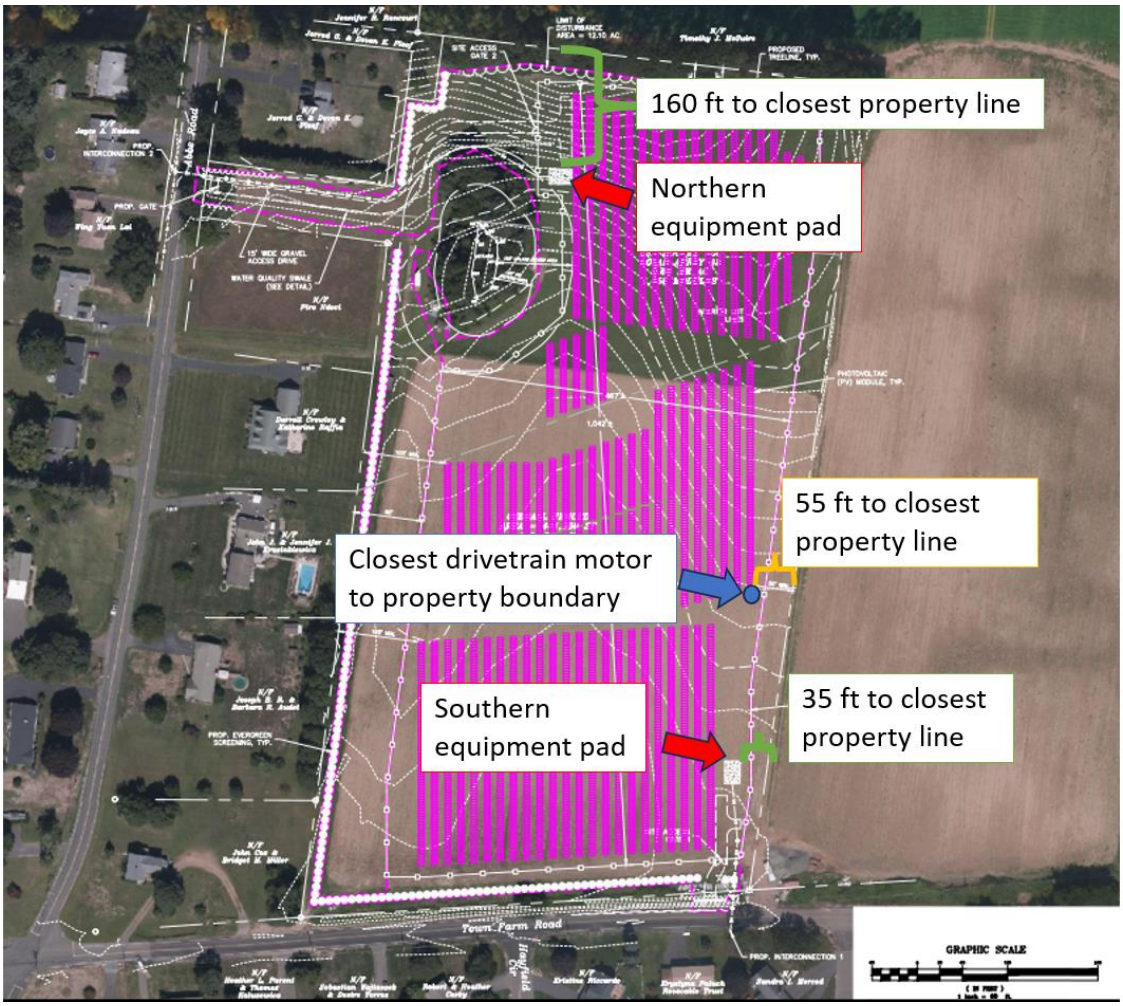
LODESTAR ENERGY

NOISE ANALYSIS

Introduction

Noise generated by this Project will derive from the operation of (8) Solectria XGI 1500-166/166kW inverters and (1) Maddox 1500kVA transformer on the southern equipment pad and (4) Solectria XGI 1500-150/166kW inverters and (1) Maddox 750kVA on the northern equipment pad illustrated in Figure 1 below. Noise will also be emitted from the tracker panels' drivetrain motor (the motor that allows the panels to track the sun). A single Solectria inverter has an acoustic noise output of 73dBA at 1 meter (3.28 ft) from the unit, a single 1500kVA Maddox transformer has an output of 60 dBA at 1 meter (3.28 ft), a single 750kVA Maddox transformer has an output of 58 dBA at 1 meter (3.28 ft), and a single ATI tracker drivetrain motor has an output of 66 dBA at 1 meter (3.28 ft).

Figure 1: Equipment Pad Location



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As stated in Regulations of Connecticut State Agencies Sec. 22a-69-3.5, noise received within residential zones (Class A Receptors) shall not exceed 51dBA at night and 61dBA during the daytime in order to minimize disturbance to abutting and adjacent property owners.

Methods/Analysis Sound Intensity of All Equipment at a Common Point

To quantify the noise output of all inverters, a logarithmic formula is required to accurately determine amplification of sound. This formula and the processes related to calculating a result are illustrated below. A separate noise analysis is conducted for each equipment pad.

