can predict post-construction bat fatalities from data gathered at multiple proposed wind facilities; 3) Evaluate temporal and spatial (both horizontal, i.e., sampling points across the turbine string, and vertically, i.e., multiple detectors at each sampling point at different vertical heights) patterns of variability of bat species group activity located across the wind facility; 4) Correlate bat activity prior to and after construction with weather conditions, fog, and other environmental variables; 5) Evaluate patterns of post-construction bat mortality in relation to weather conditions, fog, and other environmental variables and assess the predictability of mortality based on these factors; 6) Evaluate study design, temporal and spatial variation, and sample size requirements and offer suggestions for standardizing protocols for future acoustic detector studies.

Schedule and Deliverables:

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Acoustic monitoring												
Fatality Searches												
Curtailment Experiment? (Negotiating at present)												
Call Identification												
Data Analyses (2009)												
Progress Reports												
Annual Report (2009)												

BWEC Tentative Work Plan for 2008 (continued)

Deterrent Study:

Objectives: 1) Conduct field tests of the efficacy of deterring devices for reducing bat fatalities at active wind turbines. 2) Design the next generation prototype deterrent device that has increased power output, internal programming and broadcasting capabilities, and a weatherproof casing;

**Based on discussions at the BWEC technical workshop in January, we will develop a detailed action plan for deterrent research to be completed by April 2008, and will continue research based on council from the Scientific Advisory Committee and priorities that are set forth, available funding, and direction from the Oversight Committee.