Project Siting and Size of Facility Working Group

A. SUMMARY OVERVIEW:

This working group was tasked with summarizing the siting and facility size information presented by respondents to the City of Evanston’s (“Evanston”) “Request for Information” (“RFI”) for an off-shore wind farm development in Lake Michigan. The Group also has provided comments where it deems appropriate. The respondents to the RFI include:

- Mercury Wind (“Mercury”) and
- Off Grid Technologies (“OGT”).

The two responses varied in detail and content. In some instances, the respondents made incorrect or unsupported assumptions, or failed to address certain questions altogether. In others, information outside the scope of the RFI was presented.

Both responses propose wind turbines located within the bounds of the site specified in the RFI. Mercury’s response suggests a project with a capacity of between 100 and 250 megawatts using traditional vertical wind turbines. Mercury proposes a location seven to nine miles from shore, and concludes that a minimum capacity of 100 MW is necessary to achieve economies of scale and profitability.

OGT proposes the use of large, horizontal turbines (10 MW per turbine) that appear to represent novel or emerging technology. OGT proposes an initial development of twenty such turbines that would fill 140 acres of the “796 acre offshore site” located seven miles from shore, with an initial capacity of 200 megawatts. OGT also estimates that the total 796 acre project area could ultimately accommodate one hundred, 10 MW horizontal wind turbines, for a total potential capacity of 1,000 megawatts.

On the subjects of permitting and environmental assessments, both responses indicated that permits and site assessments will be required from various government agencies, but did not identify them with specificity.

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1 The footprint of the project area in the RFI is 1.5 square miles located 6 to 9 miles off-shore. Each square mile contains 640 acres. The total project area of 1.5 square miles, therefore, contains a total of 960 acres.
B. ITEMS TO BE ADDRESSED:

Describe the main components that fall under this topic and the facts as the committee understand them today.

RFI Wind Farm Program Parameters Regarding Proposed Location and Size (RFI Sections II & III):

- Relative close proximity to Evanston with potential to accommodate large scale wind energy development;
- Proposed site area of 1.5 square nautical miles (+/- 1.9 square miles);
- Proposed distance from Shore at 6-9 miles directly east of Northwestern University;
- Assumed available design wind speed of 8 meters/second (“m/s”) (+/- 18mph) at 65 meters (“m”) (+/- 213 feet) above average lake water level: and
- Assumed water depth at +/- 42 – 98 feet below surface at site area.

I. Siting Information Issues Raised in the RFI (RFI Section IIIA):

1. Address Public Impacts, Including Aesthetics (RFI III.3);
2. Effect on Marine Life, Lake Environment and Fishing (RFI III.3);
3. Effect on Migratory Birds (RFI IIIA.5);
4. Effect on Recreational or Commercial Boating (RFI III.3);
5. Effect on Recreational or Commercial Aviation (RFI III.3);
6. Wake Effects on Production and on Component Fatigue Loads (RFI IIIA.5) 
(While this may be Siting-dependant it might be more appropriately addressed by the Technology and Equipment Sourcing Working Group.);
7. Need for One or More Offshore Substations (RFI IIIB.1);
8. Location of Converter Stations (HVDC option), Lake Floor, Routing and Landfall Considerations (RFI IIIB.1);
9. Address Availability of Appropriate Port Facilities (RFI IIIB.3);
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10. Other Public Impacts: Property Values, Tourism, Public Safety and Security, Decommissioning and Restoration (RFI IIIC.3);

11. Port Development and Enhancement (RFI IIIC.4); and

12. List of Pre-emptive Site Data Collection & Analysis Supporting Siting Recommendations (RFI IIIC.2).

II.  Sizing Information Issues Raised in the RFI (RFI Section IIIA):

13. Address Public Impacts, Including Aesthetics;

14. Technical Limitations: Foundations, Fabrication, Construction Logistics, Existing Distribution and Substation Availability, Economy of Scale, Proven Availability or Dependability in the Market, etc. Size (RFI IIIB.2);

15. Specific Stated Program Requirements: Obtain maximum amount of power, build to a maximum budget, maximize economic return on investment, etc. Size (RFI II);

16. List of Pre-emptive Site Data Collection & Analysis Supporting Siting Recommendations (RFI IIIC.2); and

17. Proposed Incremental Threshold Options and Resulting Pros and Cons.

C. INFORMATION PROVIDED BY RFI RESPONDENTS

The task of this committee was to provide Evanston’s mayor and city council with a summary of the information provided by each of the RFI respondents as they relate to the key components of the RFI as described above.

I. Siting:

1. Address Public Impacts, Including Aesthetics:

Mercury:

- Mercury states that placing the turbines 7 miles from shore will reduce “visual impact by 50%,” and painting them will reduce the visual impact by an additional 20%. No explanation or bases for those statements are given. P66.

