Appendix I

Noise Propagation and Modeling Assessment

Byron Solar Project

Dodge and Olmsted counties, Minnesota

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Westwood

12701 Whitewater Drive, Suite 300
Minnetonka, MN 55343

Main (952) 937-5150
Fax (952) 947-5822

May 25, 2021

Scott Wentzell
EDF Renewables
10 Second Street NE, Suite 400
Minneapolis, MN 55413

Re: Byron Solar Project; Noise Propagation and Modeling Assessment
Dodge County, MN
Project No. R0028109.00

Dear Mr. Wentzell:

Westwood Professional Services, Inc. (Westwood) was authorized by Byron Solar Project, LLC (Byron Solar) to provide noise modeling for the Byron Solar Project in Dodge and Olmsted Counties, Minnesota (**Exhibit 1**) in support of the Site Permit Application (SPA) which will be submitted to the Minnesota Public Utilities Commission (Commission or PUC).

The planned output for the Project is up to 200 megawatts (MW) alternating current (AC) of nameplate solar-energy capacity. Byron Solar plans to construct the Project on a schedule that facilitates an in-service date in 2024. The project consists of 64 step-up locations consisting of one inverter at each location, and one substation location consisting of 2 medium power transformers (MPTs). The layout can be seen in **Exhibit 1**.

This project is required to comply with Minnesota Rules 7030.0010-7030.0080. All receptors in the project area are classified as NAC (Noise Area Classification) 1 (Residential Units). The maximum noise levels for NAC 1 are as follows:

NAC Classification	Daytime limit (dBA)	Nighttime limit (dBA)
NAC 1	60	50

It is assumed that the solar plant will only operate during daytime hours, thus an impact threshold of 60 dBA was used.

Predicted noise levels were determined using the Cadna-A noise propagation and modeling software. Existing background noise levels were assumed to be 40 dBA, in accordance with ANSI S12.9-13/Part 3 Category 6: Very Quiet Rural Residential. Noise levels for the inverters were provided by the manufacturer. Transformer noise was modelled according to maximum allowable levels published in NEMA-TR1. The data sheet and relevant excerpt from NEMA-TR1 are attached as **Exhibits 5 and 6**.

Using this data, noise contours for project noise were generated for the project area and presented in **Exhibit 5**. Additionally, future noise levels, (project contribution plus ambient) were calculated for all identified receptors within a screening distance of 500 feet. These levels are reported and compared to requirements in the following table.

Receptor ID	Land Use	Project Noise (Leq dBA)	Ambient Level (dBA)	Future Level (Project + Ambient) (dBA)	Impact Threshold (Lday dBA)	Impact?
1	Residential	31	40	41	60	No
2	Residential	26	40	40	60	No
3	Residential	29	40	40	60	No
4	Residential	37	40	42	60	No
5	Residential	35	40	41	60	No
6	Residential	34	40	41	60	No
7	Residential	35	40	41	60	No
8	Residential	36	40	42	60	No
9	Residential	34	40	41	60	No
10	Residential	29	40	40	60	No
11	Residential	28	40	40	60	No
12	Residential	29	40	40	60	No
13	Residential	28	40	40	60	No
14	Residential	25	40	40	60	No
15	Residential	34	40	41	60	No
16	Residential	32	40	41	60	No
17	Residential	27	40	40	60	No

The loudest predicted level at a receptor is 42 dB (receptor 4), well below the daytime limit of 60 dB. The predicted noise concentration zones and propagation model are shown on the attached **Exhibits 2-4**. There are no predicted impacts, and the project complies fully with MN Rules 7030.0010-7030.0080.

In performing its services, Westwood Professional Services used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.
If you have any questions or wish to discuss any particular aspect of the project, please feel free to call me at (720) 586-8104.

