

RESEARCH NEEDS TO SUPPORT AVIAN/BAT ASSESSMENTS AND MITIGATION AT WIND FACILITIES IN CALIFORNIA

PIER-EA STAFF WORKSHOP #1 SUMMARY NOVEMBER 2, 2006

I. Introductions, Workshop Objectives and Agenda Review

Linda Spiegel of the California Energy Commission (CEC)'s Public Interest Energy Research Program – Environmental Area (PIER-EA) welcomed attendees and reviewed housekeeping items and web cast participation protocols. Ms. Spiegel then introduced Paul De Morgan, Senior Mediator with RESOLVE, as the session facilitator. Mr. De Morgan initiated a round of introductions and reviewed the agenda, meeting objectives, and ground rules.

It was noted that the scoping workshop objectives included reviewing, clarifying, and prioritizing a draft list of research needs to help inform development of an avian wind energy research Roadmap. PIER-EA staff created a draft list which was released on September 29 with a deadline for public comment of October 16. The original draft list has not been revised as no comments were received from stakeholders. The workshop began with a number of presentations to establish a common platform of understanding in preparation for the group discussion(s) to follow.

II. PIER-EA Program – Environmental Area: Objectives, Goals and Funding

Kelly Birkinshaw, Manager of the PIER-EA program, provided an overview of the avian research program initiatives, objectives and timeframes within the context of overarching PIER-EA goals and mandates.¹ He informed the group that a strategic planning effort for the entire PIER-EA program was undertaken this past year. The mission was reworked and now includes research to support sustainable options in energy development, hardware development, advanced generation (e.g., Fluke cells and micro turbines), energy efficiency and energy transportation/distribution.

PIER-EA's mandate is to advance energy or technology with environmental research focused on developing cost-effective approaches to evaluating and resolving environmental effects of energy production, delivery and use in California. As such, there is an interest in better understanding the implications of emerging technologies, and how to address the environmental effects of energy production, delivery and use. He mentioned process CEC and California Department of Fish and Game (CDFG) are undertaking to develop siting guidelines related to wind/wildlife interactions. He noted the Roadmap is being developed independently of that process but in a coordinated manner to ensure that research conducted will be valuable to future revisions of the guidelines. He informed the group that data collection as part of an Environmental Impact Report or permitting conditions is generally not eligible for PIER-EA funding.

The CEC Research and Development Committee allocated \$1 million in support of this Roadmap effort. Unfortunately this amount is limiting in that (costly) field studies will need to be conducted to

¹ A copy of Mr. Birkinshaw's presentation can be found on the CEC website at www.energy.ca.gov/renewables/06-OII-1/documents/index.html#110206.

achieve the program's objectives. Mr. Birkinshaw stated it is essential to be strategic about selecting research projects for funding and as such, this scoping workshop was convened to engage stakeholders in helping to strategize and identify prioritized research topics.

The Roadmap process will begin with a gap analysis; identifying what is known, who else is conducting research and to what degree on-going research helps achieve the program's mission/goals. Short-, mid- and long-term goals and timeframes will also be identified. Mr. Birkinshaw noted that after receiving stakeholder input via today's scoping meeting, PIER-EA expects to release a draft Roadmap in January 2007. There will be another workshop held in February to discuss stakeholder comments on the draft and a final Roadmap will be released in March. It is likely that research will then begin by the third quarter of 2007. In closing, participants were welcomed to contact Linda Spiegel, Melinda Dorin, and Kelly Birkinshaw with any questions.

III. NWCC Wildlife Work Group Research Gaps White Paper

Steve Ugoretz introduced himself as being a member of the National Wind Coordinating Committee (NWCC) Wildlife Work Group since its foundation in the mid-90s. NWCC is supported by the U.S. Department of Energy and is a consensus-based work group convened to develop agreement around critical issues related to wind development in the nation. NWCC has a broad membership and has been greatly interested in these issues for a long time.

Mr. Ugoretz informed the group that NWCC has been looking at research needs and gaps as well. Sources of information have been compiled and a preliminary list of prioritized research needs has been drafted but not yet finalized. He noted that NWCC is holding a meeting on November 14-15 in San Antonio, Texas where results of the draft white paper will be reported (see http://www.nationalwind.org/calendar/view_recurring_event.asp?CalendarID=301 for details.) Mr. Ugoretz noted that although the list of research topics he will share today has not been vetted nor prioritized, he believes there is agreement at the NWCC Work Group that the majority of key issue areas have been included. Additionally, he informed the group that NWCC has been working with PIER-EA, the Association of Fish and Wildlife Agencies within a parallel effort to identify and share prioritized wildlife issues with Fish and Game Departments as wind energy develops throughout the country.

Mr. Ugoretz began his presentation² by stating that wind farms have a significant influence on wildlife in that fatalities are an issue on both the continent and off shore. The priorities in research need to get at the impacts of collisions, behavior (including effects on behavior), distribution, and prey availability in relation to wind energy facilities.

