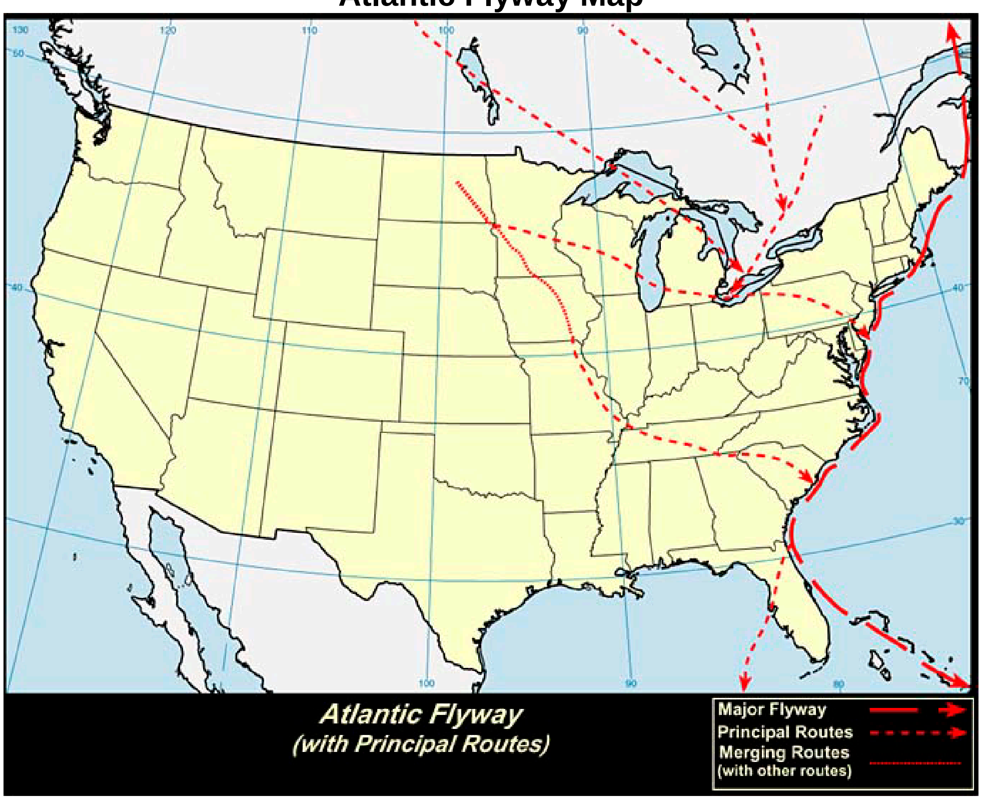
I would like to thank you for the opportunity to testify at this hearing on the biological ecological impacts of the proposed offshore wind project/s on Lake Erie.

My name is Kim Van Fleet. I am a wildlife biologist employed in the capacity of Important Bird Area Coordinator with Audubon Pennsylvania. Before and during my employment with Audubon I have also served as adjunct faculty in the Biology departments of Shippensburg University, Penn State University-Harrisburg Campus and Dickinson College teaching numerous courses including Ornithology, Ecology, and Environmental Science. As a biologist my concerns about industrial scale wind turbines are many so therefore it is important to note that not all of the testimony I give will be that of Audubon but will also be from my own perspective and experiences as a wildlife biologist who has been studying this issue over the past six years.