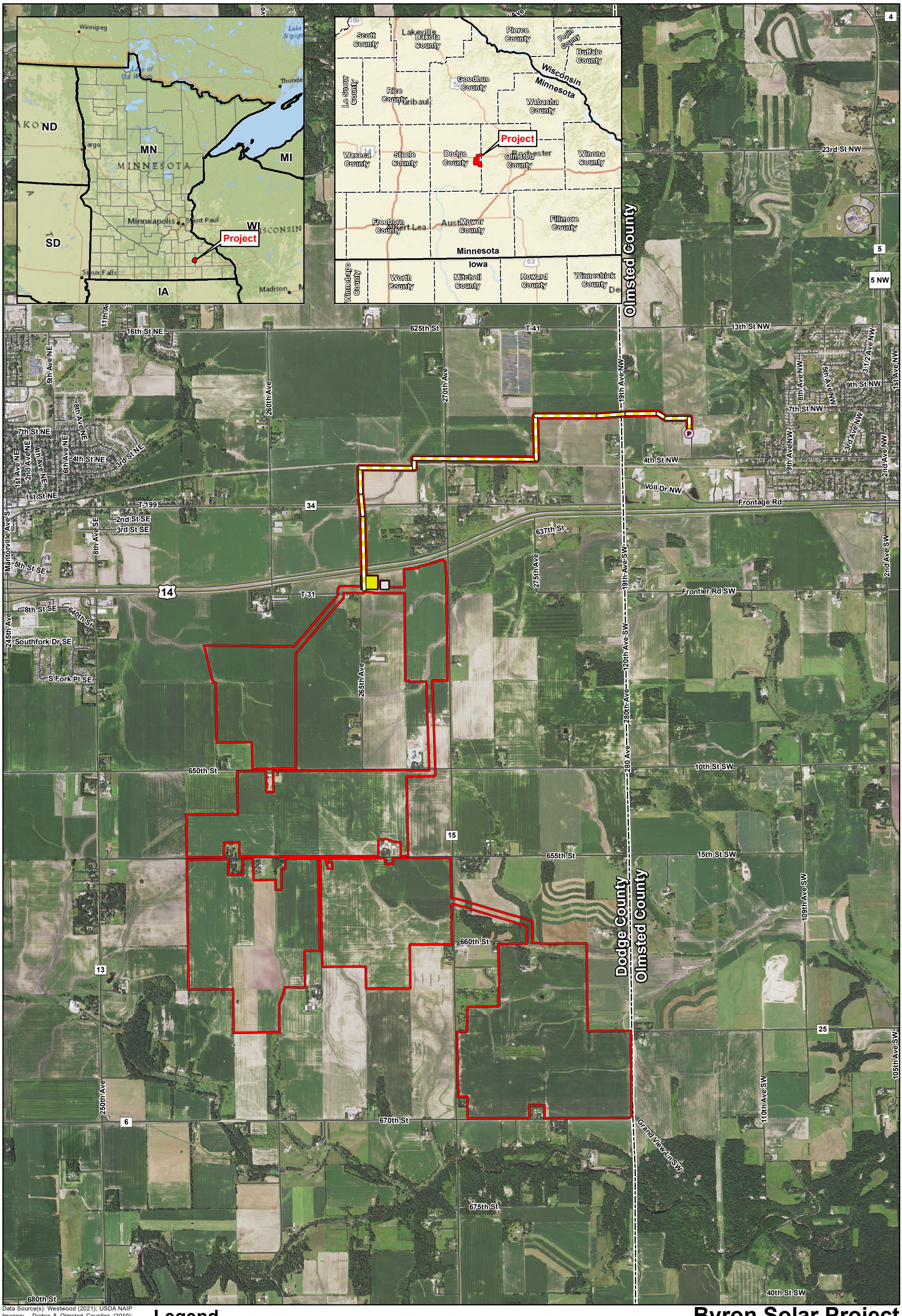
Attachments: Exhibit 1 Project Overview
Exhibit 2 Noise Impact Assessment Results
Exhibit 3 Substation Noise Impact Assessment Results
Exhibit 4 Single Inverter Noise Impact Assessment
Exhibit 5 Sunny Central 1500V Data Sheet
Exhibit 6 NEMA-TR1 Table

Sincerely,

WESTWOOD PROFESSIONAL SERVICES

Jeff Fine
Energy Resource Manager

Map Document: N:\0028109.00\GIS\Noise Exhibits\Byron_Noise_Ex1_ProjectOverviewMap_210524.mxd 5/24/2021 11:32:33 PM NGBryant



Data Source(s): Westwood (2021); USDA NAIP Imagery - Dodge & Olmsted Counties (2019); ESRI WMS National Geographic & World Streets Basemaps (Accessed 2021); Census Bureau TIGER Roads (2019).

Legend

- Project Area
- Proposed Project Substation
- Proposed Project O&M Building
- County Boundary
- Point of Interconnection
- Project Gen-Tie Line
- Census Road

N

0 0.5 Miles

Byron Solar Project

Dodge & Olmsted Counties, MN

Project Overview

EXHIBIT 1

Westwood
Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

Map Document: N:\0028109.00\GIS\Noise Exhibits\Byron_Noise_Ex2_NoiseImpactAssessmentMap_210524.mxd 5/24/2021 11:42:08 PM NGBryant

T-199
34
260th Ave
637th St
14
19th Ave NW
Voll Dr NW
275th Ave
19th Ave SW
Frontier Rd SW
640th St
T-31
280 Ave
120th Ave SW
280th Ave
265th Ave
270th Ave
1
2
3
10th St SW
15
655th St
650th St
15th St SW
4
5
6
7
8
9
262nd Ave
660th St
10
11
12
13
14
25
15
16
6
8
670th St
17
675th St

N
0
1,500
Feet

Data Source(s): Westwood (2021); USDA NAIP Imagery - Dodge & Olmsted Counties (2019); ESRI WMS National Geographic & World Streets Basemaps (Accessed 2021); Census Bureau TIGER Roads (2019).