- Mercury states that if visual aesthetics become a red flag issue, mitigation could include using floating foundations at 10 miles. Mercury states that at 10 miles the curvature of the Earth would render the turbines invisible to the naked eye. P 52.

2 The page numbers listed refer to the page numbers in Mercury’s and OGT’s respective RFI responses where the information presented was obtained.
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OGT:
- OGT states that there will not be a visual impact due to the “low profile” of their vertical axis design. OGT further asserts that their proposed tower / turbines are “aesthetically pleasing.” P 24.

Working Group Comments:
Mercury’s statement that the visual impact will be reduced by 50% if the turbines are located ±7 miles offshore is unclear, especially in light of the RFI statement that the turbine farm will be located 7 to 9 miles offshore.
Mercury’s statement that placing the turbines ten miles off shore will render them invisible from shore is not borne out by the calculations of the Working Group.

2. Effect on Marine Life, Lake Environment and Fishing:
Mercury:
- While this issue may exist wherever a project is sited in the Lake, Mercury makes a case that the underwater structure tends to provide artificial reef areas for spawning and attracts concentrations of fish based on a referenced study in Europe. Mercury indicates that with lack of net trawling there should be no “significant adverse affect” for either commercial or recreational fishing. P67-68.

OGT:
- OGT provides some general description of the lake bed and location of fish but does not address how to mitigate if there is a problem. OGT further indicates that impacts on fishing and navigation cannot be determined at this time, but will thoroughly research during the feasibility phase of the project. P 21, 24.

3. Effect on Migratory Birds:
Mercury:
- Mercury asserts that the greatest density of birds is likely to be closest to the shore, and “decline dramatically at distances greater than one mile” from the shoreline, concluding that the wind farm would not be damaging to birds. Mercury recommends that a field study be performed when further refinements to the proposed project are completed. Mercury does not indicate how to mitigate potential effects on migratory birds. P48.
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OGT:
- OGT gives an explanation of how Migratory Birds are banded, migration routes are determined, and where general routes occur, but does not address how to assess migratory bird issues and related mitigation steps if necessary. P 21.

Working Group Comments:
No authority is cited by either respondent on this issue. An environmental assessment or study of any project’s potential impacts on migratory birds certainly would be required. The project site reflected in the RFI may pose an issue for migratory birds traveling from Canada south over Lake Michigan. According to Judy Pollack of the Audubon Society, a study has been initiated recently to look into this issue.

Additionally, there is a concern about bat populations which will require study. An initial thought on this is that bats, being land-based, are less likely to be impacted at the site over the water than migratory bird populations.

4. Effect on Recreational or Commercial Boating:

Mercury:
- With regard to recreational boating, Mercury suggests that only a small number of Evanston residents would ever encounter the facility. (“Very few residents will ever boat more than 5 miles off shore. It is estimated that less than 2% of Evanston residents will ever boat on the water.”) P 67.
- On the plus side, according to Mercury, several life saving devices (rafts, lights, ladders, phones, etc.) would be made available on each turbine for boaters needing emergency assistance.
- Regarding spacing, Mercury states that there would be 2000 feet between turbines and that the largest lake barges are 225 feet in width - suggesting that the spacing would “easily accommodate” the largest barges.
- Mercury states that the lowest point of a rotor would be 100 feet above the water level, accommodating 95% of all sailboats.
- Mercury indicates that they have consulted with the Coast Guard regarding the proposed facility and shipping lanes.
- The facility would provide lighted waypoint markers. P 67-68.
OGT:

- OGT states that they will have a close and consistent engagement with all stakeholders regarding commercial navigation. P 20, 24, 25.

Working Group Comments:

The Group tends to agree that it is unlikely that a vast majority of recreational boats typically would venture out seven miles from shore, but wondered about the potential fate of the 5% of sailboats tall enough to encounter the rotor blades.

5. Effect on Recreational or Commercial Aviation:

Mercury:

- Mercury states it has researched FAA requirements and has preliminarily considered private, military, and commercial flight issues. All proposed structures over 200 feet must be evaluated and permitted by the FAA. P 68.
- According to Mercury, the highest point on a turbine blade would be 600 feet from the lake’s surface. Mercury asserts that most small private planes travel above 3000 feet, and concludes that “there should be no problem.”
- According to Mercury, commercial aircraft travel above 35,000 feet until they descend, in preparation for landing, to 3000 feet when they are 15 miles from the airport. P68.

OGT:

- OGT states that they will have a close and consistent engagement with stakeholders regarding aviation. P25.

Working Group Comments:

With regard to potential small aircraft obstructions, perhaps there should be a more definitive answer rather than “there should be no problem.”

While further study will be necessary on this subject, there appear to be no ‘red flags’ showing on this item.

