

Appendix L

Tower Study

Community Wind South Repower Project
Nobles County, Minnesota

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Tower Assessment Report

Community Wind South

United States



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Project: **Community Wind South**

Recipient:	Greenbacker Equipment Acquisition Company, LLC
Vestas Entity:	Vestas Technology
Document number:	0101-2319 V01
Date:	03/May/2021
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Original Instruction: T05 0101-2319 VER 01

Classification: Restricted

T05 0101-2319 Ver 01 - Approved- Exported from DMS: 2021-05-12 by SHKEY

Project: **Community Wind South**

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Contents

1. Summary.....	5
2. Input Data	5
3. ClimaticConditions.....	5
4. Assessment and Preliminary Findings.....	5

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1. Summary

This report presents the preliminary tower assessment of the Community Wind South wind farm, a 30.75-megawatt project in Rushmore, MN, which began operations in 2012 (the “Wind Power Plant”). This Wind Power Plant currently has 15 x MM92 2.05MW wind turbines, with a rotor diameter of 92 meters and a tower height of 96.15 meters.

Vestas has assessed for the following Repowering configuration:

- (I) 15 x V110-2.2MW Mk10D 60Hz HH 105.05m

2. Input Data

Vestas received from the Recipient the climatic data and other data required to perform the initial evaluation. When performing the analysis summarized herein, Vestas assumed that the site data and other supplied information accurately represent the conditions present at the Wind Power Plant location. It is also assumed that all relevant and available information has been supplied to Vestas.

3. Climatic Conditions

The below climatic conditions were provided by Recipient and relied upon and used as the base for conducting a preliminary evaluation of installing a V110 2.2MW Mk10D 60Hz HH105.05m wind turbine using the existing MM92 2.05MW tower.

Table 3: Summary of site average climatic conditions.

Normal wind conditions (annual)				
	Measurement period for conditions	-	N/A	
1	Height for conditions	m.a.g.l.	60	m
2	Weibull scale parameter	A	10	m/s
3	Weibull shape parameter	k	2.8	-
4	Average wind speed	V_{ave}	8.9	m/s
5	Average turbulence intensity at 15m/s ⁽⁴⁾	I_{ref}	7.7	%
6	Wind shear power law exponent ⁽⁵⁾	α	0.21	-
7	Maximum inflow angles	-	0	°

Extreme wind conditions				
8	Height for conditions	m.a.g.l.	60	m
9	Maximum 10 min. average wind speed ⁽⁶⁾	$V_{50year,10min}$	33.3	m/s
10	Turbulence at extreme wind speed	$T_{I_{ext}}$	8.3	%
11	Survival (gust) wind speed ⁽⁷⁾	$V_{50year,3sec-gust}$	41.6	m/s

4. Assessment and Preliminary Findings

Based on the input data, Vestas has performed a preliminary assessment of the structural integrity of the aforementioned wind turbine model on the existing MM92 2.05MW 96.15tower. The preliminary assessment was done according to the essential design requirements set out in IEC61400-1, 3rd edition, and preliminary findings indicate that the wind turbines can safely operate at the proposed Wind Power Plant.

Initial Vestas structural compatibility evaluations for proposed V110-2.2MW Mk10D 60Hz wind turbines atop existing MM92 2.05MW 96.15m towers installed at the Wind Power Project suggest that the concept is feasible.

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The following summarizes key preliminary findings from the initial structural compatibility review:

TOWER LOAD EVALUATION

- Tower is evaluated for 10 years of already consumed damage for MM92 2.05MW 96.15m (pre-damage) + 20 years of life with V110 2.2MW Mk10D 60Hz HH105.05m (post damage)
- Vestas V100 2.05MW Mk10D 60Hz Load model is considered to evaluate pre-damage loads on existing tower, which is a conservative approach.
- Site-specific V110 2.2MW Mk10D 60Hz tower fatigue loads are less than or comparable with existing MM92 2.05MW 96.15m tower design fatigue capacity at all cross sections.
- Site-specific V110 2.2MW Mk10D 60Hz tower extreme loads are less than or comparable with existing MM92 2.05MW 96.15m tower design extreme capacity at all cross sections.
- Existing MM92 2.05MW 96.15m tower can be re-used for 20 years after the installation of V110 2.2MW Mk10D 60Hz turbine.

TOWER FREQUENCY SEPARATION

- The structural system frequency of the proposed wind turbine configuration provides adequate frequency separation from critical operational V110-2.2MW Mk10D 60Hz frequencies.

The findings provided in this report are preliminary only and based on initial reviews conducted from input data received prior to the date of this report.

If any of the above conditions were to change, an additional detailed load analysis would need to be undertaken to confirm the V110 2.2MW wind turbine on the existing MM92 2.05MW 96.15m tower, confirming structural adequacy. Detailed load analysis might result in a different operational strategy like wind sector management, load modes, or service inspection strategy if the design loads are above the limit. As an outcome, this preliminary report will be revised with required recommendations and a new version of the report will be released.

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