Legend

- Project Area
- Proposed Project Substation
- Proposed Project O&M Building
- Point of Interconnection
- Project Gen-Tie Line
- Substation Transformer
- Inverter Skid
- Residence Within 500ft of Array Layout

Decible Level (dBA)

- 60
- 55
- 50
- 45
- 40

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Westwood Professional Services, Inc.

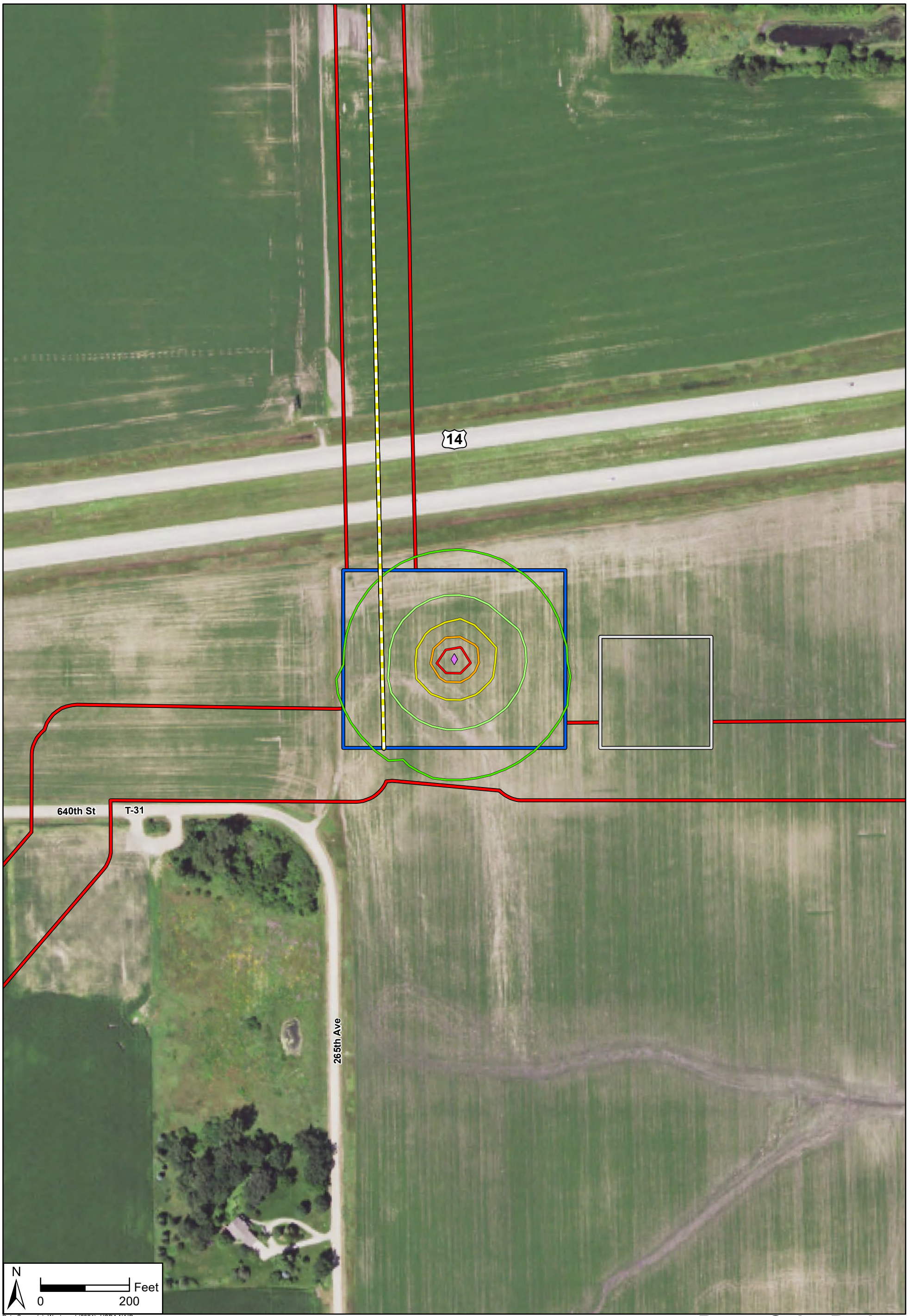
Byron Solar Project

Dodge & Olmsted Counties, MN

Noise Impact Assessment Map

EXHIBIT 2

Map Document: N:\0028109.00\GIS\Noise Exhibits\Byron_Noise_Ex3_SubstationNoiseImpactAssessmentMap_210524.mxd 5/24/2021 11:45:03 PM NGBryant



Data Source(s): Westwood (2021); USDA NAIP Imagery - Dodge & Olmsted Counties (2019); ESRI WMS National Geographic & World Streets Basemaps (Accessed 2021); Census Bureau TIGER Roads (2019).

