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Noise impact assessment for a changing at planned wind farm near Ellhöft, Germany

Introduction:

Grenzstrom Bürgerwind GmbH & Co. KG (the "customer") is developing the Ellhöft Wind Farm in the region of North Frisia, Schleswig-Holstein, Germany. Regarding a changed planning for one Wind turbine (WTG 16) from the type Siemens SWT 3.2-113 to Siemens Gamesa SG 5.0-132, the customer has requested GL Garrad Hassan Deutschland GmbH (DNV) to carry out the noise impact assessment for this changed configuration. The results of this work are summarized in this technical letter.

Details of the methodology and procedures used for the noise impact calculation can be found within the report 10270040-A-1-A "Schallimmissionsberechnung für die Umgebung des geplanten Windenergieparks Ellhöft" issued by DNV at 2020-12-10.

Wind turbines taken into account:

The following turbine configuration given by the customer is considering 33 existing and additional planned wind turbine generator systems (WTGs) in total as well as six turbines planned by the customer. The additional windfarm project is planned/realized by a Danish operator and must be respected as preload. Table 1 shows detailed information of the turbines in question.

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Table 1: Planned and existing turbines, technical data and sound power level

WTG No.	Manufacturer Type	Hub height in m	Rated power P _w in kW	Sound power level L _{WA} in dB(A)	Impulsivity penalty K _i in dB(A) ¹	Tonality penalty K _t in dB(A) ²	Sound power level L _{WA} in dB(A) (noise reduced mode for the night-time)
Existing WTGs (preload)							
S_01, S_02 and S_04 to S_08, S_11, S_12	Siemens SWT 3.0-113	92,5	3.000	105,5 ³	0 ³	0 ³	
S_09	Siemens SWT 3.0-113	92,5	3.000	105,5 ³	0 ³	0 ³	100,5 ⁵
S_10	Siemens SWT 3.0-113	92,5	3.000	105,5 ³	0 ³	0 ³	99,5 ⁵
S_03	Siemens SWT 3.0-101	79,5	3.000	107,0 ³	0 ³	0 ³	
S_23, S_24	AN Bonus 1.3MW-62	68	1.300	104,0 ⁶	0 ⁶	0 ⁶	nighttime shutdown
S_26, S_27	AN Bonus 1.3MW-62	68	1.300	104,0 ⁶	0 ⁶	0 ⁶	
S_28	Siemens SWT 2.3-93	93	2.300	106,0 ³	0 ³	0 ³	103,0 ⁵
S_29 and S_30	Siemens SWT 2.3-93	93	2.300	106,0 ³	0 ³	0 ³	104,0 ⁷
S_31	Siemens SWT 2.3-93	93	2.300	106,0 ³	0 ³	0 ³	105,0 ⁵
S_32	REpower 6M	100	6.000	107,0 ³	0 ³	0 ³	105,0 ⁵
S_33 and S_34	REpower 6M	100	6.000	107,0 ³	0 ³	0 ³	105,0 ⁷
S_35	Enercon E-101	99	3.050	106,6 ⁴	0 ⁴	0 ⁴	
01 to 03	Vestas V112/3.3 MW	94	3.300	104,4 ³	0 ³	0 ³	
Additional planning Tønder Kommune, DK (preload)							
DK01 to DK03	Vestas V126-3.45MW HTq	87	3.450	103,0 ⁸	0 ⁸	0 ⁸	
DK04	Vestas V126-3.45MW HTq	87	3.450	104,4 ⁹	0 ⁹	0 ⁹	
DK05 and K06	Vestas V126-3.45MW HTq	87	3.450	104,9 ¹⁰	0 ¹⁰	0 ¹⁰	
Planned WTGs (additional load)							
14, 18, 19	Siemens SWT 3.2 MW-113	92,5	3.200	105,0 ¹¹	0 ¹¹	0 ¹¹	100,0 ¹²
15	Siemens SWT 3.2 MW-113	115,5	3.200	105,0 ¹¹	0 ¹¹	0 ¹¹	
16	Siemens Gamesa SG 5.0-132	106,5	5.000	108,2 ¹⁵	0 ¹⁵	0 ¹⁵	105,4 ¹⁶
17	Siemens SWT-DD-130	115	3.600	107,0 ¹³	0 ¹³	0 ¹³	102,0 ¹⁴
1	According to DIN 45645 T1						
2	Recommendation from the working group on „wind turbine noise“ /3/						
3	Permitted sound power level during the day-time hours						
4	Permitted sound power level during the night-time hours (used for calculations), L _{WA} = 105,0 dB(A) acc. To Report 214220-01.01 „Zusammenfassung aus mehreren Einzelmessungen“, Kötter Consulting Engineers						
5	Permitted sound power level during the night-time hours						
6	Permitted sound power level: 104,0 dB(A)						
7	Abandonment of operation with the permitted sound power level through reduced night-time operation in favor of new planning						
8	Manufacturer's guarantee for the power optimized mode "S01"						
9	Manufacturer's guarantee for the power optimized mode "0"						
10	Manufacturer's guarantee for the power optimized mode "P01"						
11	Manufacturer's guarantee 105,0 dB(A) for the power optimized mode „Mode 1“ (Siemens Doc.: SGRE ON NE&ME TE SAS DE&UK-40-0000-085AA5F-01 / 25.01.2019)						
12	Manufacturer's guarantee 100 dB(A) for the noise optimized mode „Mode 6“ (Siemens Doc.: SGRE ON NE&ME TE SAS DE&UK-40-0000-085AA5F-01 / 25.01.2019)						
13	Manufacturer's guarantee 106 dB(A) for the power optimized mode „Mode 1“ (Siemens Doc.: SRGE ON NE&ME TE SAS DE&UK-40-0000-085AA5E-00 / 25.01.2019)						
14	Manufacturer's guarantee 102 dB(A) for the noise optimized mode „Mode 6“ (Siemens Doc.: SRGE ON NE&ME TE SAS DE&UK-40-0000-085AA5E-00 / 25.01.2019)						