Importance of Lake Erie relative to the Atlantic Flyway and Bird Migration

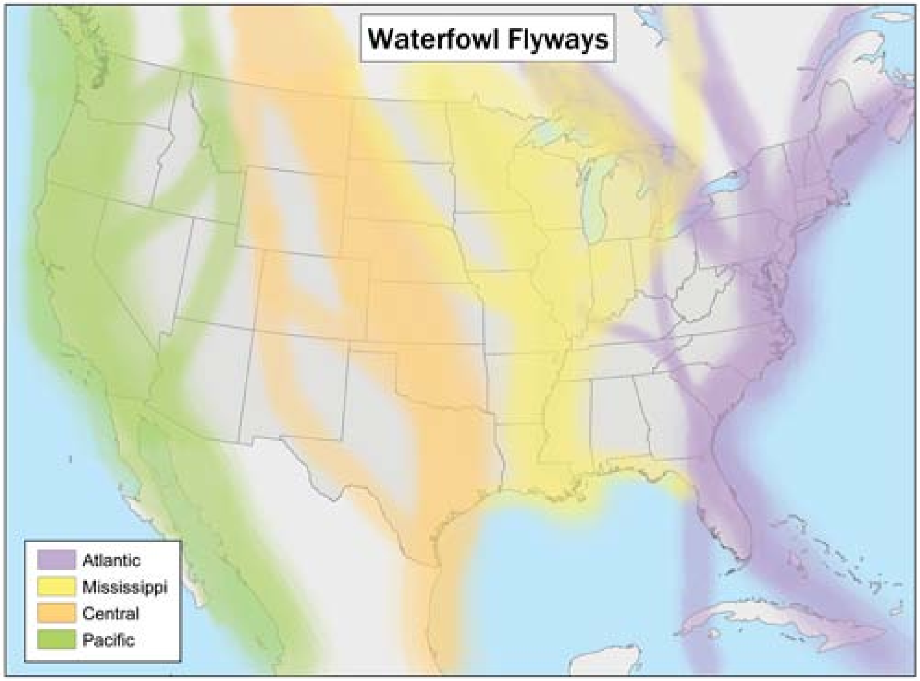
As you may or may not know Lake Erie and its coastline are important components of a principle route of the Atlantic Flyway. The Atlantic Flyway is a migration corridor used twice a year during spring and fall migration by a plethora of birds including waterfowl, shorebirds, songbirds and other landbirds that journey to and from their wintering and breeding grounds. It extends from the offshore waters of the Atlantic Coast west to the Allegheny Mountains curving northwestward across northern West Virginia and northeastern Ohio, then continues across the prairie provinces of Canada and the Northwest Territories to the Arctic Coast of Alaska The heaviest concentration and movements of birds, within this flyway occur along the coasts, mountain ranges and large river valleys conforming very closely to major topographical features oriented in their general direction of the travel.

Atlantic Flyway Map

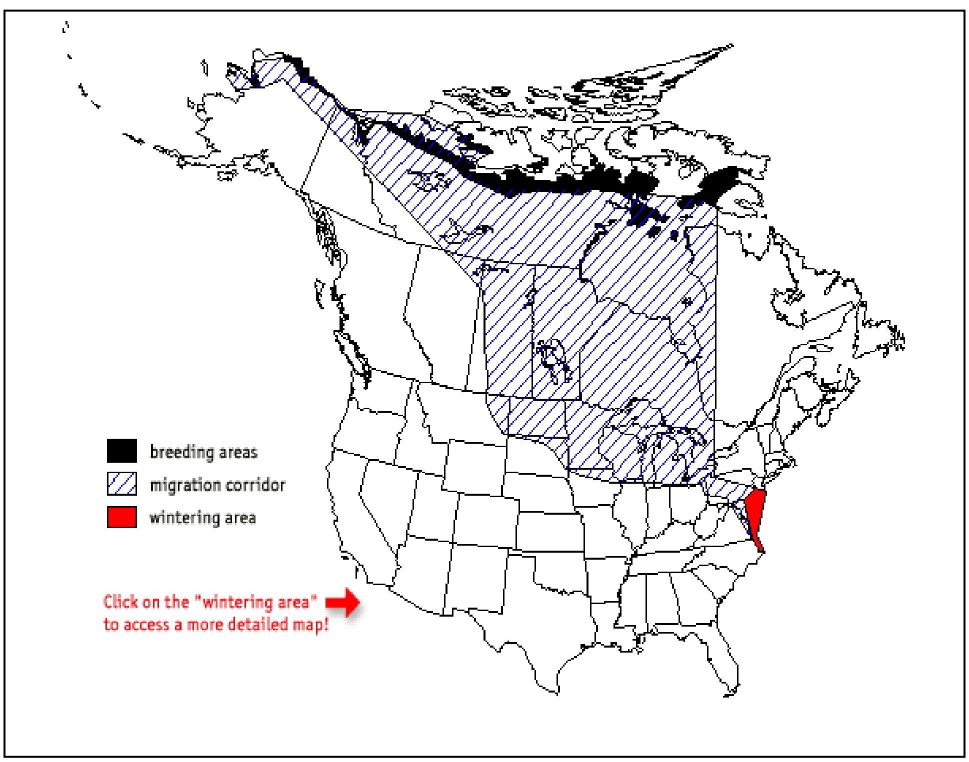


The Atlantic Flyway route from the northwest and north in particular is of great importance to migratory waterfowl including but not limited to Canvasback and Red-headed Ducks, Lesser Scaup, Teals, Loons and Tundra Swan that over winter on the marshes, back bays and waters south of Delaware to the Chesapeake Bay areas further south. Lake Erie and its surrounding environs are a critical component of this particular migration corridor in that this region of Pennsylvania.   It is one of a few migration stopover/staging areas where these birds can rest, forage and put on additional fat reserves to complete their long journeys. It should also be noted at this point that this principle migration route of the flyway narrows over the west to east breadth of Lake Erie and as such migrating birds tend to concentrate along its shoreline or narrow crossing points.