Legend

- Project Area
- Proposed Project Substation
- Proposed Project O&M Building
- Project Gen-Tie Line
- Substation Transformer
- Residence Within 500ft of Array Layout

Decible Level (dBA)

- 60
- 55
- 50
- 45
- 40

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Byron Solar Project

Dodge & Olmsted Counties, MN

Substation Noise Impact Assessment

EXHIBIT 3

Map Document: N:\0028109.00\GIS\Noise Exhibits\Byron_Noise_Ex4_SingleInverterImpactAssessmentMap_210524.mxd 5/24/2021 11:46:49 PM NGBryant

Data Source(s): Westwood (2021); USDA NAIP Imagery - Dodge & Olmsted Counties (2019); ESRI WMS National Geographic & World Streets Basemaps (Accessed 2021); Census Bureau TIGER Roads (2019).

Legend

- Project Area
- \+ Proposed Project Inverter Skid
- Proposed Project Inverter Skid Boundary

Decible Level (dBA)

- 60
- 55
- 50
- 45
- 40

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Westwood Professional Services, Inc.

Byron Solar Project

Dodge & Olmsted Counties, MN

Inverter Noise Impact Assessment

EXHIBIT 4

Efficient

- Up to 4 inverters can be transported in one standard shipping container
- Overdimensioning up to 150% is possible
- Full power at ambient temperatures of up to 25°C

Robust

- Intelligent air cooling system OptiCool for efficient cooling
- Suitable for outdoor use in all climatic ambient conditions worldwide

Flexible

- Conforms to all known grid requirements worldwide
- Q on demand
- Available as a single device or turn-key solution, including medium-voltage block

Easy to Use

- Improved DC connection area
- Connection area for customer equipment
- Integrated voltage support for internal and external loads

SUNNY CENTRAL
4000 UP-US / 4200 UP-US / 4400 UP-US / 4600 UP-US

The new Sunny Central: more power per cubic meter

With an output of up to 4600 kVA and system voltages of 1500 V DC, the SMA central inverter allows for more efficient system design and a reduction in specific costs for PV power plants. A separate voltage supply and additional space are available for the installation of customer equipment. True 1500 V technology and the intelligent cooling system OptiCool ensure smooth operation even in extreme ambient temperature as well as a long service life of 25 years.