He stated that pre-construction research should focus on the following: tools and protocols, models, list of causes and their interactions, confounding variables and corrections, and metrics to compare across sites. Mr. Ugoretz also proposed that research focus on evaluating study techniques including: assessing the strengths and weaknesses of observational, acoustic and electronic techniques, assembling a protocol that compensates for weaknesses, and standard and adequate duration of studies.

² A copy of Mr. Ugoretz's presentation can be found on the CEC website at www.energy.ca.gov/renewables/06-OII-1/documents/index.html#110206.

In conclusion, Mr Ugoretz outlined the “bottom lines” as follows:

- How can policy be developed and applied in the face of incomplete knowledge?
- What information gives us the best handle on appropriate interventions?
- What is the least expensive way to get critical information to inform decisions?
- What do we do to be reasonably protective in the meantime?

He noted that these are critical questions which we are all trying to answer.

Gary George of the LA Audubon Society inquired about NWCC’s relationship with the National Renewable Energy Laboratory (NREL). Mr. Ugoretz replied that NREL expects to act on research recommendations that come out of the NWCC white paper. He stated the caveat that he did not want to speak for NREL, but shared his opinion that it is driven by budget and authority. Historically, NREL has been provided a larger budget but if Congress does not provide more funding NREL will not be able to conduct the studies recommended in the NWCC white paper.

Karin Sinclair from NREL joined the conversation, stating that NREL has a deliberate interest in working on issues related to wind and wildlife interactions. She confirmed that the NREL budget has not been very strong throughout the last few years but there is an expectation that there will be a more robust budget allocation in 2007, and 2008-2010 looks even more promising. NREL is very interested in NWCC’s prioritization project as well as state and regional efforts for collaboration to get at answers more quickly and efficiently.

IV. PPM Energy Research

Sara McMahon of PPM Energy began her presentation³ by noting that PPM Energy is interested in understanding and mitigating impacts to birds and bats at wind facilities. In addition to project-specific surveys and studies, PPM recently helped fund two research projects: the Grassland Shrub Steppe Species Collaborative (GS3C) prairie chicken study and the Bat Wind Energy Collaborative (BWEC) bat research.

Ms. McMahon stated that the GS3C prairie chicken study is a good model for multi-stakeholder collaboration in that funding is provided by various partners and meetings were held to solicit input from stakeholders early in the process. The main objective is to look at wind facility effects and impacts on prairie chicken demography and population genetics. Ms. McMahon clarified that the four-year study includes one year of pre-construction monitoring at treatment sites (to be developed) and reference sites (not to be developed), and three years of post-construction studies conducted simultaneously at both treatment sites and paired reference sites.

The BWEC bat research goal is to develop and coordinate research, and identify solutions to prevent or minimize threats to bats. This research includes a bat deterrent study using high amplitude sonar to “jam” the bats’ sonar. Preliminary results suggest deterrence but the results are not yet conclusive.

³ A copy of Ms. McMahon’s presentation can be found on the CEC website at www.energy.ca.gov/renewables/06-OII-1/documents/index.html#110206.

Ms. McMahon informed the group that PPM Energy is also conducting applied bat studies at both the Casselman Wind Project in Pennsylvania and the Hoosac Wind Project in Massachusetts. The Casselman site study objectives are to characterize bat activity in wooded, brushy, and grassland habitats, correlate bat activity with weather patterns and develop a pre-construction risk indicator that can be used to predict bat fatality. Preliminary results indicate the following:

- Bat activity was highest from mid-Aug to mid-Sept and in October, as well as immediately after sunset and declined until just before sunrise.
- Activity increased with increased forest cover, though differed by height (greatest at 22 m).
- Activity increased with increased temperature, though differed by height (greatest at 1.5 m).
- Activity decreased with increased wind speeds.

She then described the Hoosac site study objectives as including: 1) characterizing bat activity over the site (forested habitat); 2) determining if the site one that shows high or low overall use pre-construction, and how that correlates to post-construction fatality, and 3) developing a pre-construction risk indicator that can be used to predict bat fatality.

Ms. McMahon introduced various other applied studies focused on bats, birds, grassland nesting birds and mammals. Overarching research priorities include determining: 1) what are the best and most cost-effective predictive pre-construction tools to predict post-construction avian and bat fatality; 2) what are the appropriate search intervals and methodologies for pre-construction avian use surveys and post-construction fatality monitoring; and 3) whether or not bats are attracted to turbines, and if so, can they be deterred definitively.

V. Bat Research

Bronwyn Hogan of the CDFG provided an overview of bat research conducted at wind facilities focused on what is currently being done and what is on the horizon, rather than sharing a historical perspective.⁴ Our understanding is limited in that bats as compared to birds have not been well studied, study techniques vary and are not necessarily comparable, most estimates are not standardized, and past studies did not make corrections for searcher efficiency.