Complex of North American Flyways



Tundra Swan Migration Map from Telemetry Studies



In addition to waterfowl, phenomenal numbers of waterbirds, songbirds and landbirds depend heavily on the ample food and other resources of Lake Erie, the undeveloped areas of Presque Isle and Roderick Preserve Important Bird Areas (IBAs) and Erie Bluffs when stopping over during their extensive migrations. The Piping Plover a federally listed endangered species is also observed here in migration and was historically a nesting species on Presque Isle. The outer beaches and Gull Point comprise one of 37 designated critical habitat areas in all of the Great Lakes for this endangered bird. Current work on this species at Presque Isle includes monitoring for their presence from April through June and habitat restoration on a 7-acre area of Gull Point to encourage these birds to once again breed here**.**

The diversity of bird species (325) documented at Presque Isle and its surrounding areas plus the overall abundance of each species during spring and fall migrations are artifacts of Lake Erie's location within the Atlantic Flyway. This phenomenon of migration is documented through direct observations, monitoring night calls and banding records and witnessed by tens of thousands of visitors each year makes Lake Erie, Presque Isle, Long Point in Canada and the habitats of the Lake Erie a première birding site in eastern North America.

Jerry McWilliams, an acknowledged expert birder, the birds records chairman for the Presque Isle Audubon Society, senior author of the book "The Birds of Pennsylvania" and founder and coordinator for the Presque Isle Hawk Watch has been documenting his bird observations for 24 years. During this period Jerry alone has recorded millions of migrant birds and recorded large numbers of breeding species throughout Lake Erie and the surrounding region. His comprehensive data set includes over 100,000 waterfowl, 1500 + shorebirds representing 39 species, over 100 wading birds like American and Least Bittern, up to 600 Pied-billed Grebe and up to 500,000 gulls per season. Jerry's data was an integral component which helped to define Presque Isle as an IBA

Concerns about offshore wind relative to birds and bats

A major concern of Audubon is that bird and bat kills have been documented to varying degrees at each and every industrial scale wind facility in Pennsylvania (personal comm. PGC staff). However we do not know the actual numbers or species or composition due to the proprietary nature of the data, a stipulation the wind industry insisted on as part of the voluntary cooperative agreement between the Pennsylvania Game Commission and the wind power companies. As a result it is difficult for the scientific community to independently assess or evaluate the quality and analysis of the data acquired during pre and post construction surveys, the extent or frequency of bird or bat kills that have occurred at these sites (post construction) or to evaluate the actual monitoring protocols used to do these studies.

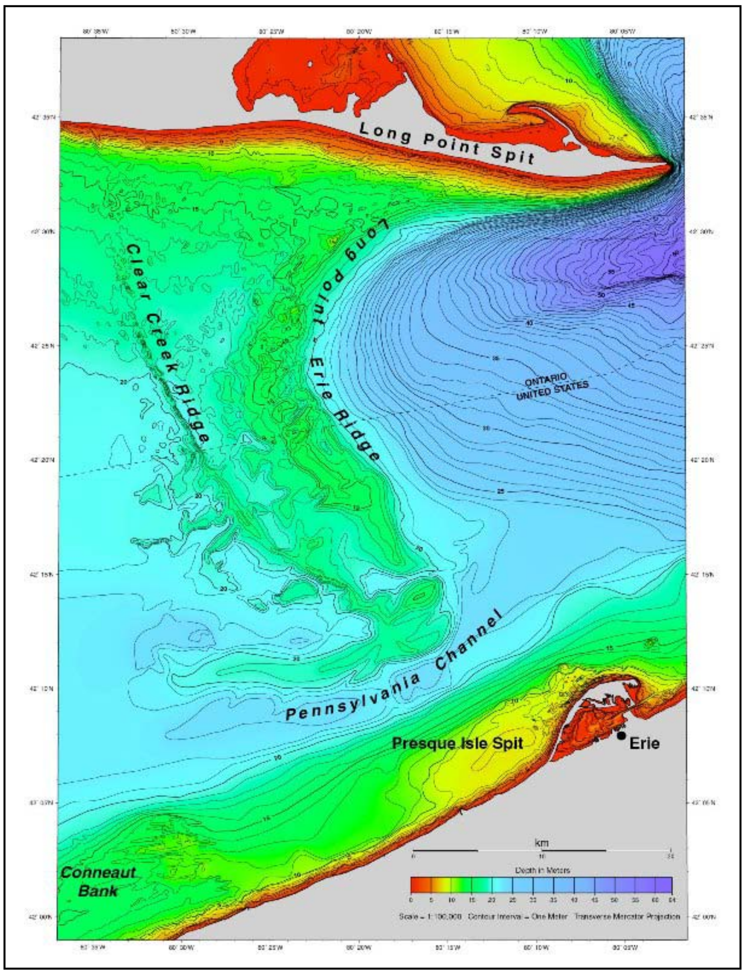
There are real concerns that any industrial scale wind facilities located offshore could result in more serious impacts on migrating populations considering the high concentrations of migrating birds that funnel across Lake Erie. The magnitude of bird strikes could potentially be much higher than onshore sites depending on where birds occur in migration relative to turbine configurations. What compounds this issue is if and how any quantitative or qualitative post construction studies could be accomplished regarding collision frequency and extent of bird strikes/kills could be effectively documented offshore due to the following