SUNNY CENTRAL 4000 UP-US / 4200 UP-US

Technical data*	SC 4000 UP-US	SC 4200 UP-US
Input (DC)		
MPP voltage range V_{DC} (at 25 °C / at 50 °C)	880 to 1325 V / 1100 V	921 to 1325 V / 1100 V
Min. input voltage $V_{DC, min}$ / Start voltage $V_{DC, Start}$	849 V / 1030 V	891 V / 1071 V
Max. input voltage $V_{DC, max}$	1500 V	1500 V
Max. input current $I_{DC, max}$	4750 A	4750 A
Max. short-circuit current $I_{DC, sc}$	6400 A	6400 A
Number of DC inputs	24 double pole fused (32 single pole fused)	
Max. number of DC cables per DC input (for each polarity)	2 x 800 kcmil, 2 x 400 mm²	
Integrated zone monitoring	○	
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A	
Output (AC)		
Nominal AC power at cos φ =1 (at 25°C / at 50°C)	4000 kVA / 3400 kVA	4200 kVA / 3570 kVA
Nominal AC power at cos φ =0.8 (at 25°C / at 50°C)	3200 kW / 2720 kW	3360 kW / 2856 kW
Nominal AC current $I_{AC, nom}$ (at 25°C / at 50°C)	3850 A / 3273 A	3850 A / 3273 A
Max. total harmonic distortion	< 3% at nominal power	< 3% at nominal power
Nominal AC voltage / nominal AC voltage range[1) 8)]	600 V / 480 V to 720 V	630 V / 504 V to 756 V
AC power frequency / range	50 Hz / 47 Hz to 53 Hz 60 Hz / 57 Hz to 63 Hz	
Min. short-circuit ratio at the AC terminals[9)]	> 2	
Power factor at rated power / displacement power factor adjustable[8) 10)]	1 / 0.8 overexcited to 0.8 underexcited	
Efficiency		
Max. efficiency[2)] / European efficiency[2)] / CEC efficiency[3)]	98.7%* / 98.6%* / 98.5%*	98.7%* / 98.6%* / 98.5%*
Protective Devices		
Input-side disconnection point	DC load break switch	
Output-side disconnection point	AC circuit breaker	
DC overvoltage protection	Surge arrester, type I	
AC overvoltage protection (optional)	Surge arrester, class I	
Lightning protection (according to IEC 62305-1)	Lightning Protection Level III	
Ground-fault monitoring / remote ground-fault monitoring	○ / ○	
Insulation monitoring	○	
Degree of protection	NEMA 3R	
General Data		
Dimensions (W / H / D)	2780 / 2318 / 1588 mm (109.4 / 91.3 / 62.5 inch)	
Weight	< 4000 kg / < 8818.5 lb	
Self-consumption (max.[4)] / partial load[5)] / average[6)])	< 8100 W / < 1800 W / < 2000 W	
Self-consumption (standby)	< 370 W	
Internal auxiliary power supply	○ Integrated 8.4 kVA transformer	
Operating temperature range[8)]	−25°C to 60°C / −13°F to 140°F	
Noise emission[7)]	67.0 dB(A)*	
Temperature range (standby)	−40°C to 60°C / −40°F to 140°F	
Temperature range (storage)	−40°C to 70°C / −40°F to 158°F	
Max. permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month/year) / 0% to 95%	
Maximum operating altitude above MSL[8)] 1000 m / 2000 m / 3000 m	● / ○ / ○ (earlier temperature-dependent derating)	
Fresh air consumption	6500 m³/h	
Features		
DC connection	Terminal lug on each input (without fuse)	
AC connection	With busbar system (three busbars, one per line conductor)	
Communication	Ethernet, Modbus Master, Modbus Slave	
Communication with SMA string monitor (transmission medium)	Modbus TCP / Ethernet (FO MM, Cat-5)	
Enclosure / roof color	RAL 9016 / RAL 7004	
Supply transformer for external loads	○ (2.5 kVA)	
Standards and directives complied with	UL 62109-1, UL 1741 (Chapter 31, CDR 6I), UL 1741-SA, UL 1998, IEEE 1547, MIL-STD-810G	
EMC standards	FCC Part 15 Class A	
Quality standards and directives complied with	VDI/VDE 2862 page 2, DIN EN ISO 9001	

● Standard features ○ Optional * preliminary

1) At nominal AC voltage, nominal AC power decreases in the same proportion
2) Efficiency measured without internal power supply
3) Efficiency measured with internal power supply
4) Self-consumption at rated operation
5) Self-consumption at < 75% Pn at 25°C
6) Self-consumption averaged out from 5% to 100% Pn at 25°C
7) Sound pressure level at a distance of 10 m
8) Values apply only to inverters. Permissible values for SMA MV solutions from SMA can be found in the corresponding data sheets.
9) A short-circuit ratio of < 2 requires a special approval from SMA
10) Depending on the DC voltage