The species of bats most commonly affected by turbine-related impacts include the Hoary, Red (eastern and western), Silver-haired, and Mexican free-tailed. Bronwyn Hogan shared the following overview of current studies' preliminary indications:

- Fall migration appears to be riskiest time but more year-round studies are needed to confirm.
- Fatalities are not limited to wind farms on forested ridge tops in the east as open prairies are being identified as a problem as well.
- There is evidence that bats are not simply running into turbines as thermal imaging studies have shown bats following turbine tips and landing on stationary turbine blades and towers
- Increased turbine height may be extending the blades into the migratory space used by nocturnal migrants (birds and bats).
- There appears to be a negative correlation between fatalities and wind speed (e.g., more fatalities occur at lower speeds).

⁴ A copy of Ms. Hogan's presentation can be found on the CEC website at www.energy.ca.gov/renewables/06-OII-1/documents/index.html#110206.

- Collecting acoustic data at ground level alone is not adequate to assess impacts of turbines on bats as the number and species of bats are different at higher elevations.

Bronwyn Hogan noted new research includes studies being conducted in Pennsylvania and Alberta, Canada to correlate pre-construction surveys with post-construction mortality monitoring, radar being used to try to predict large migration events, and a mitigation experiment of feathering blades is being tested. Other new research techniques include looking at deterrents, population genetics, and banding.

In closing, Bronwyn Hogan stated there is a need to determine the appropriate level of effort required for both pre- and post-construction surveys to accurately predict risk and estimate fatality as inexpensively as possible. In addition, the development of (voluntary) guidelines in various states should be drafted to include study techniques and protocols that would allow for comparisons of research results from different sites and regions.

Mark Sinclair of the Clean Energy States Alliance inquired about the status of information regarding bat mortalities in California, wondering if there is a high risk that there will be major issues with respect to new wind facility development. Bronwyn Hogan replied that the only relevant information comes from the High Winds study. Year-round monitoring was conducted in from August 2003 to July 2005, and totals indicated more bats than birds were killed both years with Hoary and Mexican free-tailed being the most common mortalities. She posited that impacts will vary widely between areas.

Jim McKinney of CEC asked for an update on the current state listings of bat species. In reply, it was noted that the next list of species of special concern is due out shortly and the Red bat will be added to the list at that time. Out of all the tree roosting bats, the Red bat is the only species of special concern.

VI. PIER-EA – Overview of Environmental Area Avian Program Research and Introduction to Draft Research Needs List

Linda Spiegel shared a brief overview of the PIER-EA Avian program and the process that informed the development of the *Draft List of Research Topics* document to be discussed later today.⁵ CEC has been involved in studying avian/wind issues for decades beginning in the late 1980's. The PIER-EA program was created in 2001 in an effort to try to resolve identified issues. In 2002 the PIER-EA Avian program was initiated, producing three Roadmaps on Avian Electrocutation with Power Poles, Avian Collision with Power Lines, and Avian Collision with Wind Turbines that same year (see www.energy.ca.gov/PIER-EA/environmental/reports.html#habitat for details). Ms. Spiegel noted that awards are granted through competitive solicitation and sole source. Great diversity can be seen in contractors and partners in research which include utilities, universities, consultants, conservation groups, federal government, electric institutes, species experts, graduate students, and national labs.

Ms. Spiegel informed the group that the following Transmission System products have also been funded through the avian program and that they have been done in a collaborative way:

⁵ A copy of Ms. Spiegel's presentation can be found on the CEC website at www.energy.ca.gov/renewables/06-OII-1/documents/index.html#110206.

- Electrocutation and mitigation web site and product encyclopedia
- Online annotated bibliography of avian collisions & electrocutions
- Raptor mortality field guide
- Corona testing of line marking devices
- Update APLIC's suggested practices for raptor protection on power lines
- Validating a model for predicting electrocution on distribution poles
- Raptor electrocution on power lines: problem assessment, mitigation and monitoring
- Remote sensor of bird strikes on power lines
- Line marker effectiveness studies

Ms. Spiegel stated that PIER-EA's new research efforts will be focused on supporting the CEC/CDFG guidelines, strengthening research protocols, identifying the most appropriate protocols for pre- and post-construction monitoring and mitigation, addressing the highest priorities, and seeking collaborative opportunities to leverage available PIER-EA funding to the greatest benefit.

The key issues related to pre-construction surveys are how to identify risk and determining appropriate metrics. Ms. Spiegel noted that existing pre- and post-construction survey tools have some limitations, but these limitations must be addressed as post-construction surveys are critical to validating early assessments and to determining if significant impacts are occurring. To address these limitations initial studies will require intensive long-term protocols to: 1) derive at metrics that are reliable; 2) not reach diminishing returns; and 3) provide consistent/comparable data to facilitate meta-analyses and improve forecasting.