1. When birds collide with spinning rotor blades they are frequently dismembered making them difficult to identify.
2. Bird bodies or body parts will only remain buoyant for limited periods of time. Once they become saturated they will sink below the water surface. Feathers may remain on the surface longer depending on the surface tension of particular feather types and feather structure
3. If bodies or parts are somehow collected the degree of deterioration depending on low long they were in the water will be a factor in making correct identifications
4. Scavengers such as gulls and other aquatic organisms like fish will readily predate on floating or sinking carcasses and parts.
5. Observers will need to be highly skilled at identifying body parts of individual species or single feathers to assure correct identification of bird species

Additional concerns would be increased risk of scavenging birds colliding with turbines and potential disruption of bird movements through the region during spring and fall migration. Post construction surveys at two offshore Danish wind facilities (Fox et al. 2008) showed that certain waterfowl species were displaced from traditional stopover areas where turbines were constructed. Other birds that did return to the area avoided the turbines by flying around the entire configuration as opposed to flying through the arrays. Overall mortalities were low however in both cases regular behaviors, movements and foraging activities were disrupted and additional time and energy was spent in finding new resource areas or maneuvering around the structures. In addition the authors pointed out that cumulative impacts from this and other planned facilities would most likely have an additive impacts on waterfowl species. A scenario likely to be repeated in Lake Erie should turbines be constructed there.

The bathymetry of Lake Erie is such that the Long Point Erie Ridge, an underwater ridge running from Presque Isle in Pennsylvania to the Long Point Spit in Ontario Canada is also the most likely location for industrial scale turbines since it is relatively shallow, easily accessed by water and affords lower costs in transport and delivery of turbine components to the site and actual construction. Unfortunately this feature of the lake is also the narrowest section of water where migrating birds tend to concentrate as well (Diehl, Larkin, and Black 2003). This sets a scene for the perfect storm in the bird migration realm should turbines be erected here.

Bathymetry of Lake Erie



Risks to Birds
Some bird species including loons, waterfowl (swans, geese, and ducks) gulls, terns, and shorebirds, migrate both at night and during the day while numerous passerines only migrate at night. Raptors,

cranes, and certain passerines like corvids, swallows, blackbirds, and bluebirds generally migrate during the day.

During good weather conditions and at the height of the night migration (non dusk and dawn hours) many birds can be found flying at higher altitudes. Results of various radar migration studies show flight altitude varying between 100 to about 500 meters. This variation can be attributed to multiple factors including study methods, radar type, location, species composition and weather conditions. One radar study in particular conducted by Cooper, Stickney and Mabee (2003) for Chautauqua Windpower LLC at a proposed industrial wind site located approximately 3.5 - 4 km inland from the Lake Erie shoreline during fall migration provided relevant information regarding flight behavior of nocturnal migrants along Lake Erie. Their study which employed vertical radar and night vision equipment revealed that many of the nocturnal migrants occurring between 100 and 200 meters were songbirds. Bats were more inclined to fly below the 100m level. Most of the birds passed through the area at or below the proposed turbine height (about 106m + or –) and potentially well within rotor sweep areas. The more recent generation of turbines being installed at onshore sites in Pennsylvania are taller measuring up to 425 feet (129.54m) in height depending on manufacturer, turbine model, tower height and rotor blade length with rotor sweep diameters of 90 to 126 meters. Turbines used for offshore facilities would most likely be similar in their dimensions and therefore present a greater hazard to birds flying at 100 to 200 meter altitudes.