SUNNY CENTRAL 4400 UP-US / 4600 UP-US

Technical data*	SC 4400 UP-US	SC 4600 UP-US
Input (DC)		
MPP voltage range V_{DC} (at 25 °C / at 50 °C)	962 to 1325 V / 1100 V	1003 to 1325 V / 1100 V
Min. input voltage $V_{DC, min}$ / Start voltage $V_{DC, Start}$	934 V / 1112 V	976 V / 1153 V
Max. input voltage $V_{DC, max}$	1500 V	1500 V
Max. input current $I_{DC, max}$	4750 A	4750 A
Max. short-circuit current $I_{DC, sc}$	6400 A	6400 A
Number of DC inputs	24 double pole fused (32 single pole fused)	
Max. number of DC cables per DC input (for each polarity)	2 x 800 kcmil, 2 x 400 mm²	
Integrated zone monitoring	○	
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A	
Output (AC)		
Nominal AC power at cos φ =1 (at 25°C / at 50°C)	4400 kVA / 3740 kVA	4600 kVA / 3910 kVA
Nominal AC power at cos φ =0.8 (at 25°C / at 50°C)	3520 kW / 2992 kW	3680 kW / 3128 kW
Nominal AC current $I_{AC, nom}$ (at 25°C / at 50°C)	3850 A / 3273 A	3850 A / 3273 A
Max. total harmonic distortion	< 3% at nominal power	< 3% at nominal power
Nominal AC voltage / nominal AC voltage range[1) 8)]	660 V / 528 V to 759 V	690 V / 552 V to 759 V
AC power frequency / range	50 Hz / 47 Hz to 53 Hz 60 Hz / 57 Hz to 63 Hz	
Min. short-circuit ratio at the AC terminals[9)]	> 2	
Power factor at rated power / displacement power factor adjustable[8) 10)]	1 / 0.8 overexcited to 0.8 underexcited	
Efficiency		
Max. efficiency[2)] / European efficiency[2)] / CEC efficiency[3)]	98.7%* / 98.6%* / 98.5%*	98.7%* / 98.6%* / 98.5%*
Protective Devices		
Input-side disconnection point	DC load break switch	
Output-side disconnection point	AC circuit breaker	
DC overvoltage protection	Surge arrester, type I	
AC overvoltage protection (optional)	Surge arrester, class I	
Lightning protection (according to IEC 62305-1)	Lightning Protection Level III	
Ground-fault monitoring / remote ground-fault monitoring	○ / ○	
Insulation monitoring	○	
Degree of protection	NEMA 3R	
General Data		
Dimensions (W / H / D)	2780 / 2318 / 1588 mm (109.4 / 91.3 / 62.5 inch)	
Weight	< 4000 kg / < 8818.5 lb	
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Temperature range (storage)	−40°C to 70°C / −40°F to 158°F	
Max. permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month/year) / 0% to 95%	
Maximum operating altitude above MSL[8)] 1000 m / 2000 m / 3000 m	● / ○ / ○ (earlier temperature-dependent derating)	
Fresh air consumption	6500 m³/h	
Features		
DC connection	Terminal lug on each input (without fuse)	
AC connection	With busbar system (three busbars, one per line conductor)	
Communication	Ethernet, Modbus Master, Modbus Slave	
Communication with SMA string monitor (transmission medium)	Modbus TCP / Ethernet (FO MM, Cat-5)	
Enclosure / roof color	RAL 9016 / RAL 7004	
Supply transformer for external loads	○ (2.5 kVA)	
Standards and directives complied with	UL 62109-1, UL 1741 (Chapter 31, CDR 6I), UL 1741-SA, UL 1998 IEEE 1547, MIL-STD-810G	
EMC standards	FCC Part 15 Class A	
Quality standards and directives complied with	VDI/VDE 2862 page 2, DIN EN ISO 9001	

