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BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application of Highland Wind Farm, LLC for a Certificate of Public Convenience and Necessity To Construct a 102.5 MW Electric Generation Facility and Associated Electric Facilities, to be Located in the Towns of Forest and Cylon, St. Croix County, Wisconsin

Docket No. 2535-CE-100

DIRECT TESTIMONY OF JOANNE J. BLANK

Q. Please state your full name and business address.

A. My name is JoAnne J. Blank. My business address is 954 Circle Drive, Green Bay, Wisconsin 54304.

Q. By whom are you employed and in what capacity?

A. I am employed as a Senior Scientist and Project Manager by Stantec Consulting Ltd.[1]

Q. Would you briefly state the duties of your present position?

A. The duties of my present position include the management of renewable energy development projects, with a focus on the feasibility and pre-construction phases. My areas of specialization include site selection and feasibility, environmental permitting, spatial data management, sound and shadow modeling and permit compliance.

Q. What is your educational and professional background?

A. I have a Bachelor of Science and Master of Science degree in Atmospheric and Oceanic Sciences from the University of Wisconsin – Madison. I also have a Master of Science

[1] Formerly Bonestroo which was acquired by Stantec in September, 2011.

are under lease and available for Project use. The Project is mostly located in the Town of Forest, with the exception of the new substation, to be built in the Town of Cylon. The major Project components consist of the Turbines; their associated padmount transformers; access roads; 34.5 kilovolt ("kV") underground cable system to collect the power from the turbines and deliver it to the substation; the new substation; an operations and maintenance ("O&M") building; and a temporary construction laydown yard located near the O&M building. HWF will be built on private, mostly agricultural land with the exception of public right-of-ways ("ROW") to be used for portions of the collection system.

Q. Please describe wind power technology as it relates to the Project.

A. The turbine class proposed for HWF has rated power capacities of 2.3 – 2.5 MW per turbine with a horizontal-axis, upwind configuration. A yaw system continuously monitors wind direction and the rotor position is adjusted for optimal wind direction. Power will be generated by wind passing over the turbine's rotor blades, converting kinetic energy into rotational energy by turning a low, variable-speed generator shaft. The shaft speed range varies by turbine design from 7.5 to 20 revolutions per minute (rpm). The variable speed turbines take advantage of both low wind speeds and the aerodynamic efficiencies gained as the wind increases. Electricity is produced by converting the mechanical energy through the motion of drawing electrons from a magnetic field through twisted wire coils. The generator is cooled with an internal, active water/air heat exchanger. Assuming a 30 percent capacity factor, with a total rated capacity of 102.5 MW, the Project will produce approximately 247,500 megawatt-hours (MWh) each year, taking into consideration the time that the turbines will not be running

health problems as concentrations of naturally occurring substances, such as arsenic, reach un-healthy levels. Additionally, drawdowns can affect the level of drinking wells, wetlands, lakes and streams. The production of electricity from wind power does not consume significant amounts of water in the generation process. Small amounts of water are used during the construction process, mainly in the concrete foundations and equipment cleaning operations, and in the closed-loop cooling system within the nacelle. Coal-fired, combined-cycle natural gas and nuclear power plants in Wisconsin generally use one of two methods to cool the steam for generation back to water. Both methods use tall cooling towers and large water withdrawals. A wet cooling system circulates water through the tower, cooling by evaporation. The water lost through evaporation must be made up by withdrawal from a high-capacity well or nearby surface water body. Minerals and microbial species that accumulate from the water need to be cleaned from the system for optimal performance. Periodic discharges or "cooling tower blowdowns" may contain pollutants, such as chlorine, iron, copper, nickel, aluminum, boron, chlorinated organic compounds, suspended solids, brominated compounds, and non-oxidizing biocides. Though the pollutants are often in low concentrations, the cumulative mass may be significant due to the large amount of cooling water discharged.

