



BWEC 5-year plan (1 January 2024–31 December 2028)

Mission

Advancing and disseminating science-based solutions to cost-effectively quantify and mitigate the impact of wind turbines on bats.

History

As concerns about climate change and long-term environmental impacts from the use of fossil fuels have heightened (McLeish 2002), wind energy has become an increasingly important sector of the low carbon energy industry (Pasqualetti et al. 2004, Global Wind Energy Council 2019). Wind-generated electricity is an important part of our energy future because it is renewable, generates near-zero emissions of greenhouse gases and other pollutants during operations, displaces energy generated from carbon-based fuels, and consumes no water during production (National Research Council 2007, Ledec et al. 2011, Union of Concerned Scientists 2011). However, wildlife and habitats can be directly or indirectly impacted by development and operation of wind energy projects to varying degrees depending on species, project characteristics, geographic regions, and other factors (Arnett and Baerwald 2013). There are concerns regarding potential cumulative impacts of wind energy development on bat populations, particularly when many species of bats are known or suspected to be in decline from various stressors, including disease and habitat disturbance (Jones et al. 2009, Frick et al. 2010, Frick et al. 2017).

Carcasses searches have documented bat mortality at land-based wind energy facilities worldwide (Arnett et al. 2016). Although bat mortality is observed at most wind energy facilities, results can vary between years at the same site, and within and among regions (Allison et al. 2019). It remains unclear the extent to which bats may interact with offshore wind turbines, and because traditional carcass searches are not possible, technological solutions are needed to model or observe collision risk. Moreover, there is a paucity of data regarding the population status and trends for most species of bats, and how bat populations respond to various stressors. Thus, it is difficult to assess the potential population-level impact of wind turbines on bats or the level of mitigation required to ensure the coexistence between bats and wind energy development.

To address the impact of wind energy development on bats, the Bats and Wind Power Generation Technical Workshop, sponsored by the American Wind Energy Association (now American Clean Power; ACP), Bat Conservation International, National Renewable Energy Laboratory, and U.S. Fish and Wildlife Service was held on 19–20 February 2004 in Juno Beach, Florida. From the 2004 meeting, the Bats and Wind Energy Cooperative (BWEC) was formed to conduct targeted research, provide technical guidance,

and sponsor research required to accomplish its mission and objectives. Since the inaugural meeting, the BWEC has added representatives from the Association of Fish and Wildlife Agencies, Energy and Wildlife Action Committee, U.S. Department of Energy, and the U.S. Geological Survey to the Oversight Committee. Subsequent committee meetings have been held in 2008, 2012, 2015, 2018, and 2022. Proceedings from all BWEC meetings are available at www.batsandwind.org.

Rationale

The need for the BWEC is more urgent than ever. The concern regarding the impact of wind turbines on bats was raised in 2004, when the global installed capacity was approximately 48 GW. As of the end of 2022, the global installed wind energy capacity reached 906 GW (<https://www.statista.com/statistics/268363/installed-wind-power-capacity-worldwide/>). Estimates for growth vary, but the Global Wind Energy Council forecasts nearly 143 GW increase in installed capacity per year between 2023 and 2030 (GWEC 2023). Despite these projections falling below what is necessary to stay on track for a net zero/1.5 °C pathway (GWEC 2023), the increased capacity heightens the concern for bats, particularly considering that solutions to minimize collision mortality are not widely adopted because they vary in effectiveness and can be cost-prohibitive.

The Bats and Wind Energy Cooperative (BWEC) is an alliance of bat ecology, industry, technology, and conservation experts from government agencies, private industry, academic institutions, and non-governmental organizations that promotes the free exchange of perspectives and scientific information. Although the BWEC will engage with the broader wind energy and wildlife community, it will function as a smaller, more focused group, specifically devoted to addressing research on bat and wind turbine interactions.

Scope

Historically, BWEC-led research focused on bat and wind turbine interactions at land-based wind energy facilities in North America. However, the overall mission and the research priorities established during Science meetings are broadly applicable to other countries and to offshore wind energy development. The BWEC will continue to focus on North America but will assess the global state of the science regarding bats and both land-based and offshore wind energy to inform its actions and recommendations.

