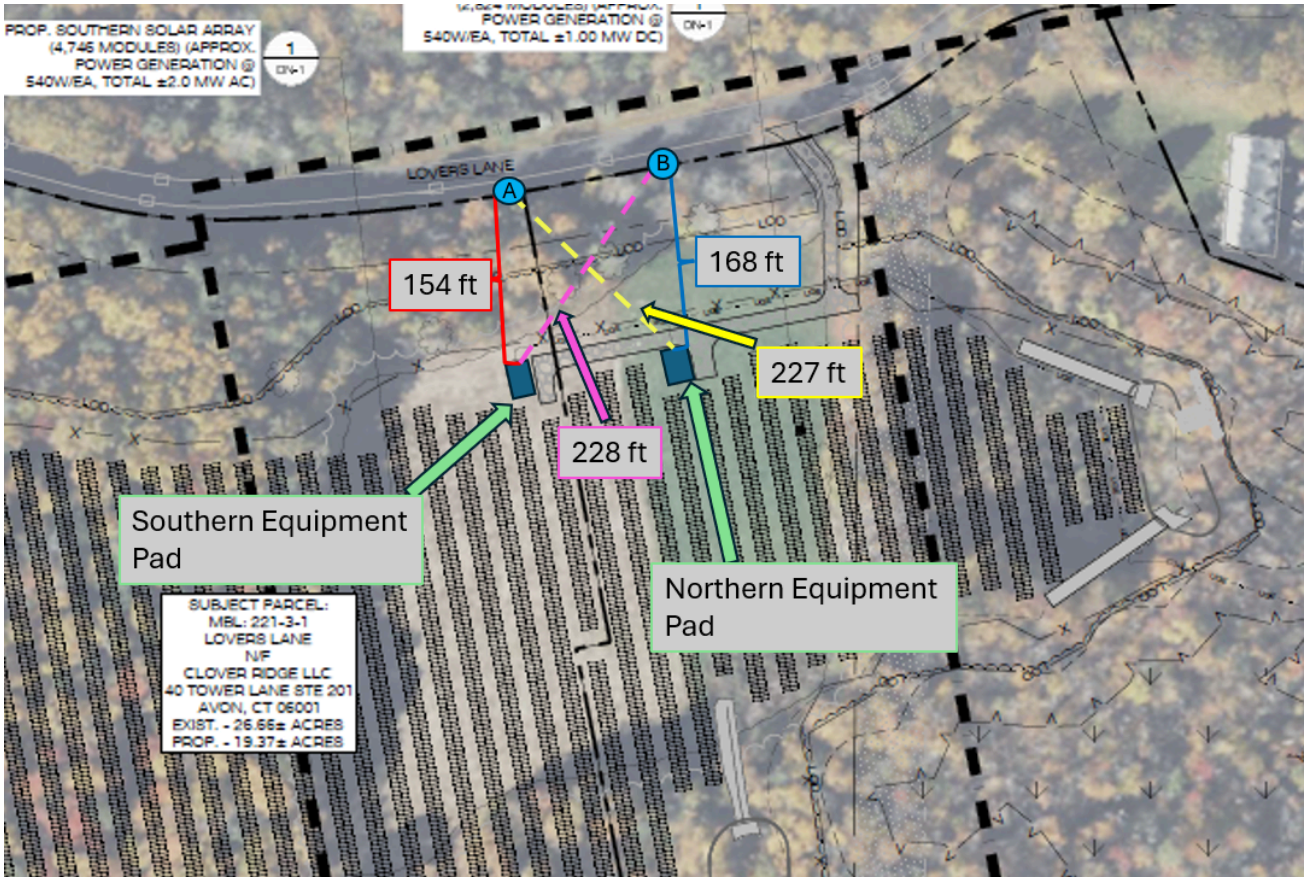
LODESTAR ENERGY

NOISE ANALYSIS

Introduction

Noise generated by this Project will derive from the operation of (12) Solectria XGI 1500-166/166kW inverters, (1) Maddox 2250kVA transformer on the southern equipment pad and (6) Solectria XGI 1500-166/166kW inverters and (1) Maddox 1250kVA on the northern equipment pad illustrated in Figure 1 below. A single Solectria inverter has an acoustic noise output of 73dBA at 1 meter (3.28 ft) from the unit, a single 2250kVA Maddox transformer has an output of 62 dBA at 1 meter (3.28 ft), and a single 1250kVA Maddox transformer has an output of 60 dBA at 1 meter (3.28 ft).

Figure 1: Equipment Pad Location



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

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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.

Point A Calculation:

Equation 1. Decibel Addition

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

Southern Equipment Pad
(1) Solectria XGI 1500-166/166kW inverter = 73 dBA at 3.28 ft
(12) Solectria XGI 1500-166/166kW inverters = **83.9 dBA at 3.28 ft**
(1) Maddox 2250kVA transformer = 62 dBA at 3.28 ft
(8) Solectria XGI 1500-166/166kW inverters + (1) Maddox 2250kVA transformers = **83.9 dBA at 3.28 ft**

Northern Equipment Pad:
(1) Solectria XGI 1500-150/166kW inverter = 73 dBA at 3.28 ft
(6) Solectria XGI 1500-150/166kW inverters = **80.8 dBA at 3.28 ft**
(1) Maddox 1250kVA transformer = 60 dBA at 3.28 ft
(6) Solectria XGI 1500-150/166kW inverters + (1) Maddox 1250kVA transformers = **80.8 dBA at 3.28 ft**

Equation 2. Audibility

Point A is the closest property line to the southern equipment pad. The Southern equipment pad has 12 inverters and 1 transformer, which, combined, have an 83.9 dBA output. The northern equipment pad contains 6 inverters and 1 transformer, which, combined, have an 80.8 dBA output. The southern equipment pad is 154 ft away from Point A is the exhibit below. The northern equipment pad is 227 ft away from Point A. To quantify the reduction in sound from the point of origin to the closest abutting property from the southern equipment pad, 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:

From Southern Equipment Pad to Point A:

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

Calculation

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

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

$$DL = 20\ log(154/3.28)$$

DL= 33.4 dBA

83.9 dBA – 33.4 dBA = 50.5 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

From Northern Equipment pad to Point A:

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

Calculation

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

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

$$DL = 20\ log(227/3.28)$$

DL= 36.8 dBA

80.9 dBA – 36.8 dBA = 44.1 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

To calculate the combined noise level of both pads at Point A:

50.5 dBA + 44.1 dBA = 51.4 dBA

Point B Calculation
Point B is the closest property line to the northern equipment pad. The Southern equipment pad has 12 inverters and 1 transformer, which, combined have an 83.9 dBA output. The northern equipment pad contains 6 inverters and 1 transformer, which, combined have an 80.8 dBA output. The northern equipment pad is 168 ft away from Point B. The southern equipment pad is 228 ft away from Point B. To quantify the reduction in sound from the point of origin to the closest abutting property from the southern equipment pad, 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:

From Northern Equipment Pad to Point B:

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

Calculation

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

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

$$DL = 20\ log(168/3.28)$$

DL= 34.2 dBA

80.8 dBA – 34.2 dBA = 46.6 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

From Southern Equipment pad to Point :

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

Calculation

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

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

$$DL = 20\ log(228/3.28)$$

DL= 36.8 dBA

83.9 dBA – 36.8 dBA = 47.1 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

To calculate the combined noise level of both pads at Point B:

46.6 dBA + 47.1 dBA = 49.9 dBA

The noise level from both equipment pads combined at Point A is 51.4 dBA and at point B is 49.9 at the loudest. Both are within compliance of noise regulations.