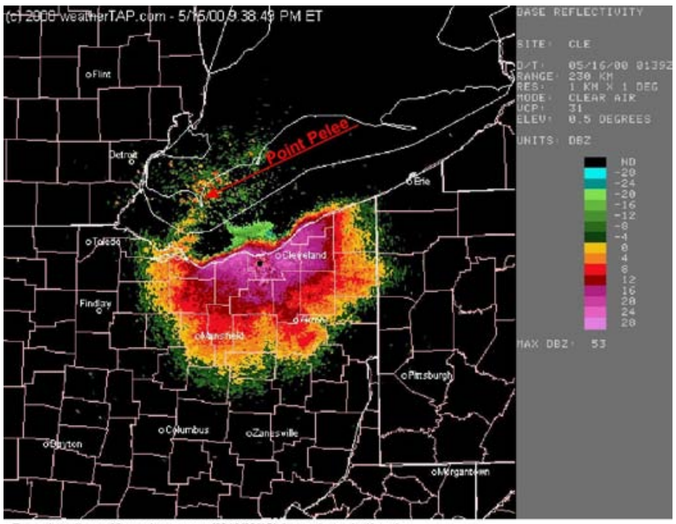
Low cloud ceilings or foggy conditions can be a danger to birds in close proximity to taller and lighted man-made structures like guyed communication towers during heavy migration periods. Documented kills of large numbers of migratory birds have and will continue to occur at these sites during low visibility conditions like overcast or foggy nights. The likelihood for the same to occur at turbines under similar circumstances is quite real for the following reasons

1. During low cloud ceilings migrating flocks of birds will drop in altitude flying below cloud level.
2. If birds happen to fly through a wind turbine project when these conditions occur and spinning turbine blades are obscured or partially obscured by cloud cover or other conditions that reduce visibility then the likelihood of bird/turbine collisions will increase especially during migration seasons.
3. Lake Erie is considered to be the stormiest of the Great Lakes due to the frequent frontal systems and convection which results in a lot of cloud cover throughout the year.
4. In addition to convection and frontal systems avection fogs also occur on Lake Erie approximately 15 days of any given year.

The hours around dusk and dawn within or adjacent to an industrial scale wind facility could present additional risks to migrating birds. During these hours flocks of migrating birds either descend to rest on the water surface or nearby land or ascend to continue their journey depending on whether they are nocturnal or diurnal in their movements. During these periods they are flying at much lower altitudes in poorer light conditions. Depending on the bird species, flock size, their visual acuity and location relative to the turbines when ascending or descending, the turning speed of the rotor blades, weather conditions, and flight altitude the risk of collision with the tower or blades could increase and potentially result in cataclysmic outcomes for large numbers of birds.

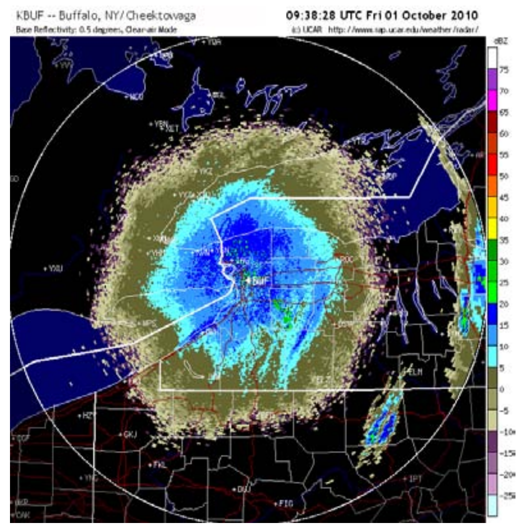
Many will argue that even though industrial scale turbines take a toll on birds they are less of a threat to bird and bat populations than other anthropogenic sources of mortality and are quick to point out that the number of fatalities attributed to building and window collisions, cats, communication towers, electric transmission lines are higher. No one will argue that birds are indeed killed by each of these. However it is more important to view this from a proper perspective in that from an ecological standpoint it is the cumulative impacts of each and every wind turbine in conjunction with other sources of bird mortality like window, building and communication tower collisions, heavy metals from environmental pollution, transmission lines electrocutions, habitat loss and their combined impacts on bird populations over time. This is the real issue. Every new anthropogenic structure or perturbation increases the level of stress on already stressed populations along with the likelihood of increases in collision mortalities. Turbines on this migration corridor will just add to the mix.