The BWEC will advance solutions to identified problems and provide sound and practicable recommendations regarding the development of technologies and protocols for quantifying and minimizing risk to bats in support of long-term, responsible wind energy development. This requires the BWEC to be flexible and adapt to changes in wind turbine technology, economic constraints, deployment strategies, bat population trends, and conservation needs. As such, the BWEC will reevaluate its activities and structure of the group every three years at the Science meeting.

Structure

The BWEC is made up of the Oversight Committee (OC), Advisory Committee (AC), and the Program Coordinator (PC). All committee members and the PC have the responsibility to engage their networks to elicit information on ongoing research and help promote BWEC activities to ensure the BWEC is well informed and recognized. Additional roles and responsibilities for each are described below:

- 1) Oversight Committee: The OC consists of one representative and one alternate from each of the following organizations: Association of Fish and Wildlife Agencies, American Clean Power, Bat Conservation International, Energy and Wildlife Action Coalition, National Renewable Energy Laboratory, U.S. Department of Energy, U.S. Fish and Wildlife Service, U.S. Geological Survey. The OC may designate other organizations to serve on this committee. The OC will be responsible for the direction of the BWEC and approve of decisions with agreement of 7 of the 8 members, though every effort will be made to achieve unanimous consent. Duties include, but are not limited to:
 - a. Reviewing and approving research priorities and other BWEC products.
 - b. Approving new members to the AC and the OC.
 - c. Attending annual and Science meetings to share information and assess input from the advisory committee and invited experts.
 - d. Attending biannual OC meetings to review BWEC business and approve of any changes in the direction of the BWEC.
 - e. Ensuring the BWEC is influential, and products reach key audiences.
- 2) Advisory Committee: The AC consists of at least 15, and no more than 20, experts from private industry, state and federal agencies, non-governmental organizations, and academia who have relevant experience related to bats and wind energy research. In general, the AC shall be composed of the following membership (note: a member may satisfy more than one criterion, for example a bat expert may be from a federal agency):
 - a. Approximately 1/3 of the Committee representatives will have relevant expertise in bat research (e.g., behavior, physiology, ecology).
 - b. At least one representative each from Canada, Mexico, and Europe.
 - c. At least 3 representatives from different wind energy developers/operators.
 - d. At least 2 representatives from state agencies.
 - e. At least 3 representatives from federal agencies.

The AC is responsible for providing scientific and technical guidance to the OC. Individuals of the AC will be appointed by the OC and will be asked to serve a minimum of three years. Duties include, but are not limited to:

 - a. Serving as the peer-review panel for BWEC products.
 - b. Contributing to BWEC products, including webinars, research briefs, and technical reports.
 - c. Attending annual and Science meetings to share information on existing and upcoming projects and providing guidance on research priorities.
 - d. Ensuring the BWEC is influential, and products reach key audiences.
- 3) The PC for the BWEC is employed by the National Renewable Energy Laboratory (NREL) and is supported by the communications staff at NREL. Duties include, but are not limited to:
 - a. Managing all BWEC activities.
 - b. Facilitating the review process for BWEC products.
 - c. Hosting webinars and posting the recordings online.
 - d. Maintaining the BWEC website.
 - e. Facilitating working groups.
 - f. Subcontracting the 3rd-party facilitator for the Science Meeting.

- g. Preparing final versions of BWEC products and ensuring products are disseminated widely.
- h. Maintaining the research roadmap and projects database.

To increase engagement, accelerate progress, and incorporate additional subject matter expertise, the BWEC will create working groups, as needed, to address specific BWEC priorities. The number of working group members and the duration of working groups will vary based on the objective. The PC will facilitate working groups along with at least one member of the AC or OC. Working groups can be used to help inform research priorities, develop research briefs or technical reports, and/or organize webinars.

