5/15/2020

Chris Green, P.E., Senior Development Manager
Tri-Global Energy
17300 N. Dallas Parkway, Ste. 2020
Dallas TX 75248

Re: Panther Grove Wind Project Foundation Quantity Estimate

Dear Mr Green,

Barr Engineering Co. has carried out a preliminary foundation design for the Panther Grove Wind Project using the turbine loading data you provided for the Vestas V150 wind turbine with a 105m hub height. We understand that this turbine is currently considered the most likely candidate for Panther Grove.

Tri-Global also requested that Barr provide estimated foundation quantities for additional wind turbine models and provide that information in an official format. This letter summaries the findings of that effort.

A wind turbine foundation's diameter, embedment, concrete volume and steel tonnage will vary based, primarily, on the overturning loads imparted by the wind turbine to the foundation. Quantities were requested for 12 turbine types, but load documents could only be provided for 11 of these. Quantities were estimated for each turbine Barr received a load document for.

The table at the end of this memo presents the estimated foundation diameter, embedment, concrete volume and steel tonnage for each turbine type. The turbine loads, and foundation size, vary widely.

- Tower normal operating loads vary between 39,509 kN-m and 94,403 kN-m
- Tower factored extreme loads vary between 72,008 kN-m and 162,360 kN-m
- Foundation diameter between approximately 67 and 84 feet.
- Foundation embedment between approximately 11 and 14 feet.
- Foundation concrete volume between approximately 473 and 972 cubic yards.
- Foundation steel weight between approximately 38 and 75 tons.

The quantities presented in these calculations are based on the following assumptions:

- Our experience indicates that most wind projects in Illinois have very shallow groundwater. All foundation quantities are based on an assumption of groundwater 1 ft below the ground surface.
- Our quantity estimates are based on round spread footing foundations, very similar to what is shown in the foundation drawing for the Vestas V150.
- Our quantity estimates anticipate the use of 75 KSI steel for all top and bottom rebar mats, and 60 KSI steel for all additional steel.
- A geotechnical investigation was not provided for use in this effort. Out quantity estimates assume competent soils and typical soil densities. If soils were found to have low allowable

bearing pressures, or were found to have atypically low density, there could be some impact on the final foundation design.

Because of the large number of assumptions required for this effort, we want to make clear that these quantities are most appropriate for high-level cost estimating / foundation comparison purposes. Factors such as the findings of the geotechnical investigation (including required soil remediation) or changes to the loads in final turbine loading documents could impact the final design.

On behalf of Barr Engineering, thank you for engaging us for this effort. Please let us know if you have any questions regarding the data presented in the letter. Please feel free to contact us if there is any way we can help in the further development of the Panther Grove or other wind projects.

Thank you.

David Herrington
Project Manager
Barr Engineering Co.

Turbine Model	Load Document?	Max Factored Tower Load [kNm]	Normal Operating Tower Load [kNm]	Foundation Diameter [ft]	Foundation Depth [ft]	Concrete Volume [yd³]	Steel [tons]
GE3.03MW 81.5m HH	Yes	72008	39509	67	11	473	38
GE3.03MW 89.0m HH	Yes	78857	42920	69	11	511	41
GE3.03MW 110.0 HH	Yes	108020	54956	73	12	642	50
GE5.5MW 107.4m HH	Yes	128207	79854	79	13	816	63
GE5.5MW 125.4m HH	Yes	155625	94403	84	14	972	75
SGRE 5.0MW 90m HH	Yes	110483	62912	75	12	690	54
SGRE 5.0MW 102.5m HH	Yes	128217	72640	77	12	747	59
SGRE 5.0MW 127.5m HH	Yes	160874	94100	84	14	969	74
Vestas 4.2MW 105m HH	Yes	136755	74542	77	12	758	59
Vestas 4.2MW 120m HH	No	162360	83468	80	13	854	66
Nordex N149 108m HH	Yes	150395	82544	80	13	845	65