Another method of cooling used at Wisconsin steam-generated power plants is a once-through cooling system. This system withdraws millions of gallons of water from surface waters daily, and returns most of it (98-99%) to the host water body at a temperature 10 to 15 degrees (F) warmer than when it was extracted. Environmental impacts associated with this method include the entrainment of fish and other aquatic life during the intake process and thermal pollution from the warm water returned to the water body after the

these by-products have been shown to be harmful to our environment and must be disposed of, treated or other containment measures utilized to separate them from our land and groundwater. Coal combustion by-products include fly ash (captured from the air in filters), flue-gas desulfurization materials (produced in the "scrubbing" process that removes sulfur and oxides from the flue gas stream) and bottom ash or boiler slag (removed from the bottom of coal furnaces). There is a beneficial re-use market of bottom ash products; though the U.S. Environmental Protection Agency ("EPA") is currently considering regulations to ensure the safe binding of contaminants that remain in the final placed product.

The EPA collectively terms the coal ash by-products as coal combustion residuals ("CCRs"). There are also waste products created when air pollutants are removed from the gas inside the power plant stack and in the extraction process when coal is cleaned at source mines. The EPA states that CCRs contain contaminants of concern such as mercury, cadmium and arsenic, which are associated with cancer and various other serious health issues.

Common disposal methods of CCRs include liquid slurry that is held in surface impoundments or a solid form, disposed of in solid waste landfills. At this time, the disposal of ash is not regulated as hazardous waste; landfills and impoundments without proper protection may allow the toxic elements of the CCRs to leach into groundwater, where it may in turn contaminate drinking water supplies. The EPA is currently considering a Federal rule to ensure safe disposal methods and monitoring of disposal sites. An example of a catastrophic event concerning CCRs was the structural failure of a Tennessee Valley Authority ("TVA") coal ash impoundment in 2008 in Kingston, TN.

extraction. The EPA's Office of Research and Development cites numerous detrimental impacts associated with these methods, including impacts to and loss of ecosystems and downstream water quality deterioration with toxic chemicals. Large amounts of resources are spent on the restoration of surface and open-cut mining areas upon completion of extraction.

Natural Gas: Natural gas is extracted from deep underground gas-producing rock formations such as shale by a process called "hydraulic fracturing," more commonly known as "fracking." The process stimulates the target formation, enhancing recovery of the gas by pumping a mixture of fluids, such as water, chemicals, diesel fuels, and/or propping agents under high pressure into the rock. Agents such as diesel fuel are often used as the primary carrier or as an additive in delivering the propping agents to the fracture. Diesel fuel often contains chemicals of concern such as benzene, toluene, ethyl benzene, and xylene compounds ("BTEX"). BTEX compounds are regulated under national drinking water regulations because of their mobility in ground water and the risks they pose to human health. The EPA has identified numerous pathways in which these contaminated fluids can escape through injection wells or injection zones and enter underground sources of drinking water such as aquifers or private and public wells. As of May 2012 the EPA has released "Draft Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities using Diesel Fuels." Similar contaminants and related health issues are of concern due to unregulated releases of polluted wastewater to nearby surface waters, groundwater and wetlands. Open-air impoundments or evaporation ponds contribute to air pollution as volatile chemicals escape.

- Carbon Monoxide (CO)
- Lead (Pb)
- Nitrogen Oxide (NO)
- Ozone (O_3)
- Particulates ($PM_{2.5}$ and PM_{10})
- Sulphur Dioxide (SO_2)

In addition to the pollutants regulated above, in December, 2011, the EPA finalized the first national Clean Air Act standards to reduce mercury and other toxic air pollution from coal- and oil-fired power plants. The Mercury and Air Toxic Standards are in response to science showing that mercury and toxic air pollution is a threat to public health, and has not up to this point, had national limits on emissions. Fossil-fuel power plants are the primary emitters of mercury (50%), acid gases (75%) and toxic metals (20-60%) in the U.S.[4] While the scrubbing of these toxic components from the airstream will benefit the air quality of the nation, it also shifts the toxic residuals to the solid waste generated by coal-fired plants. The waste will likely meet requirements to be disposed of as hazardous waste. As pollution concerns and controls mount, the power plants that are the worst offenders will be retired; the electricity that they generate can be replaced by wind farms like HWF which do not emit harmful toxins into the air.