6. Wake Effects on Production and on Component Fatigue Loads (RFI IIIA.5):

Mercury:
Based on “industry standard” and assumed wind speeds, Mercury suggested placing the turbines a distance of a minimum of 7 to 10 rotor lengths apart. Their analysis then suggested placing the turbines 5 rotor diameters apart in the direction perpendicular to prevailing winds, and 10 rotor diameters in the direction facing the prevailing winds. They then calculated the megawatt return per square nautical mile. A final determination will require the collection of all MET data. P42, 43.

OGT:
- No comments from OGT.

*Working Group Comments:*

*Wake Effect here refers generally to the reduced speed/energy and altered turbulence of wind caused by its encounter with a turbine.*

7. **Need for One or More Offshore Substations:**

Mercury:
- Mercury recommends an off shore substation for every 150MW of wind turbines and an interconnection location at an on shore utility substation. The on shore interconnection substation is where they suggest that responsibility changes from the wind farm owner to the utility grid owner. P52.
- Mercury made the basic assumption that there would be an off shore substation. P50.
- The on shore electrical substation is assumed to be located at Dewey and Emerson, which is approximately 1.4 miles inland and owned by ComEd / Exelon. The 1.4 mile land based cable will need to be buried underground and would therefore need to be coordinated with the City of Evanston’s roadwork schedule. P52, 53.

OGT:
- The only comment from OGT regarding substations is that the issue will be considered. P20.

8. **Location of Converter Stations (HVDC option), Lake Floor, Routing and Landfall Considerations:**

Mercury:
- Mercury suggests burying the cables from the wind farm 3-4 feet under the lakebed. The line would come ashore to a small underground cable connection pit and then proceed to the ComEd high voltage substation at Emerson and Dewey. P53.
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- Mercury recommends an AC interconnection. HVDC (high voltage direct current) is not cost effective at a distance of less than 50km, as in the proposed case. P52, P53.

OGT:
- No comments from OGT.

9. Address Availability of Appropriate Port Facilities:
Mercury:
- Mercury states that a ¼ mile lakefront facility is required in conjunction with a deep water port as a staging area for the components. P61-62.
- Mercury Wind suggests either the Evanston shoreline for port development as a staging area or one of three ports investigated in Illinois, Indiana or Wisconsin. P70.
- The Evanston shoreline lacks the rail connection and deep water facility required for the project, although Mercury expressed its willingness to build a marina and port for Evanston at no charge to the city. P 70.
- The option of developing a new marina between Davis/Church and Clark Street beaches for an O&M facility suggested a development synergy for marina and restaurant to support the new monitoring facility. P44, 45.
- For operating and maintenance, Mercury identified three “ideal” port locations from which to perform those functions: Winnetka Electrical Utility Dock, Wilmette Harbor or the Evanston Dock near Church Street Beach; the closer to the Wind Farm, the better. P 44

OGT:
- No comments from OGT.

Working Group Comments:
The Evanston dock is certainly not a deep water facility, and utilizing Evanston, Wilmette or Winnetka lakefront for industrial/construction purposes would dramatically alter the character of those locations. Waukegan, Port of Chicago, Gary, and possibly sites in Michigan could be plausible port locations.

10. Other Public Impacts: Property Values, Tourism, Public Safety and Security, Decommissioning and Restoration:
Mercury:

- Mercury states that impact on real estate value is completely arbitrary, but believes that property values will increase, based in part on the comparison to Hawaii’s experience, where there are land based wind farms and where property values are high. P 67.
- “[T]he Federal government believes that turbines increase the property value, therefore, they tax it. Mercury Wind is not suggesting that the city raise taxes on lake shore residents, simply noting that property values will increase.” P 67.
- Mercury expects minimal effect on tourism and suggests they would like to conduct tours for a small fee. They cite wind farms in Hawaii for the proposition that turbines do not hurt tourism. P 69.
- Mercury suggests benefits to safety and security from the Wind Farm include guidance, lighting, fog horns, off shore distress phones, off shore inflatable rafts and emergency off shore boat anchorage points. In the event of a catastrophic power outage the wind farm provides continued power. P 69.
- Mercury’s investigation suggests decommissioning would take up to 2 years, with six months for the tearing down of the project and six to twelve months for the restoration of the site. P 69.

OGT:

- OGT states that public safety and security will be thoroughly researched during the feasibility phase, but because of the offshore location OGT believes this will not be an issue. P 20, 24.

11. Port Development and Enhancement:

See responses for item 9. above.

12. List of Pre-emptive Site Data Collection & Analysis Supporting Siting Recommendations:

Mercury:

- Mercury suggests that the number of studies will be as required by the city, state, and federal government, but that this will be mostly related to permitting. They suggest a 6 to 12 month onsite wind study and a 1 to 4 month interconnection feasibility study.
• Reducing data collection costs are noted on page 20. The goal of partnering with another company to study the wind feasibility is noted on page 23.