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- 15 Manufacturer's guarantee 106,2 dB(A) for the power optimized mode „Mode AM0“ (Siemens Doc.: D2413226/001 Rev. 0 vom 2020-04-24) plus 2 dB additional safety margin
- 16 Manufacturer's guarantee 103,4 dB(A) for the noise optimized mode „Mode N1“ (Siemens Doc.: D2413226/001 Rev. 0 vom 2020-04-24) plus 2 dB additional safety margin

Chosen points of impact and results

The points of noise impact chosen for the calculation are the most relevant residences within the area of noise impact of the planned wind turbines. For the area in question these points of impact are given in table 2 together with the calculation results for the night-time period between 22:00 h and 06:00 h.

The coordinates of the listed points of impact can be found within Annex 14.4 of Noise Impact Report 10270040-A-1-A. Detailed results for every single noise impact level of each single turbine at the points of impact can be found within Annex 14.5 (day-time) and Annex 14.6 (night-time) of the above mentioned report.

Table 2: Chosen relevant points of impact and results for night-time preload and total load

point of immission	permissible noise level, night-time dB(A)	noise rating level, night-time in dB(A)			meets the max. permissible noise level?
		preload	additional load	total load	
IP 02 Struxbüller Weg 1	45	44	- ¹⁾	44	Yes
IP 03 Böglumer Straße 1	45	45	- ¹⁾	45	Yes
IP 04 Böglumer Straße 6	45	47	- ¹⁾	47	No
IP 05 Uhlenberg, Fassade Süd EG	45	41	- ¹⁾	41	Yes
IP 05 Uhlenberg, Fassade Süd OG	45	41	- ¹⁾	41	Yes
IP 05 Uhlenberg, Fassade Nord EG	45	44	40	45	Yes
IP 05 Uhlenberg, Fassade Nord OG	45	44	40	45	Yes
IP 05 Uhlenberg, Fassade Ost EG	45	40	40	43	Yes
IP 05 Uhlenberg, Fassade Ost OG	45	40	40	43	Yes
IP 05 Uhlenberg, Fassade West OG	45	45	- ¹⁾	45	Yes
IP 06 Dorfstraße 7	45	43	37	44	Yes
IP 08 Grenzstraße 6	45	45	- ¹⁾	45	Yes
IP 09 Grenzstraße	45	47	- ¹⁾	47	No
IP 10 Grenzstraße 2	45	45	- ¹⁾	45	Yes
IP 11 Grenzstraße 3	45	45	- ¹⁾	45	Yes
IP 15 Grenzstraße 8	45	45	- ¹⁾	45	Yes
IP 20 Dorfstraße 8	45	37	37	40	Yes
IP 24 Saedholm 1 (DK)	45	42	- ¹⁾	42	Yes
IP 41 Karlsminde (DK)	45	34	- ¹⁾	34	Yes
IP 42 Karlsmindevej 1 (DK)	45	- ¹⁾	- ¹⁾	- ¹⁾	Yes
IP 43 Lydersholmvej 13 (DK)	45	- ¹⁾	- ¹⁾	- ¹⁾	Yes
IP 44 Vindvedvej (DK)	45	- ¹⁾	- ¹⁾	- ¹⁾	Yes
IP 45 Hovmosevej 1 (DK)	54	- ¹⁾	- ¹⁾	- ¹⁾	Yes
IP 47 Hovmosevej 15 (DK)	45	33	- ¹⁾	33	Yes
IP 48 Grenzstraße 4	45	36	- ¹⁾	36	Yes
IP 50 Engholm (Edlefsen)	45	34	- ¹⁾	34	Yes
IP 51 Berbekssand 2	45	36	- ¹⁾	36	Yes
IP 53 Berbekssand 3	45	38	- ¹⁾	38	Yes
IP 54 Beyersweg 15 A-C	45	43	41	45	Yes
IP 55 Beyersweg 13	45	43	40	45	Yes
IP 56 Schwarze Berge	45	40	- ¹⁾	40	Yes
IP 63 Am Wald 1	45	45	36	45	Yes
IP 67 Dorfstraße 2a	45	42	40	44	Yes
IP 64 Grenzstrasse 12	45	43	36	44	Yes
IP 69 Dorfstraße 9	45	39	39	42	Yes
IP 70 Dorfstraße 21-25	45	35	38	40	Yes