As stated earlier Jerry McWilliams has been recording his bird observations in the region for years. In addition to recording numbers of each species he also records other information such as date, location, and flight altitude along with weather conditions. His personal notes reveal that he has often observed birds five miles from shore at varying altitudes above the water. His visual observations are substantiated by peer reviewed studies on bird migration over the Great Lakes (Bonter 2003 and Diehl, Larkin, and Black 2003) and examination of radar images of birds in migration (see images below). In addition these studies also document the reality that the birds are found further than five miles offshore during migration seasons.

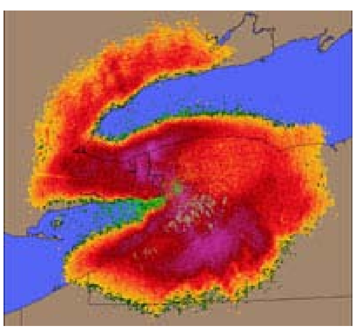


From: http://marg09.wordpress.com/2010/03/15/pigeon-bay-windfarm/
March 15, 2010

Radar Image March 15, 2010 Cleveland Ohio



Radar image October 1, 2010 Buffalo New York



This radar image from May 16, 1999, captures the distribution of birds in the airspace shortly after the onset of nocturnal migration near Lakes Erie (left) and Ontario (right). Colors represent logarithmic differences in migrant density; in order of lowest to highest density they are green, yellow, orange, red, and purple. Voids in the radar echo pattern occur over the lakes because most of the migrants are landbirds. Radar echoes caused by northbound migrants can be seen extending over the southern portion of both lakes as birds depart the coastal landscape and fly out over the water. Regions of stronger radar echo this early in the migratory flight show where in the landscape (stopover habitat) birds occurred in high densities prior to the onset of migration http://www.fort.usgs.gov/radar/

Although this testimony is in regards to offshore wind it should be noted that last year at the Erie Shores wind facility in Ontario Canada a three-year old bald eagle was killed when it collided with a wind turbine. Findings revealed that its one wing had been severed and it died from severe trauma. In addition a breeding pair of bald eagle that were actively nesting near the same project and within ½ mile of a turbine abandoned their nest once that turbine was brought on line. It was highly suspect that the turbine may have had a role in the abandonment of the nest (personal comm. USFWS staff). A similar incident could occur at Lake Erie if turbines are constructed too close to the shoreline.

Wind power, backup generation and CO_2 emissions

I am a biologist, ecologist and teacher by education, training and experience. I do not profess to be an energy expert but like many others I am able to research topics outside my field of expertise, understand the science and math of these disciplines and communicate effectively with those who are experts in this field. With that said I would like to present some basic terminology and mathematics associated with wind power for general knowledge and understanding.

First the term megawatt (MW) refers to a quantity of *instantaneous* power and is not the way we measure electricity for household or industrial use. For that we use a unit of instantaneous power linked to a unit of time, in this case, a megawatt hour (MWh). One MWh is one megawatt of electric power delivered at that constant rate for one hour. Our household bills are figured by the kilowatt hour (kWh) where 1 MWh = 1000 kWh.

Several years ago the American Wind Energy Association (AWEA) claimed that 15,000 MW of wind energy were available to supply 3 million homes. The figure from a 2009 AWEA report raised the number to 35,000 MW and included small turbines (under 100 kW). These figures represent the approximate total of the ***nameplate capacity*** of installed wind turbines in the USA not ***capacity factor***. ***Capacity factor*** is the actual average output over a set period of time (usually 1 year) to the hypothetical maximum possible (i.e. running full time at rated power). Annual capacity factor for wind power varies across North America from 15-30 % depending on location and wind availability.

Now for example lets say there is hypothetical facility with 20 - 2.0 MW turbines (40 MW of nameplate capacity) and it runs at 25% capacity factor.
To calculate capacity factor for one 2.0 MW turbine operating at 25% capacity factor for one year we multiply MW X number of days in a year X number of hours in a day by 25% (0.25)

2.0 MW X 365 days X 24 hrs. X 0.25 = 4380 MWh = 4,380,000kWh

For a 20 -2.0 MW turbine facility simply multiply the number of kWh by the number of turbines to get total kWh of power

4,380,000 kWh X 20 = 87,600,000 kWh

To covert back to MW for this 20 turbine facility operating at 25% capacity you divide the total number of kWh by 1000 or multiply by 0.001

87,600,000 X 0.001 = 87,600 MWh

Finally to convert MWh to MW simply divide the number of MW hours by the total number of hours (in a year)

87,600 MWh / 8760 = 10 MW

At 25% capacity factor 10 MW is the actual amount of power being produced at this hypothetical facility.