Regarding mitigation, Ms. Spiegel proposed that a large sample size is important in that risk associations are difficult to quantify and associations explored at smaller turbines have not yet been tested. Ms. Spiegel noted that auditory warnings, blade painting, micro-siting, environmental modifications, and habitat compensation are all possible mitigation strategies, although some do have limitations. In closing, she introduced the following categories for consideration to help in prioritizing the draft list of research topics:

- Survey techniques
- Risk assessment
- Fatality estimates
- Mitigation

Paul Vercruyssen of CEERT inquired if avian wind research screening tools are currently being applied. Ms. Spiegel confirmed that efforts are underway and the hope is results will be analyzed by February or March 2007. She stated secondary wind resource area (WRA) maps are being compared to identify areas where relative increased impacts may occur, quantifying impacts for each species and additive impacts for multiple species with the intent of comparing results across various areas. This analysis covers all areas identified in the secondary WRA maps.

VII. Morning Session Question and Answer

Mr. De Morgan encouraged the group to raise any topics for consideration and discussion as time allows during the remainder of this agenda topic or during afternoon discussions. Mr. Vercruyssen inquired what types of screens were used to make the determination of listing the Red bat as a

species of special concern. He suggested this information could be helpful to informing the discussions about research needs today. Betsy Bolster of CDFG replied that past reports have been prepared by experts and have undergone rigorous peer-review. CDFG applies a set of criteria to designate species of special concern (e.g., greatly restricted range, significant reductions in populations, roost data, etc.). Mr. McKinney added that it may be advantageous to consider off-shore developments as well when assessing research needs.

In preparation for the afternoon discussions Ms. Spiegel clarified the format of the *Draft List of Research Topics* document. She noted the first question under each heading (e.g., pre-construction, post-construction and mitigation) is an umbrella question and the numbered questions below it are more specific but related to the umbrella question.

VIII. Review of Pre-Construction, Post-Construction, and Mitigation Draft Research Topics List

In response to a question regarding coordination of PIER-EA's Roadmap with the guideline development process, Mr. Birkinshaw replied that by necessity the guidelines will be a matter of expert opinion and the best consensus of experts is needed now for the process to move forward. PIER-EA has the luxury of resources and time to provide a more empirical foundation for answering some of these research questions. He acknowledged that there may be some comparability issues between the Roadmap and the guidelines in the future, but the trade off will be worthwhile if more statistically robust techniques are identified. Bronwyn Hogan suggested the guidelines could reference the PIER-EA Roadmap and encourage testing of some of the prioritized research.

Jim Newman of Pandion Systems, Inc. commented that given the tension inherent in the separate timelines for development of the guidelines and the Roadmap, some techniques and methodologies identified today may need to be set aside and reviewed in light of guidelines upon release. Depending on what the recommendations are, it may be necessary to tweak the research priorities in response. It was confirmed that the expectation is for the guidelines to be released before the Roadmap is completed, but the group was encouraged to address the information presented today and then cycle back as needed after the guidelines are issued. Julie Vance of CDFG reminded the group that the guidelines are taking a toolbox approach for counties/agencies' consideration, based on research and the best available data. The PIER-EA Roadmap process will get at answers that the guidelines do not have at this time.

Melinda Dorin of PIER-EA stated that regardless of the guideline recommendations for survey duration, PIER-EA is interested in revisiting known pre-construction survey information from the perspectives of research. Ms. Spiegel added that answering the question of the appropriate frequencies, durations, and radii for point counts/visual observation scans would not be more cost effective if one well designed study could answer multiple questions and as an example. She suggested it could be accomplished by, for example, conducting studies with one-hour duration intervals, upper limit of radii (e.g., 100 meters) with a daily frequency at first, then sub-sample until the diminishing return is understood.

Jon Belak of EDM International, Inc. wondered where technological devices (e.g., EDM International's Bird Strike Indicator for remote detection and reporting of collisions) fit into research needs. Ms. Spiegel replied that such technology is a survey technique for post construction

monitoring and that a recent draft report from EDM suggests the feasibility is unclear. Ms. Dorin suggested that technology could be added as an option under post-construction or mitigation survey techniques.

Mr. George proposed that one criterion to apply to the prioritization exercise would be relative amount of knowledge of particular areas and/or issues. Turbine interactions with migratory songbirds and bats are least known while interactions between turbines and raptors are fairly well known. He noted each species requires very different survey techniques as well. Bronwyn Hogan suggested that it could be helpful to look at these questions within categories (e.g., survey techniques, risk assessment, fatality estimates, and mitigation) rather than individually as it could be possible to answer a number of questions with one study.

Ms. Spiegel reiterated that the first question under each heading of the *Draft List of Research Topics* document was framed from a very high level, and noted that there are many techniques which fall under “survey methodologies.” For the purposes of creating this document, PIER-EA attempted to dissect out the various techniques for discussion. It was clarified that the goal of discussions is to prioritize the questions from this list and identify any other questions that have not been included. As such, the group turned their attention to the *Draft List of Research Topics* document, focusing on clarification questions, suggestions for ways to prioritize the list, and identification of any themes, overlap, or categories.