Southern Equipment Pad:

Equation 1. Decibel Addition

$$L = 10 \log_{10} \left(\sum_{i=1}^{n} 10^{(L_i / 10)} \right)$$

(1) Solectria XGI 1500-166/166kW inverter = 73 dBA at 3.28 ft
(8) Solectria XGI 1500-166/166kW inverters = **82 dBA at 3.28 ft**
(1) Maddox 1500kVa transformer = 60 dBA at 3.28 ft
(8) Solectria XGI 1500-166/166kW inverters + (1) Maddox 1500kVa transformers = **82 dBA at 3.28 ft**

Equation 2. Audibility

The proposed Project design includes the installation of inverters. The 8 inverters and 1 transformer combined have an 82.1 dBA output. To quantify the reduction in sound from the point of origin to the closest abutting properties (35 ft away), the formula stated in Equation 2 utilizes the inverse square law for sound intensity. This formula states that the reduction in sound pressure is relative to the distance from the source. The formula is set forth below in equation 2 and applied to the instant case in which proposed site conditions are calculated:

$$\textit{Equation 2. } DL = L_{P2} - L_{P1}$$

Calculation

$$DL = 10\ log\ log\ (R_2/R_1)^2$$

$$DL = 20log\ (R_2/R_1)$$

$$DL = 20\ log(35/3.28)$$

DL= 21 dBA

82 dBA – 21 dBA = 61 dBA

Variables:
DL = difference in sound pressure (dBA)
L_{P1} = Sound pressure level at location 1 (1m)
L_{P2} = Sound pressure level at location 2 (Closest abutting property line)
R_1 = distance from source to location 1
R_2 = distance from source to location 2

Northern Equipment Pad:

Equation 1. Decibel Addition

$$L = 10\,\mathrm{Log}_{10}\left(\sum_{i=1}^{n} 10^{(L_i/10)}\right)$$

(1) Solectria XGI 1500-150/166kW inverter = 73 dBA at 3.28 ft
(4) Solectria XGI 1500-150/166kW inverters = **79 dBA at 3.28 ft**
(1) Maddox 750kVa transformer = 58 dBA at 3.28 ft
(4) Solectria XGI 1500-150/166kW inverters + (1) Maddox 750kVa transformers = **79 dBA at 3.28 ft**

Equation 2. Audibility

The proposed Project design includes the installation of inverters. The 4 inverters and 1 transformer combined have an 79 dBA output. To quantify the reduction in sound from the point of origin to the closest abutting properties (160 ft away), the formula stated in Equation 2 utilizes the inverse square law for sound intensity. This formula states that the reduction in sound pressure is relative to the distance from the source. The formula is set forth below in equation 2 and applied to the instant case in which proposed site conditions are calculated:

$$\textit{Equation 2.}\ \ DL = L_{P2} - L_{P1}$$

Calculation

$$DL = 10\ log\ log\ (R_2/R_1)^2$$

$$DL = 20log\ (R_2/R_1)$$

$$DL = 20\ log(160/3.28)$$

DL= 33.8 dBA

79 dBA – 33.8 dBA = 45.2 dBA

Variables:
DL = difference in sound pressure (dBA)
L_{P1} = Sound pressure level at location 1 (1m)
L_{P2} = Sound pressure level at location 2 (Closest abutting property line)
R_1 = distance from source to location 1
R_2 = distance from source to location 2

Tracker Drivetrain:

Equation 1. Decibel Addition

$$L = 10 \log_{10}\left(\sum_{i=1}^{n} 10^{(L_i / 10)} \right)$$

(1) ATI Tracker Drivetrain Motor = 54 dBA at 3.28 ft

Equation 2. Audibility

The tracker drivetrain motor has a 54 dBA output. To quantify the reduction in sound from the point of origin to the closest abutting properties (55 ft away), the formula stated in Equation 2 utilizes the inverse square law for sound intensity. This formula states that the reduction in sound pressure is relative to the distance from the source. The formula is set forth below in equation 2 and applied to the instant case in which proposed site conditions are calculated:

Equation 2. $DL = L_{P2} - L_{P1}$

Calculation

$$DL = 10\ log\ log\ (R_2/R_1)^2$$

$$DL = 20log\ (R_2/R_1)$$

$$DL = 20\ log(55/3.28)$$

DL= 24 dBA

54 dBA – 24 dBA = 30 dBA

Variables:
DL = difference in sound pressure (dBA)
L_{P1} = Sound pressure level at location 1 (1m)
L_{P2} = Sound pressure level at location 2 (Closest abutting property line)
R_1 = distance from source to location 1
R_2 = distance from source to location 2

Conclusion

In conclusion, the noise levels emitted from the inverters and transformers on the northern equipment pad will be 45.2 dBA at the closest abutting property line, which is 160 ft away from the origin of noise emanation. The noise levels emitted from the inverters and transformers on the southern equipment pad will be 61 dBA at the closest abutting property line, which is 35 ft away from the origin of noise emanation. It is also worth noting the closest abutting property line is an open farm field. The closest residence is 315 ft away from the southern equipment pad. The noise emitted from the tracker drivetrain motor will be 30 dBA at the closest abutting property, which is 55 ft away from the origin of noise emanation. At night time, the equipment will not be in use and will make no noise, or 0 dBA. Noise will be further reduced at farther property lines and buildings. Therefore, the proposed Project and its components comply with the applicable regulations.