1) The single noise level caused by each of the WTGs is at least 12 dB(A) below the permitted noise level and they are not respected within the calculation of the total noise level (according to /4/). Therefore, no value can be ascertained.

Assessment of results

In the opinion of the author and with respect to the TA-Lärm /1/ and the policies from /5/ and /6/ inducted per decree /4/ for the region of Schleswig-Holstein, the possibility of the surrounding residents being unduly affected by the planned WTGs can be ruled out for the given configuration, as long as the emission levels given for the turbines are not exceeded.

With reference to /7/ and taking into account the actual planned configuration for the Elhöft wind farm, with changed turbine types and reduced hub heights as well as repowering of another existing turbine of the type AN Bonus 1.3 MW (WEA_SV22), it can also be assumed that the valid Danish regulations regarding noise impact are still fulfilled.

Bibliography

- /1/ Technical Guidelines on Wind Turbine Generators, Part 1: Determination of Noise Emission Values, Revision 18, (FGW Guideline), German Association for the Advancement of Wind Energy (*Technische Richtlinie für Windenergieanlagen, Teil 1: Bestimmung der Schallemissionswerte, Revision 18, (FGW-Richtlinie)*), Fördergesellschaft Windenergie e.V., 1998-10.
- /2/ 6th general administrative regulation associated with the federal law on noise control "A Technical Guide to Noise Control" (*Sechste Allgemeine Verwaltungsvorschrift zum Bundes-Immissionsschutzgesetz, „Technische Anleitung zum Schutz gegen Lärm TA – Lärm“*), 1998-08-28.
- /3/ Noise control as part of the approval process for new wind turbine generator systems, Recommendation from the working group on "wind turbine noise" made up of environmental protection agencies and measurement institutes. (*Schallimmissionsschutz im Genehmigungsverfahren von Windenergieanlagen, Empfehlung des Arbeitskreis „Geräusche von Windenergieanlagen“ der Immissionsschutzbehörden und Messinstitute*), 1999-10.
- /4/ Ministerium für Energiewende, Landwirtschaft, Umwelt, Natur und Digitalisierung des Landes Schleswig-Holstein, „Einführung der aktuellen LAI-Hinweise zum Schallimmissionsschutz bei Windenergieanlagen in Schleswig-Holstein“, 2018-01-31
- /5/ Dokumentation zur Schallausbreitung: Interimsverfahren zur Prognose der Geräuschimmissionen von Windkraftanlagen, Fassung 2015-05.1
- /6/ Hinweise zum Schallimmissionsschutz bei Windenergieanlagen (WKA), Überarbeiteter Entwurf vom 2016-03-17 mit Änderungen PhysE vom 2016-06-23, Stand 2016-06-30
- /7/ Vindmøller ved Vindved, Miljørapport med VVM-redegørelse og Miljøvurdering (April 2017), Bilag 5, (calculated 2017-01-27)

Sincerely

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