Revisions to the *Draft List of Research Topics* document were proposed throughout discussions and included edits, additions, and comments. The following select numbered questions were discussed by participants and are captured below as originally drafted and numbered by PIER-EA. Please see Attachment A for the complete list of questions along with the revisions made during the meeting and other flipchart notes taken.

A. Pre-Construction

2. *How well does observation data on bird/bat use and behavior predict potential levels of mortality?*

Ms. McMahon noted that this is very important to developers as prediction tools help with siting processes.

4. *Can a meta-analysis of comparable data from several projects lead to an indicator of high risk situations?*

Ted Weller of the USDA Forest Service wondered if this question is about the proportion of populations impacted. Ms. Spiegel replied the question was raised because it is unclear if there is a risk even if radar indicates migratory routes are at higher elevations than turbines. Discussions about rephrasing the question ensued and it was noted that it was more important to look at what would be done with this information rather than focusing on how to change the language of the question.

7. *Can surveys conducted at dawn and dusk alone predict risk?*

Dick Anderson, a consultant to CEC working on the guidelines development process, wondered if this question should be expanded upon. Ms. Spiegel replied that migratory songbirds are often active at dusk and dawn.

5. *Are the heights of bird migration routes generally higher than collision risk zones?*

Mr. Vercruyssen noted that #7 relates to #5 in that point counts conducted at dawn and dusk could possibly replace migratory radar studies as the descent/ascent is the critical risk period for turbine strikes. Mr. George added that the San Geronio study found birds were most vulnerable two to three hours after sunset and before dawn. This indicates the timing of dawn/dusk surveys could be useless. Brenda LeMay of Horizon Wind Energy countered that it would be possible to capture high risk periods at dawn/dusk for night migrants, and at what altitude night migrants travel. If flight heights are known the need to conduct night radar studies (or not) could be determined. Mr. Weller noted that if questions about this topic remain it is still a viable research topic.

10. *What are the appropriate metrics to determine site use? What should we be measuring? What is the best way?*

Bronwyn Hogan proposed that identifying the best metrics would generate data that would be useful to the most people in the most situations, particularly for comparability between studies and meta-analyses. Mr. George inquired if PIER-EA's goal was research as an exercise in information gathering or funded scientific studies. It was clarified that information gathering would be a part of the process, but would also look at survey techniques. It is possible to use some existing data when evaluating survey techniques, but most of this data does not correlate so field research will likely have to be conducted to do the assessment. Mr. Birkinshaw added that determining the "best" methods is a policy decision but PIER-EA can tackle the trade-offs and advantages/disadvantages of the various methods instead. Ms. Vance stated her opinion that the "best" way to get at data should be determined from collecting data.

Joseph Sullivan of Ardea Consulting added this topic leads to a risk assessment question in that there is a need to assess what metrics point to risk. Mr. Weller raised the questions of what metrics mean and what should be measured to get at bird use. There are currently many techniques available but the best way to do so should be identified. Ms. LeMay commented it is hard to come up with standards without the right metrics.

B. Post-Construction

15. *What is the appropriate duration of monitoring to adequately account for annual variation in fatalities due annual variation in use? Can long-term periodic monitoring (e.g. every 3 years) capture that variation as well as yearly monitoring?*

Ms. McMahan encouraged the group to consider the usefulness of the wildlife handling and reporting system, as well as of ancillary monitoring.

16. *What are the adequate search intervals and search radii for the various turbine heights to capture a high percentage of fatalities?*

Susan Sanders of CEC stated that many of these questions will vary greatly depending on the site but search radii in particular would be applicable throughout the state and should be prioritized. Mr. Vercruyssen agreed and suggested this question could be split into two separate questions.

19. Is the number of dead songbirds found an accurate indication of songbirds killed?

In response to a question of whether this question is related to the “poof factor” or other issues that need to be investigated Ms. Spiegel clarified that it addresses scavenger and searcher biases. Mr. Sullivan noted that many of these issues have been worked out in the area of contaminant effects and reference prior NWCC studies that might be of value. Ms. Spiegel inquired if copies of these report(s) could be shared with PIER-EA; it was agreed that Mr. Sullivan would determine if RESOLVE has extra copies or would share his copy if needed.

Mr. George wondered if the “poof factor” was explicitly being included as a research topic. Ms. Spiegel replied it is being included in this question. Bronwyn Hogan requested this question include bats along with songbirds. Ms. Spiegel agreed and stated the study could be designed to accommodate both.

26. Do patterns of bird use change after construction of wind facilities?

Bronwyn Hogan inquired if any of the research topics addressed increased scavenging rates as learned behavior post installation of turbines (e.g., ravens). Ms. LeMay replied that this topic could fall under question #26.

A participant asked if low use indicates low fatality. Ms. Spiegel replied that the goal is to gather accurate and comprehensive data for fatalities at wind facilities to then compare bird use data and predict fatalities at various sites. This data could also put to rest the issue of whether or not a concern exists in certain areas. Mr. Vercruyssen wondered if fatality data would be coupled with population studies to get at levels of significance. Ms. Spiegel clarified that PIER-EA is interesting in understanding of bird use. The interest is to evaluate the potential for risk by identifying low and high risk areas.