The air emissions of relevant criteria pollutants and mercury avoided by generating electricity at HWF rather than a coal-fired power plant are summarized here, based on the

[4] U.S. Environmental Protection Agency, EPA Fact Sheet: Mercury and Air Toxics Standards, Benefits and Costs of Cleaning Up Toxic Air Pollution from Power Plants (Dec. 2011), http://www.epa.gov/airquality/powerplanttoxics/pdfs/20111221MATSimpactsfs.pdf.

power plants are the largest single contributors to carbon pollution in the U.S. and that currently there are no regulations on the amount of carbon pollution new power plants can emit, the EPA has undertaken the writing of standards that new fossil-fuel power plants will need to follow. Additionally, the EPA issued the Mandatory Reporting of Greenhouse Gases Rule (74 Fed. Reg. 56,260 (Oct. 30, 2009)) which requires the reporting of GHG emissions by facilities emitting 25,000 metric tons or more of GHGs. The reporting data will be used to make future informed policy decisions. Wisconsin power plants emitted over 45.5 million tons of CO_2 into the atmosphere in 2009. The generation of electricity from wind does not emit any CO_2 into the atmosphere. For every MWh of wind energy produced, CO_2 emissions from fossil-fueled power plants are reduced by approximately 1,277 pounds.[5] HWF, as designed, would reduce CO_2 emissions each year by approximately 158,000 tons. Over a lifetime of 25 years, HWF would avoid the emission of more than 3.9 million tons of CO_2 into Wisconsin's air. Other greenhouse gas emissions are also avoided by generating electricity with wind. These avoidances include methane (CH_4) and nitrous oxides (N_2O). Methane is emitted in lesser amounts than CO_2; however it is a more powerful greenhouse gas. Methane is more prevalent in the generation of electricity from natural gas. Methane may also be released during the extraction of gas and coal from the earth and during transport to power plants. The generation of electricity from wind power at HWF will not release methane or nitrous oxides to the atmosphere.

[5] Midwest Independent Transmission System Operator, Inc., MTEP 06 Midwest ISO Transmission Expansion Plan, p. 274 (Dec. 2006, rev. Feb. 2007).

The operation of HWF will not withdraw from or discharge to surface waters. The O&M building will have a permitted private well and septic system to handle everyday operations.

Q. Will the Project have any impact on wetlands?

A. As previously noted, HWF was designed to minimize impacts on the nearby residents and the environment. Impacts to wetlands were mostly avoided, with the small exceptions described below. The features described were identified using desktop information (aerials, USGS topographic maps, Wisconsin Hydrography data, USDA soils data and the Wisconsin Wetland Inventory) and verified with field surveys. The Project was redesigned after initial field surveys to further minimize impacts to wetlands and waterways. Most wetlands are previously disturbed (farmed wetlands) and not of high functional value (WDNR designation). No turbine foundations will be constructed in wetlands. There are 0.137 acres of permanent impacts and 0.223 acres of temporary impacts to wetlands. These areas include:

- Eight permanent impacts to wetlands crossed by access roads.
- Five of the above wetland features will also be temporarily impacted by crane crossings (crane paths will overlap with access roads at these crossings to minimize impact).
- Two additional wetlands will be temporarily impacted by erection crane crossings.

Access road crossings will be approximately 16 feet wide and will be constructed perpendicular to, and at narrow sections of wetlands to minimize fill. Cranes will cross a total of seven wetlands creating a temporary impact. Five of the crossings will overlap

impact private wells in the area. Post-construction restoration and landscaping will restore the pre-construction flow regime to the maximum extent possible.

Q. What criteria were used when placing turbines within the Project boundary?

A. The initial placement of turbines considered the wind resource, participation of landowners and general constructability. The initial locations were then carefully "microsited" to minimize impacts to residents and the environment and comply with setbacks as directed in the most recent PSCW wind farm approval (We Energies Glacier Hills Wind Park) and the subsequent wind siting rules enacted by the PSCW in Wis. Admin. Code Ch. PSC 128 ("PSC 128"). In addition to the wetland and waterway avoidance and impact minimization discussed previously the following setbacks and considerations were utilized to place turbines:

- Occupied Community Buildings – 1,250 feet
- Non-participating Residences – 1,250 feet
- Participating Residences – 550 feet (>1.1 x tip height)
- Non-participating Property Lines – 550 feet (>1.1 x tip height)
- Public Right-of-Ways – 550 feet (>1.1 x tip height)
- Overhead Communication, Transmission and Distribution Lines (service lines to homes not included) – 550 feet (>1.1 x tip height)
- Microwave Worst Case Fresnel Zones (described by Mr. Polisky)
- Locations of sensitive habitats and natural resources
- Geotechnical (sub-surface) investigations

After considering the above items, sound and shadow models were completed and an iterative process was used to move turbines to their present proposed locations.