Sizing:

13. **Address Public Impacts, Including Aesthetics:**

Mercury:

• Mercury anticipates that the public response to the wind farm will be generally positive, with the exception of a few Evanston residents objecting because of visual impact or bird migration. Mercury states that the developer will engage key stakeholders who may be against the wind farm. P66.

• Mercury would paint the turbines light gray or light blue to blend in with the horizon. P66. *See also* item C 1. above.

OGT:

• OGT expects that aesthetics and noise will not be a factor because of their unique wind tower / turbine design. OGT further claims that its proposed wind tower / turbine design would be “aesthetically pleasing.” P24.

14. **Technical Limitations: Foundations, Fabrication, Construction Logistics, Existing Distribution and Substation Availability, Economy of Scale, Proven Availability or Dependability in the Market, etc.:**

Mercury:

• Foundations: Mercury describes the three main types of off shore foundations (monopole, gravity and floating) and suggests that the final decision on which to use will follow a geotechnical survey. They do not recommend a floating foundation as such a foundation is currently not well proven. P59, 60.

• Fabrication: Did not find specific response but is generally built into the rest of the document.

• Construction Logistics: Mercury recommends shipping components by rail is cheaper than by truck, but shipping by barge/ship would be the best method. Any solution would be dependant on the location of an equipment staging area. P60
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- Distribution and Substation Availability: See response to item number 7 in Siting, above.
- Economy of Scale: Mercury shows analysis of various capacity turbines in chart form, ultimately recommending the use of 3 to 3.6 megawatt turbines. P 16
- Mercury discusses the ready availability and dependability of wind power, including offshore wind power, in recent years. P 58, 59. Mercury asserts, “now getting +95% availability out of your off shore wind farm is not unheard of.” P59.
- Mercury discusses the existing technologies for mounting the turbines, and concludes that under current circumstances installing turbines more than 9 miles off shore is not recommended because of water depths greater than 100-120 feet. P 13, 14.
  Note, a chart on page 15 shows that 88% of all offshore wind farms are using monopile foundations, with 8.5% using gravity types. Floating foundations are an emerging technology.
- Ice is a concern with offshore wind farms in fresh water. However, Mercury’s RFI response states that offshore wind farms in fresh water have demonstrated that foundations can be designed to withstand certain types of ice, using “ice cone’s.” P17.

OGT:
- They state that the year of construction will be 2012. P12.
- They state that the giant turbine systems have the capability to reduce the scale of the proposed wind farm by 90%. P7.
- OGT proposes to deal with icing via geothermal heating of the interior systems at the base of each 10 MW system. P16.

Working Group Comments
The Group believes there may be only one offshore wind farm in fresh water subject to freezing, and that that is a relatively new wind farm. Icing concerns remain an open question.
Construction completion by 2012 is wildly optimistic.

15. Specific Stated Program Requirements: Obtain maximum amount of power, build to a maximum budget, maximize economic return on investment:

Mercury:
No response from Mercury.
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OGT:
- The maximum power output from 796 acres using a conventional 3.0 MW turbine will require only 12.4 acres of space per turbine, therefore providing a maximum of 64 turbines within the 796 acres. Assuming conventional turbines, this provides ‘only’ 192 MW of power. OGT claims that using their turbines in the same 796 acres would produce 1GW of power using only 100 turbines (from their preliminary data). P8.
- OGT goes on to further state that the largest turbine in the world can produce a maximum of 5 MW, but that one of their large magnetic levitation (maglev) wind turbines can produce 1GW (1000 MW) of power, enough to supply 750,000 homes. P9.
- Their ROI is stated to be ‘extremely favorable’ in class wind zones of 4 and 5. P16.

Working Group Comments
The statement regarding breakthrough gains in power from OGT’s proposed turbine raises real questions given that OGT has no actual installations of this technology. OGT’s assertion that its system will be more than five times more efficient than proven technology should be considered with caution.

It is almost inconceivable that a single turbine that could produce 1 gigawatt (1000 megawatts) of power. This may be a typo in OGT’s RFI response. OGT is stating that their system can produce 200 times the amount of power of a proven system.

Additionally, OGT claims that their proposed system will increase generation capacity by 20%, decrease operational costs by 50%, and enjoy a lifespan of 500 years, ‘far exceeding the 20-25 years of conventional wind turbine designs.’ This does not seem plausible without further supporting information.

16. List of Pre-emptive Site Data Collection & Analysis Supporting Siting Recommendations:

See responses to C 12. above.

17. Proposed Incremental Threshold Options and Resulting Pros and Cons:

None noted by either Mercury of OGT in their respective RFI responses.