25. Are pre-construction surveys adequately predicting mortality?

27. What is the level of bat mortality at all California wind facilities?

28. What is the level of bird mortality at all California wind facilities?

Mr. Vercruyssen wondered how the fatality data referenced in question #25 differs from data referenced in #27 and #28. He further inquired if PIER-EA hoped to quantify mortality at existing sites solely to understand whether or not they should be expanded. Ms. Spiegel replied that the interest lies partly in understanding the impacts of expansion, but also includes getting at a meta-analysis of bird use to feel comfortable about expansions through solid predictions of risk. Bronwyn Hogan stated there will be no available bat use data if surveys are not initiated but suggested that tissue samples (from carcasses) could get at population level impacts. Mr. Vercruyssen responded that if risk is being discussed it is essential to look at not only mortality but also impacts to populations to provide context for mortality numbers. Ms. Spiegel stated this approach would require field work although there is some good data from a few locations. Ms. Vance noted the value of conducting risk assessments regarding a population and/or a species but for some species good population data does not even exist.

C. Mitigation

33. Can habitat manipulations (rodent control, other prey reduction techniques) reduce bird use near turbines reduce fatalities to acceptable levels while not causing impacts to other species?

Mr. Vercruyssen shared his opinion that it is not fair to state “zero” impacts to other species on the site (e.g., rodent control) and proposed the question could be characterized more broadly by asking if manipulations provide aggregate benefit(s) to other species. Ms. Spiegel replied the question could be reworded but the goal is to encourage their use in other areas away from turbines. With respect to the impact to rodents, Ms. Vance reminded the group that certain species of rodents are currently ESA listed. Joanne Vinton, an interested member of the public, stated a cautionary note that the effects of rodent control could have a complex web of effects that may not be seen in the short-term.

32. Can seasonal shut downs prevent fatalities?

Mr. Weller noted that periodic shutdowns also reduce fatalities.

Mr. George wondered if research would look at mitigation for disturbances other than fatalities. Ms. Spiegel clarified that this PIER-EA effort would focus on direct impacts.

36. Is providing habitat off-site an effective measure to compensate for fatalities at wind facilities?

Ms. McMahon noted that the goals and formulae for mitigation should be policy-level decisions, informed by science. Ms. Spiegel replied that once a mitigation bank is established, research could be done to look at use and activity levels but acknowledged this is a grey area for PIER-EA. It was agreed that the question should be rewritten to indicate it is not about whether or not to do off-site mitigation but rather if it is being done effectively.

IX. General Discussion and Prioritization Exercise

As the group moved into prioritizing the list, it was suggested that birds and bats should be indicated specifically throughout all the research questions as appropriate, especially to help inform the prioritization exercise. Others disagreed, and Ms. Spiegel suggested the group hold these thoughts for a little while to see how the prioritization exercise plays out.

Ms. Sinclair commented that “birds” represent a huge subject with many species that have different concerns at different sites. As such, it will be difficult to answer research questions on a large scale, rather the focus should be on particular species in particular locales. While there is potential for overlap, it may be difficult to get the desired answers if the studies are too broad.

The group was encouraged to consider to what extent clarification is needed and whether it would be possible to move towards prioritization with the research questions as written. Additional comments, reactions about overlap, and/or opportunities for integration were encouraged before moving forward.

The question of whether the concept of applying new technology for prevention of impacts was imbedded in the research questions was raised. It was suggested that it was implied in various

questions. Ms. Vance clarified that avoidance, minimization and mitigation are not the same thing; CDFG considers mitigation as steps taken to offset impact, while minimization would be related to avoidance of take. Mr. Belak noted EDM's Bird Strike Indicator does not affect impact but it does observe and record impacts and could be used to look at many of these questions (e.g., carcass search, poof factor, etc.). Ms. Dorin added that new technology could have a place in the Roadmap and that from a process perspective, new technology (grant) proposals would be considered if the proposal is in response to a research question.

Ms. Sanders requested the group's attention return to the overall framework of the list of research topics. It appears that all the questions are in service of avoidance which reinforces the need to identify mechanisms to avoid impacts. Sue Orloff of Ibis Environmental, Inc. noted that some of the research questions are complex and proposed that it would be good to state the relative importance of each; detailing what could be gained by answering each and clarifying how they link to other questions. Ms. Spiegel replied that the Roadmap will provide a thorough description about what is known/not known and what you can get at by answering the questions.

Mr. Anderson suggested the focus of research should be on meta analyses and standardization of techniques; describing what works and what does not. He stated that before a project is built there is a need to gather good data to quantify and qualify known problems, and reinforce what studies are being done well, along with identifying areas for improvement. After a project is built the emphasis should be on how to improve survey techniques. He added that universal problems could benefit from additional focus, and that it will be some time before good predictive models can be constructed.