- Town of Forest Ball Field (NW corner of State Hwy 64 and 270th Street)
- St. John's Evangelical Lutheran Church and Cemetery (State Hwy 64 and 280th Street)
- Immanuel Lutheran Church and Cemetery (210th Avenue, west of Cty Hwy P)
- "Town" Cemetery (280th Street, north of 210th Avenue)
- Living Word Chapel (State Hwy 64, east of 270th Street)
- Forest Methodist Church (Cty Hwy D, south of State Hwy 64)
- Christ Gospel Church (280th Street, south of 220th Avenue)
- Kiddie Country Care (310th Street, north of State Hwy 64)
- Lake Country Private School (30th Street, south of 1330th Avenue)

The Project will not have any undue adverse effect on these sites. Additionally, all sites meet the required setbacks in PSC 128.

Q. Will the Project have any undue adverse impacts to local historic archaeological or architectural sites?

A. Based on a Phase IA archaeological review of the Project area there are no previously recorded historic properties proximate to the 41 primary turbines sites or the 11 alternate turbine sites. However, should any cultural, historical or paleontological items be exposed as part of the proposed Project construction activities, the responsible agency will be immediately notified in accordance with the Advisory Council on Historic Preservation's Protection of Historic Properties regulations (36 C.F.R. Part 800.13(b)). In cases of historic cemeteries adjacent to road ROWs, collection system construction will be routed to the opposite side of the road.

Q. Will there be impacts to non-participating residents in the Project area due to the sound emitted by the wind turbines?

A. A noise assessment was completed to model the predicted sound at sensitive receptors (homes, schools, churches, etc.) within the Project area. Models for the three preferred turbine models (Nordex N100 and N117, Siemens 2.3-113) were run in WindPro, an industry standard software application for noise modeling. PSC 128 limits the allowable noise impact attributable to turbines to 50 dBA during daytime hours and 45 dBA during nighttime hours. The preliminary assessment for HWF was performed using a non-vegetated landscape, to provide the most conservative results. Approximately 45 non-participating residences would experience greater than 45dBA at their homes using this conservative scenario. The model was rerun using a more realistic, but still conservative approach, applying an agricultural vegetative land cover. No non-participating residences or sensitive community buildings are expected to experience more than 45 dBA using this more realistic scenario. A sound level of 45 dBA is comparable to the sound one hears from a typical home refrigerator.

Q. Please discuss the methodology for handling sound complaints at non-participating residences or public buildings and what type of mitigation is proposed?

A. HWF will host a Project web-site and have a local (or toll-free) telephone number that can be used to register complaints or concerns about the wind farm. The complainant will be contacted by HWF or one of its representatives to evaluate the concern. If it is determined that the sound level at the residence or public building is not in compliance with the PSC 128 noise standard, mitigation measures will be taken. These mitigation measures may include installing insulation or some form of sound-deadening material

residence will be dependent on the turbine model chosen, the weather (sunshine versus clouds), distance, vegetation and surrounding buildings.

Q. PSC 128 requires mitigation for homes experiencing more than 20 hours of shadow per year. Can you describe the mitigation techniques that will be provided for these residences and also how complaints about shadow flicker at other non-participating residences or public buildings will be handled?

A. PSC 128 requires different levels of mitigation for shadow flicker impact on non-participating inhabited buildings. Greater than 20 hours of impact can be mitigated with blocking measures while greater than 30 hours must be mitigated with operational curtailment. HWF will comply with the shadow flicker limits and mitigation techniques as described in PSC 128. A brief summary is presented here; additional detail can be found within the PSC 128 regulations.

- HWF will be operated in a manner to not cause more than 30 hours of shadow flicker per year at non-participating residences or occupied community buildings; operational curtailment will be used to comply with this requirement. With the current design of the Project, approximately 4 to 12 non-participating residences may experience shadow flicker greater than 30 hours per year, depending on the turbine model chosen.
- Reasonable mitigation will be provided to non-participating residences or community buildings that experience more than 20 hours per year of shadow flicker. Reasonable mitigation will include the installation of blinds or landscape plantings, at the expense of HWF. With the current design of the Project,