● Standard features ○ Optional * preliminary

1) At nominal AC voltage, nominal AC power decreases in the same proportion
2) Efficiency measured without internal power supply
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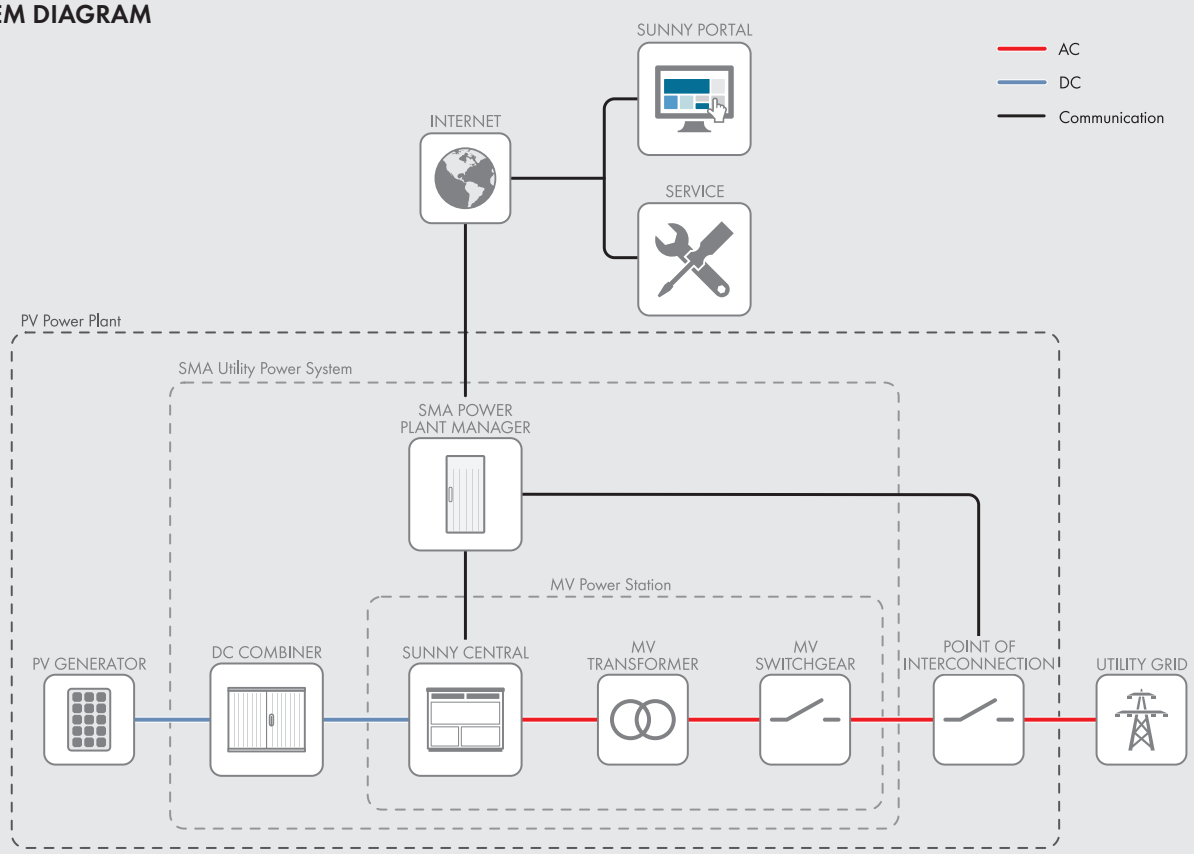
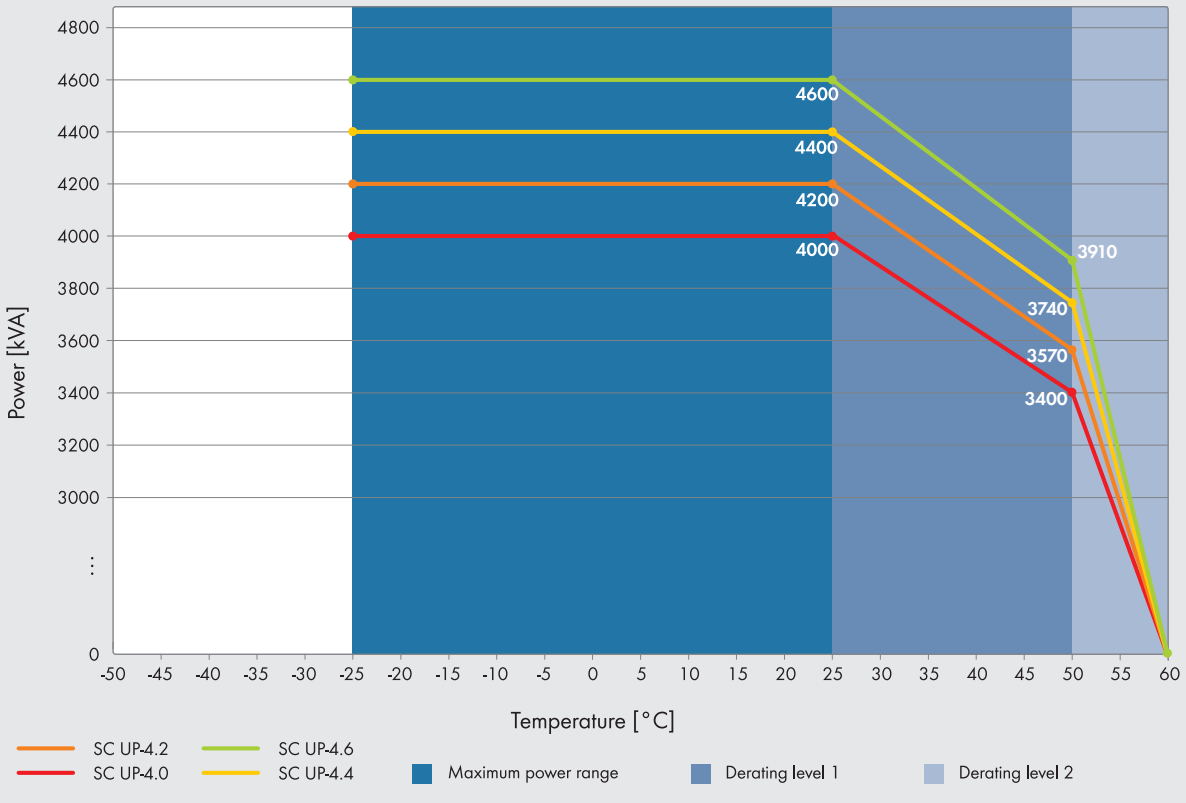
5) Self-consumption at < 75% Pn at 25°C
6) Self-consumption averaged out from 5% to 100% Pn at 25°C
7) Sound pressure level at a distance of 10 m
8) Values apply only to inverters. Permissible values for SMA MV solutions from SMA can be found in the corresponding data sheets.
9) A short-circuit ratio of < 2 requires a special approval from SMA
10) Depending on the DC voltage

SYSTEM DIAGRAM



TEMPERATURE BEHAVIOR (at 1000 m)



Toll Free +1 888 4 SMA USA
www.SMA-America.com

SMA America, LLC

ble 0-2
AUDIBLE SOUND LEVELS F(.-IMMERSED POWER TRANSFORMERS

Column 1 - Class*OA, Ow and FOW Ratings
Column 2 - Class* FA and FOA First stage Auxiliary Cooling**†
Column 3 - Straight FOA* Ratings, FA* FOA* Second-stage Auxiliary Cooling*†