Mr. Weller put forth the following proposal regarding potential categorization of research topics: risk assessment, survey effort, survey methods, and minimization of impacts, with birds/bats as subcategories of each. Mr. Sullivan noted that all topics are potential tools that lead into a risk assessment. The question is which of these tools provide the best ability to determine risk.

Members of the group proposed the following criteria for consideration, as appropriate, in preparation for the prioritization exercise:

- Relative amount of knowledge that exists
- Species being considered (birds, bats, raptors, songbirds)
- Short-mid-long term?
- Statewide applicability
- Use existing data – meta analysis
- What are the real problems?
- Where do we already do things well?
- Where can we do things better?

A few new ideas for research were added to the list before beginning the prioritization exercise. Each member of the group was provided with 14 votes; no more than two of which could be allocated to any one research topic. After participants allocated their priorities, in person and via WebEx, the group reviewed the results and shared thoughts and reactions.

2. *How well does observation data on bird/bat use and behavior predict potential levels of mortality?*
25. *Are pre-construction surveys adequately predicting mortality?*

Ms. Sanders inquired if these questions are essentially the same, as they both link pre-construction data and post-construction monitoring results, and get at avoidance. Ms. Orloff proposed adjustments and assumptions be examined before implementing #25 and others. She noted that these two questions are related in that the interest is in understanding the accuracy of pre-construction techniques to derive mortality predictions when compared to post-construction mortality data.

Ms. McMahon commented that many of the questions between #15 and #28 lead to metrics used for pre-construction surveys to predict post-construction mortality; whereas #'s 16, 20, 21, 22, 24 and 37 address post-construction mortality monitoring itself, and that these questions could be answered by conducting a meta-analysis to establish what are the appropriate search intervals and methodologies for pre-construction avian use surveys and post-construction fatality monitoring. The questions could also be addressed as part of a research project designed to establish what the best and most cost-effective predictive pre-construction tools are to predict post-construction avian and bat fatality. Ms. Orloff added that any of the higher ranked priorities could be addressed by good pre- and post-construction correlations. Mr. Vercruyssen replied that while many do get at the same end result, it is still important to look at how effectively mortality can be predicted now even though some associated issues have not yet not resolved.

It was noted that the prevention/avoidance/mitigation options did not get very high rankings. These are applied to existing projects but should also extend to all planned developments. Ms. Spiegel replied that PIER-EA will use the information from discussions today to help inform development of the Roadmap. She clarified that the results of the prioritization exercise do not indicate formal inclusion/exclusion in the Roadmap.

14. *What activity levels of bats in an area would be considered high risk?*

Mr. Weller noted that this question is an anomaly given the macro-scope context. He pondered if there is a need for more questions at this scale. Ms. Sanders explained that she voted for this question because it could be possible to correlate bat activity in forested areas versus areas within range of water bodies to get at bat activity data. It was noted that while migration routes for birds are fairly well defined, birds could still be considered for similar research.

37. *New Survey Technology: develop and testing*

Jennifer Hogan of CDFG noted this item is related to policy but should be flagged as important due to its relevance to the everyday reality of the permitting world.

Mr. Vercruyssen commented that due to the character of many of the questions, some could be grouped together while others cannot. He suggested that the avoidance questions ranked lower because avoidance techniques are options that may or may not have a great impact, but other questions get at the potential of predictions. It was noted that PIER-EA will consider all suggestions for categorization when drafting the Roadmap. Mr. Vercruyssen proposed an alternate approach of addressing a number of questions from each category (e.g., pre-construction, post-construction, avoidance) regardless of today's ranking results. He noted many questions could be served by an

accounting of existing surveys/research to help inform where we are at and how to proceed from here.

Mr. Weller commented that all of this research is in its infancy, and the development of wind power has enabled us to study migration and inform macro ecology of bat distributions through carcass surveys. This information has not been accessible until now.

Ms. McMahon noted that while everyone would want an answer to every question, it will be very hard to do so for some. As such, she proposed PIER-EA should focus on the questions we can answer. Mr. Verduyck agreed and suggested the topic should be discussed further at the next PIER-EA workshop.

Mr. Weller stated that only one person would be needed to manage a bat banding project in every study area and should not be too costly. Ms. Spiegel concurred and added that a similar approach could apply to birds as well by sending in feathers for analysis. She then requested that participants forward research reports to Ms. Dorin and herself to help in drafting the Roadmap.

The question of how to use available funds as wisely as possible was raised. Ms. Spiegel stated that this workshop was help with the goal of addressing this question. It is possible that in the future the funding could be increased if it is demonstrated that good work is being done. She was not certain how the \$1 million would be administered, and clarified that none of the funds have been allocated or spent yet. PIER-EA is looking for leverage opportunities via collaborative efforts.