Meetings

One of the main functions of the BWEC is facilitating engagement of various organizations to review the current state of knowledge and establish research priorities for quantifying and mitigating impacts. To maintain this important function, the BWEC committee members will meet as follows:

- 1) All Committee members will convene in-person every three years for the BWEC Science meeting. The purpose is to review the state of the science and establish priorities for bats and wind energy research. The PC will subcontract a 3rd-party to facilitate the meeting.
 - a. The BWEC may invite subject matter experts to present their research during the Science meeting, but these non-BWEC members will not participate in the establishment of priorities.
 - b. The BWEC may open sections of the Science meeting to the broader wind energy and wildlife community to help disseminate the latest research findings. This may be done through either virtual attendance or via webinars. Sections of the Science meeting dedicated to the establishment of priorities will be closed to non-BWEC members.
- 2) Annually, all committee members will meet virtually to exchange information on existing or upcoming research projects, discuss recent results, and address current issues related to the BWEC or bats/wind-related research.
- 3) The OC will, at minimum, meet virtually on a biannual basis with the PC to discuss BWEC business and potential changes in the direction of the BWEC.
- 4) Impromptu meetings may be scheduled, as needed, will be convened to address urgent issues, summarize comment/response matrices on BWEC reports, or discuss BWEC business.

Activities

To meet its mission, the BWEC will serve as a hub for bats and wind energy research, which will include the following outreach and engagement activities:

- 1) Maintain the www.batsandwind.org website. The Program Coordinator will update the website on a biannual basis.
- 2) Develop a proceedings report based on the Science meeting that includes short-term research priorities (e.g., 1 to 5-year horizon).
- 3) Disseminate results from working groups, which may take the form of webinars, research briefs, BWEC reports or publications. All documents and webinar recordings will be available on www.batsandwind.org.

- 4) Develop a research roadmap that links the various research priorities (e.g., bat behavior, mortality monitoring, minimization strategies), identifies research gaps, long-term research needs (approximately 10-year horizon), and recommends next steps for research to inform funding opportunities and decision making. The roadmap will be updated every three years in conjunction with the Science meeting.
- 5) Develop a research projects database. The database will include high-level details on existing and upcoming research projects to help track the partners, timing, locations, and objectives of projects. The primary focus for the database will be North America but may include relevant projects from around the world. The database will be reviewed and updated on a biannual basis. The database will be accessible on www.batsandwind.org.

Peer Review

An important aspect of the BWEC is that all documents published or endorsed by BWEC are peer-reviewed by committee members before dissemination. Members of the BWEC committees and external subject matter experts, as needed, will serve as reviewers for BWEC products. In the event a committee member is a co-author of a document under review, the committee member will recuse themselves from the review process.

As with any formal scientific review process, BWEC products are confidential and shall not be shared until a final draft has been completed and approved. This process ensures that 1) scientific credibility is maintained through review by the committees (and non-BWEC subject matter experts as needed); 2) all committee members are allowed adequate time to provide feedback prior to the release of the product; and 3) potential conflicts are resolved in as fair, equitable, and credible manner as possible prior to dissemination.

The PC will be responsible for facilitating the review process, which is as follows:

- 1) The PC will submit the 1st version of the document to the AC for review. A minimum of four reviews are required for publication by BWEC. Further, reviews must come from at least two different stakeholder groups. Reviewers will have 15 business days to complete their review.
- 2) The PC will receive and compile the comments into one document and create a comment/response excel file to track how each comment is addressed.
- 3) The PC will submit the 2nd version of the document, with track changes, and the comment response matrix back to the reviewers for feedback. Reviewers will have 10 business days to either approve or express remaining concerns with the document.
- 4) The PC will make any final revisions needed and submit the 3rd version of the document and the comment response matrix to the OC for final review and approval. The OC will have 15 business days to decide whether to proceed with disseminating or if further review and revisions are necessary. If there were any unresolved comments from a previous round of review, they can be addressed during this stage.