Average Sound Level ††, Decibels	Equivalent Two-winding Rating▲																	
	350 kV BIL and Below			450, 550, 650 kV BIL			750 and 825 kV BIL			900 and 1050 kV BIL			1175 kV BIL			1300 kV BIL and Above		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
57	700	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...
58	1000	.	. .	...	..	..	...	...	...	...	...	...	...	...	...	...	...	...
59	--	. .	...	700	...	...	...	...	...	...	...	...	...	...	...	...	...	...
60	1500	. .	..	1000	...	...	. .	..	...	...	...	...	...	...	...	...	...	...
61	2000	.	. .	...	...	.	...	...	..	...	...	...	...	...	...	...	...	...
62	2500	...	...	1500	...	.	.	..	..	..	...	...	...	..	..	...	...	...
63	3000	...	...	2000	...	..	. .	...	...	...	...	. .	...	..	...	...	...	...
64	4000	...	...	2500	...	...	...	...	...	...	...	...	...	...	...	...	...	...
65	5000	...	...	3000	...	...	...	...	...	...	...	...	...	..	...	...	...	...
66	6000	...	...	4000	.	.	3000	...	...	...	...	...	...	...	...	...	...	...
67	7500	6250▲▲	..	5000	3750▲▲	..	4000	3125▲▲	..	..	...	. .	...	..	...	...	...	...
68	10000	7500		6000	5000	.	5000	3750	...	. .	...	. .	...	..	...	...	...	...
69	12500	9375	.	7500	6250	..	6000	5000	...	...	...	...	...	...	...	...	...	...
70	15000	12500	.	10000	7500	..	7500	6250	. .	...	...	...	..	. .	...	...	...	...
71	20000	16667		12500	9375		10000	7500	...	...	...	...	...	...	...	...	...	...
72	25000	20000	20800	15000	12500	..	12500	9375	...	...	...	...	...	..	...	...	...	...
73	30000	26667	25000	20000	16667	...	15000	12500	...	12500	...	. .	...	...	..	...	...	...
74	40000	33333	33333	25000	20000	20800	20000	16667	...	15000	...	...	12500	...	...	...	...	...
75	50000	40000	41667	30000	26667	25000	25000	20000	20800	20000	16667	...	15000	...	...	12500	...	...
76	60000	53333	50000	40000	33333	33333	30000	26667	25000	25000	20000	20800	20000	16667	. .	15000	...	...
77	80000	66687	66667	50000	40000	41667	40000	33333	33333	30000	26667	25000	25000	20000	20800	20000	16667	...
78	100000	80000	83333	60000	53333	50000	50000	40000	41667	40000	33333	33333	30000	26667	25000	25000	20000	20800
79	...	106667	100000	80000	66667	66667	60000	53333	50000	50000	40000	41667	40000	33333	33333	30000	26667	25000
80	..	133333	133333	100000	80000	83333	80000	66667	66667	60000	53333	50000	50000	40000	41667	40000	33333	33333
81	...	...	166667	...	106667	100000	100000	80000	83333	80000	66667	66667	60000	53333	50000	50000	40000	41667
82	...	...	200000	...	133333	133333	...	106667	100000	100000	80000	83333	80000	66667	66667	60000	53333	50000
83	..	...	250000	...	...	166667	...	133333	133333	...	106667	100000	100000	80000	83333	80000	66667	66667
84	..	...	300000	...	...	200000	...	...	166667	...	133333	133333	...	106667	100000	100000	80000	83333
85	..	...	400000	...	...	250000	...	...	200000	...	...	166667	...	133333	133333	...	106667	100000
86	...	...	...	...	...	300000	...	...	250000	...	...	200000	...	...	166667	...	133333	133333
87	...	...	...	...	...	400000	...	...	300000	...	...	250000	...	...	200000	...	...	166667
88	...	...	...	...	...	...	...	...	400000	...	...	300000	...	...	250000	...	...	200000
89	...	...	...	...	...	...	...	...	...	...	...	400000	...	...	300000	...	...	250000
90	...	...	...	...	...	..	...	...	...	...	...	...	...	...	400000	...	...	300000
91	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	400000

*Classes of cooling (see 2.6.1 of American National Standard C57.12.00-1988.
**First- and second-stage auxiliary cooling (see TR 1.0.02).
†For column 2 and 3 ratings, the sound levels are with the auxiliary cooling equipment in operation.
††For Intermediate kVA ratings, use the average sound level of the next larger kVA rating.
▲The equivalent two-winding 55°C or 65°C rating is defined as one-half the sum of the kVA rating of all windings.
▲▲Sixty-seven decibels for all kVA ratings equal to this or smaller.