

MEMORANDUM

February 12, 2003

TO: Environmental Quality Board Members &
Technical Representatives

FROM: Larry B. Hartman & Alan Mitchell
EQB Staff, Tel: 651-296-5089 or 3714

SUBJECT: Request of Moraine Wind to Locate Wind Turbines within 5 Rotor
Diameters of the Site Permit Boundary and to Amend Internal
Turbine Spacing Requirements (Permit No. 01-10-LWECS-NE)

Action Requested: Moraine Wind is requesting MEQB approval to place six wind turbines within five rotor diameters of the site permit boundary and an amendment of the permit to reduce turbine spacing requirements from four rotor diameters crosswind and eight rotor diameters downwind to three rotor diameters and six rotor diameters respectively.

Background: Moraine Wind, LLC ("Moraine") is the current permittee under Site Permit No. 01-10-LWECS-NE, having assumed those rights and obligations from Navitas Energy, the original permittee. The site permit was granted for a 130.5 megawatt (MW) large wind energy conversion system (LWECS). Moraine plans on building this project in three phases. Phase I consists of 34 turbines to generate approximately 51 megawatts of electricity. Phase II consists of 33 turbines to generate approximately 49.5 MW, and Phase III consists of 20 turbines to generate another 30 megawatts.

Phase I of this project is scheduled to be built in 2003 in Pipestone and Murray Counties and will use the General Electric (GE) Wind 1.5 MW turbine. These turbine towers are approximately 215 feet in height. Each turbine will have three blades and each blade will be approximately 115.5 feet long. The rotor diameter will be approximately 232 feet. The rotor swept area is 42,001 square feet or approximately one acre.

Explanation of Site Permit Conditions: The wind access buffer requirement at III.C.1 of the site permit has been a condition in all LWECS site permits issued by the MEQB, except one. The purpose of this condition is to insure that each developer provides a wind buffer to protect its project and neighboring projects from what is known as "turbulence" or "wakes" that happen when turbines are located close to one another. A wake occurs within the rotor swept area of a turbine and affects the ability of a downwind turbine to extract energy from the wind if it is too close to the upwind turbine. Generally, the effects of wakes are typically dissipated at a distance of ten rotor diameters.

Therefore, the MEQB required a five-rotor diameter setback in the site permit, so that one project would not affect another one, thereby protecting the wind resource of each developer.

The MEQB site permit buffer setback requirement of five 5 RD was based exclusively on the impacts that could be caused by wake loss effects. It did not consider or evaluate other factors such as: a) the extreme variability of the wind resource; b) changes in topography or terrain within or outside of a site boundary; c) wind resource assessment or meteorological principles that apply to turbine spacing factors such as crosswind or downwind spacing in relation to the prevailing wind direction; d) wind rights; e) environmental and other land use factors. All of these factors and others such as the cost of underground electrical cables and turbine roads must be considered when micro-siting the turbines to make efficient and economical use of the resource.

Within the Phase I project, Moraine has sited the turbines so as to have good exposure to winds from all directions, with emphasis on exposure to the prevailing winds from the south. Nearly all of the turbine sites are above 1,800 feet in elevation. Turbine spacing within the wind farm has been designed to provide a three-rotor diameter spacing in the east-west direction and six-rotor diameter spacing in the north-south direction. Wake loss within a wind farm is minimized by micro-siting, which is a detailed analysis of crosswind and downwind spacing and associated energy losses. In this instance, the north-south spacing between strings of turbines is greater than the east-west spacing between individual turbines because of the prevailing north-south wind direction.

Crosswind and downwind spacing is also influenced by the amount of land available. The incremental costs of turbine access roads and underground electrical cables are also considered. If turbine spacing requirements are decreased or increased, the effects of such changes are evaluated against energy losses or gains.

Moraine Wind, LLC Situation: Although a project developer like Moraine Wind will include proposed locations for the turbines in its permit application, the exact location of the turbines will not be known until the micro-siting analysis has been completed. The micro-siting process finds the best locations from the standpoint of the wind resource, required setbacks from roads, homes and other resource features. Moraine Wind and its consulting meteorologists have used computerized models to evaluate wake loss.

When a permit applicant comes to the MEQB for a site permit, the boundaries of the project are often superficial. The applicant usually establishes the boundaries by including an area big enough to include the number of turbines proposed, and the boundaries usually follow section lines, half section or quarter section lines. But in most cases there is nothing magical about the project boundaries. In fact, another method to address Moraine's request would be for the Board to simply change the boundaries of the project. However, since permit Condition III.C.1 specifically recognizes that the permittee may request authorization to locate turbines closer to the project boundary, it makes sense for Moraine to pursue this request.

Again, Moraine has addressed the situation with each turbine site in its submission, but generally the reasons include that the location of these turbines will not interfere with other existing or possible projects because crosswind spacing requirements are different than prevailing spacing requirements. In other cases, development opportunities may be limited because of occupied dwellings, shelterbelts, or other physical obstacles. Also, the closest any turbine will be to the project boundary is 1.5 RDs, and most are around two or more RDs from the edge, so there is still room to site additional turbines at some point in the future if a neighboring project should be proposed or Moraine should wish to expand.

Another important fact is that, in all cases, Moraine will not locate any turbines closer to each other than the requested 3 RD crosswind limitation and the 6 RD downwind limitation that is also being requested.

Moraine has also requested a permit amendment (Condition III.E.6.) to change the internal turbine spacing from 4 X 8 to 3 X 6 RDs. Moraine has used a computerized model to evaluate wake losses. Moraine estimates that there will be an approximate 3.2% increase in losses from the proposed configuration as compared to one that complies with a 4 x 8 RD separation. However, there are countervailing considerations that must be considered. Placing the turbines more closely reduces other costs, such as those associated with turbine access roads and underground feeder lines. It also reduces the overall size of the project and preserves land for additional future development.

Significant Issues: There are no significant issues. One comment letter was received from Florida Power and Light requesting more time to review Moraine's request that would allow 6 turbine locations to be located within 5 RDs of the anticipated final site permit boundary. FP&L wants to evaluate the effect of this request on three existing turbines located in section 13 of Rock Township in Murray County. The proposed findings provide an opportunity for Florida Power and Light to petition the MEQB for reconsideration of its decision within thirty days of the issuance of an Order. No other developer filed a comment letter.

Staff Recommendation: MEQB staff recommends that the Board approve and adopt the proposed Findings of Fact and Conclusions and Order.