BWEC Oversight Committee as of 1 January 2024

Meaghan Gade	Association of Fish & Wildlife Agencies
Quintana Hayden	American Clean Power Association
Mylea Bayless	Bat Conservation International
John Anderson	Energy Wildlife Action Coalition
Robert Thresher	National Renewable Energy Laboratory
Joy Page	U.S. Department of Energy
Thomas Wittig	U.S. Fish and Wildlife Service
Mona Khalil	U.S. Geological Survey

BWEC Advisory Committee as of 1 January 2024

Robert Barclay	University of Calgary
Robin Brabant	Royal Belgian Institute of Natural Sciences
Christi Calabrese	EDP Renewables
Janine Crane	NextEra Energy Resources
Amanda Hale	Western EcoSystems Technology
Manuela Huso	U.S. Geological Survey
Sean Marsan	U.S. Fish and Wildlife Service
Rodrigo Medellin	Instituto de Ecologia, UNAM
Christian Newman	Electric Power Research Institute
Trevor Peterson	Stantec
Tim Sullivan	U.S. Fish and Wildlife Service
Ted Weller	U.S. Forest Service
Sara Weaver	Bowman Consulting
Shilo Felton	Renewable Energy Wildlife Institute
Goni Iskali	Apex Clean Energy
Misti Sporer	Deriva Energy
TBD	State representative
TBD	State representative

Program Coordinator as of 1 January 2024

Cris Hein	National Renewable Energy Laboratory
-----------	--------------------------------------

Literature Cited

- Allison, T. D., J. E. Diffendorfer, E. F. Baerwald, J. A. Beston, D. Drake, A. M. Hale, C. D. Hein, M. M. Huso, S. R. Loss, J. E. Lovich, M. D. Strickland, K. A. Williams, and V. L. Winder. 2019. Impacts to wildlife of wind energy siting and operation in the United States. *Issues in Ecology* 21:23.
- Arnett, E. B., and E. F. Baerwald. 2013. Impacts of wind energy development on bats: implications for conservation. Pages 435–456 *in* Bat evolution, ecology and conservation. R. A. Adams and S. C. Pedersen (eds). Springer, New York, USA.
- Arnett, E. B., E. F. Baerwald, F. Mathews, L. Rodrigues, A. Rodriguez-Duran, J. Rydell, R. Villegas-Patraca, and C. C. Voight. 2016. Impacts of wind energy development on bats: a global perspective. Pages 295–324 *in* C. C. Voight and T. Kingston, editors. *Bats in the Anthropocene: conservation of bats in a changing world*. Springer, Berlin, Germany.
- Frick, W.F., J.F. Pollock, A. Hicks, K. Langwig, D.S. Reynolds, G. Turner, C. Butchkowski, T.H. Kunz. 2010. An emerging disease causes regional population collapse of a common North American bat species. *Science*, 329: 679–682.
- Frick, W. F., E. F. Baerwald, J. F. Pollock, R. M. R. Barclay, J. A Szymanski, T. J. Weller, A. L. Russell, S. C. Loeb, R. A. Medellin, and L. P. McGuire. 2017. Fatalities at wind turbines may threaten population viability of a migratory bat. *Biological Conservation* 209: 172 – 177.
- Global Wind Energy Council (GWEC). 2016. www.gwec.net. Accessed 31 March 2016.
- Global Wind Energy Council (GWEC). 2023. Global Wind Report 2023. www.gwec.net. Accessed 30 June 2023.
- Jones, G. D. S. Jacobs, T. H. Kunz, M. R. Willig, and P. A. Racey. 2009. Carpe noctem: the importance of bats as bioindicators. *Endangered Species Research* 8: 93–115.
- Ledec, G. C., K. W. Rapp, and R. G. Aiello. 2011. Greening the wind: environmental and social considerations for wind power development in Latin America and beyond. A full report submitted to the Sustainable Development Department, Latin America and Caribbean Region, The World Bank. 170 pp.
- McLeish, T. 2002. Wind power. *Natural New England* 11: 60–65.
- National Research Council. 2007. Ecological impacts of wind-energy projects. National Academies Press, Washington, D.C., USA.
- Pasqualetti, M., R. Richter, and P. Gipe. 2004. History of wind energy. Pages 419–433 *in* C. J. Cleveland, editor. *Encyclopedia of energy*. Volume 6. Academic Press, San Diego, California, USA.
- Union of Concerned Scientists. 2011. Tapping into the Wind. http://www.ucsusa.org/assets/documents/clean_energy/tappingintothewind.pdf.