Wind is often referenced as a green renewable energy source and on the surface it appears to be just that since turbines don't directly use fossil fuels or emit carbon dioxide (CO_2). The original purpose behind promoting wind generated power was to bring about a reduction of greenhouse gases including CO_2 emissions in the hopes of reducing or slowing down the impacts of global climate change on the biomes of the world.

Wind generation is highly variable because winds are variable. Wind does not blow 24 hours a day, 7 days a week, 365 days a year. Winds tend to blow most consistently in spring and fall when we are close to the boundary line between polar and tropical air masses and more so at night rather than during the daytime. They are generally stronger in winter than in summer since fronts travel faster in winter. Because of its intermittency and our inability to store it, wind generated power must go directly into the grid and thus augments conventional forms of energy like coal, gas, nuclear and to a lesser degree hydro each of which has its own set of biological and ecological impacts

Conventional forms of energy provide base load, load following and peak power because they are consistent, reliable and predictable. At times when wind power goes into the grid conventional forms must be ramped back to keep the grid in sync at 60 Hz (cycles per second).* Hydro power is used primarily for load following or peak demand times. Conversely when winds stop blowing conventional forms of power production must be able to respond fairly quickly so that brownouts or blackouts don't occur on either end of the spectrum. Due to its thermodynamic properties coal can only be ramped back to a certain point so that it can be available in a short order if needed (when the wind stops blowing) Unfortunately when coal is ramped back it burns less efficiently and more dirty resulting in increased CO_2, SO_X or NO_X emissions (deGroot and lePar 2009, Bentek study 2010, and Lang 2010).

The point here is that Pennsylvania is a state that relies heavily on coal fired plants for power generation and back-up for wind generating facilities when the wind doesn't blow. As a biologist, I have concerns about additional emissions that could result from the inefficient burning of coal when power plants are ramped back as well as the impacts on overall air quality. I would suggest that serious studies be conducted by independent researchers to address the extent and scale of this issue across the state.

Recommendations:
It is essential that all study recommendations listed below be conducted by independent researchers, use established peer reviewed scientific protocols and be peer reviewed.* *

- Specifically examine the breadth of spring and fall bird and bat migration along the shores and across areas of Lake Erie including areas targeted for potential wind development. Studies should employ all available methods and technologies including but not limited to radar (horizontal and vertical), visual (night vision equipment and daytime observations), and acoustics to acquire comprehensive data on migration including, to the extent possible, species composition. These studies should also be conducted over a minimum of 2-3 years to allow for temporal and spatial variation in migration patterns

- Careful siting of facilities is key to avoiding serious bird fatalities. Therefore studies should not be just counts of abundance and distribution patterns. They should be scientifically robust and planned so that all environmental factors (i.e. meteorological conditions), bird behaviors that put certain species at greater risk and their effects on bird populations are fully understood. Once behavior patterns are defined these should be taken into account regarding site location, array configuration and individual placement of each industrial/utility scale turbine.

- Additional studies for offshore turbines should be conducted to assess and monitor the impacts of said construction on the benthic community.

Establish buffer zones and specify areas unsuitable for development:
The state of Pennsylvania should follow the precedent of other Great Lakes states such as Ohio and Michigan in delineating off shore areas in terms of their suitability for wind development. Suitability criteria will need to include a number of commercial, navigational, and environmental factors. We call for the state of Pennsylvania to protect our environmental resources even as offshore wind is developed by:

- Avoiding construction of turbines within or near areas of known or newly confirmed migration flight paths
- No onshore or offshore construction of turbines within or near sensitive habitats or stopover staging areas

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* The U.S. power grid and that of Canada run at a frequency of 60 Hz (cycles per second). At any given point in time all generators connected to grid must run at the same speed or in a "synchronized" mode which is 3600 $rpms_s$ Allowable variation on the grid is +/- 0.5Hz (30 rpm). To maintain the stability of the grid when winds power does go into it, conventional forms of energy like coal, gas and nuclear must be ramped back so that too much power does not go into the grid.