Mr. Weller inquired if it is possible that some of the funds could be contributed to a collaborative effort (e.g., bat/wind collaborative). Ms. Spiegel confirmed that this option would be considered and clarified that all proposals are reviewed by a technical advisory team and are scored accordingly. In order to pass, the research must be applicable to California. Furthermore, matching or cost-sharing funds score additional points for a proposal. The question was raised of whether or not PIER-EA could solicit matching funds for targeted research. It was noted that PIER-EA's proposal submission manual includes detailed scoring sheets which allow for individualized tailoring of proposals.

Given the costs of the applied bat studies at the Casselman Wind Project (e.g., \$300-400,000 over five years) and the Hoosac Wind Project (e.g., \$300,000 over five years) it was emphasized that it is critical to identify high-level priorities for research. Many of these questions can be answered with a well-designed study. As currently envisioned, the Roadmap will be designed to detail research questions without actually detailing the studies. Ms. Spiegel noted that this proposed construct is open to discussion if needed.

Ms McMahon stated that the prairie chicken study was costing approximately \$675,000 for five years and they were hoping to get additional money to reach \$800,000. The bat studies included pre- and post-construction surveys.

X. Next Steps

In follow-up to the workshop, RESOLVE will distribute a draft meeting summary to attendees within a few weeks. Participants were encouraged to review the draft summary and provide any corrections or clarification edits pertaining to their respective organizations to ensure the record is accurate and complete.

Stakeholders also have the opportunity to provide formal written comments related to this workshop to Ms. Dorin or Spiegel by November 15, 2006. It was noted that even if the deadline cannot be met, comments and questions are always welcomed by PIER-EA. PIER-EA will distribute a link to access the public records associated with this process via the web as soon as it becomes available.

The Roadmap development timeline is currently anticipated as follows:

- Release of the draft Roadmap is expected in January 2007.
- A workshop will be held in February to create a common understanding, share information, describe funding opportunities, and solicit stakeholder feedback on the draft.
- Public written comments will be considered before revisions and formal release of the final Roadmap in March.

It was noted that PIER-EA will look for recommendations, additions, and deletions to the draft Roadmap once released. It was suggested that if stakeholders do not like any aspects of the Roadmap they should strive to propose an alternate approach rather than just stating what they do not like.

Ms. Spiegel stated the Roadmap and the Research will be closely related and part of the same process. The solicitation package will very specifically reflect Roadmap parameters. In closing, stakeholders expressed their appreciation for the public involvement aspect of the Roadmap process.

November 2, 2006 PIER-EA Staff Workshop Attendees

The following participants were in attendance at the meeting:

Dick	Anderson	CEC Consultant
Mike	Best	Pacific Gas and Electric
Jennifer	Bies	RESOLVE
Kelly	Birkinshaw	California Energy Commission PIER-EA
Greg	Blue	EnXco
Matt	Coldwell	California Energy Commission
Paul	De Morgan	RESOLVE
Melinda	Dorin	California Energy Commission PIER-EA
Garry	George	LA Audubon Society
Bronwyn	Hogan	California Department of Fish and Game
Jennifer	Hogan	California Department of Fish and Game
Brenda	LeMay	Horizon Wind Energy
John	Mathias	California Energy Commission
Jim	McKinney	California Energy Commission
Sara	McMahon	PPM Energy
Rebecca	Perree	FPL Energy
Susan	Sanders	California Energy Commission
Karin	Sinclair	National Renewable Energy Laboratory
Stuart	Smith	Oak Creek Energy Systems
Linda	Spiegel	California Energy Commission PIER-EA
Joan	Stewart	FPL Energy
Joseph	Sullivan	Ardea Consulting
Annette	Tenneboe	California Department of Fish and Game
Paul	Vercruyssen	Center for Energy Efficiency and Renewable Technologies
Julie	Vance	California Department of Fish and Game
Joanne	Vinton	Interested Public
Ted	Weller	USDA Forest Service
Chris	White	Oak Creek Energy Systems
Kerry	Willis	California Energy Commission
Marcus	Yee	California Energy Commission
Rick	York	California Energy Commission
Darin	Nguyen	California Energy Commission

The following individuals participated in discussions by phone:

Jon	Belak	EDM International, Inc.
Betsy	Bolster	California Department of Fish and Game
Scott	Flint	California Department of Fish and Game
Jim	Newman	Pandion Systems, Inc.
Sue	Orloff	Ibis Environmental, Inc.
Mark	Sinclair	Clean Energy States Alliance
Steve	Ugoretz	NWCC Wildlife Work Group
Joe	Vincenty	California Department of Fish and Game
Linda	White	Kern Wind Energy Association
Marcia	Wolfe	M. H. Wolfe and Associates

WebEx records indicate the following individuals joined the meeting by phone for varying lengths of time but they did not introduce themselves during the course of the conversations:

Manuel	Alvarez	Southern California Edison
Matthew	Amalong	
Gina	Bartlett	Consultant to Alameda County
John	Hingtgen	California Energy Commission
Dave	Johnston	
Nancy	Rader	CalWEA
Tony	Tully	California Energy Commission