**Over the past few years I have personally reviewed numerous reports and in several cases read documents acquired through the Freedom of Information Act or litigation processes involving different wind facilities. During this time it has become apparent that the industry regularly contracts consulting firms that work almost exclusively for them, they fail to use peer reviewed methods in their data collection and they fail to conduct their surveys for the appropriate amount of time or during the correct time of bird movements, and since everything is voluntary have selected to disregard requests from regulatory agencies like USFWS and the PGC to conduct additional surveys. Hence numerous studies inadequately address legitimate biological or ecological concerns.

- No turbines within or near known, restored or targeted Piping Plover habitat

- No onshore turbines within known shoreline migration corridors or within five to six miles of the shoreline where more bird activity regularly occurs

The state of Michigan developed guidelines for avoiding bird habitat, areas containing threatened and endangered species, very high concentrations of birds including seasonal congregating areas. A five mile buffer was adopted for each of these criteria. A more stringent 6 mile buffer was adopted for shoreline parks and wilderness areas, and the most stringent criteria adopted, along national park lakeshores, was 13 miles. The full set of buffer distances adopted by Michigan last year appears at the back of this testimony. We believe Pennsylvania should adopt the 5 mile buffer at this time directly consistent with the careful analysis and policy development precedent of Michigan.

Post construction:

- Post construction monitoring is essential to identify new problems or to inform any mitigation procedures.
  Surveys should occur throughout the migration season for a minimum of 3 years. After which time they should be conducted once every two years
  If turbines are found to be of harmful to birds and bats they should be turned off during migration period
  If turbines continue to impact birds outside of the migration then decommissioning including the full dismantling of the turbine is recommended in conjunction with site restoration to a state equal to or better than it was prior to said turbine. All costs should be the responsibility of the current operator of the facility

- In order to offset and address potential impacts of constructed wind turbines, an Impact Fund should be established, the monies derived from a percentage of the net profits from power production including those from PTCs.

Additional recommendations:

- Additional peer reviewed studies should be conducted to examine and assess the effectiveness of wind power on CO_2 emissions in the state of Pennsylvania and throughout the Lake Erie region.

As a wildlife biologist and citizen of this state I have serious concerns about all of the topics I've presented in my testimony today. Logic dictates that as more industrial/utility scale turbines are erected the probability of bird and bat collisions and displacement of species will also rise only adding to the cumulative impacts of all anthropogenic sources causing bird and bat deaths. We need to take serious actions to minimize these potential outcomes though sound peer reviewed science and avoid siting turbines in all areas that tend to concentrate bird and bat populations. It is also my understanding that the state of Pennsylvania is in the process of decommissioning older coal fired plants and for good reasons. However as more wind power comes on line in the state we will need to make certain that additional forms of conventional power are in place to serve as back-up. We need to carefully examine exactly what kind of power best meets this need while continuing to strive for lower greenhouse gas emissions. Thank you.

Respectfully

Kim Van Fleet

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EXHIBIT 2
Summary of Mapping Criteria

Criteria	Buffer distance
Criteria to Define "Conditional" Areas	
Scenic vistas	6 miles
National park lakeshores	13 miles
Shoreline parks and wilderness	6 miles
Shipwrecks	0.5 miles
State bottomland preserves	Addressed during permitting
Underwater archeological sites	Addressed during permitting
Habitat/biological (5 criteria)	
• Concentrations of bird or bat species of conservation concern	5 miles
• Threatened and endangered species	5 miles
• Recreational fish spawning sites and refuges	1 mile
• Very high concentrations of birds or bats on at least a seasonal basis	5 miles
• Nearshore zone of biological productivity	3 miles
Commercial fishing areas	0.5 miles
International and state boundaries	0.5 miles
Shipping lanes (pursuant to NOAA nautical chart data)	1 mile
Disposal sites	0.5 miles
Harbors/marinas	5 miles
Large river mouths	5 miles
Criteria for "Categorical Exclusion" Areas	
Military operation areas	Addressed during permitting
Submerged transmission lines	Addressed during permitting
Aids to navigation	Addressed during permitting
Buoyed navigation channels	Addressed during permitting
Coastal airport zones	Addressed during permitting

SOURCE: Michigan Great Lakes Wind Council, 2010. Data on underwater archaeological sites, buoyed navigation channels, and submerged transmission lines are not currently available and therefore are not reflected in the maps in this report. Data for some of the mapping criteria, such as commercial fishing, shipwrecks, and habitat, are incomplete.