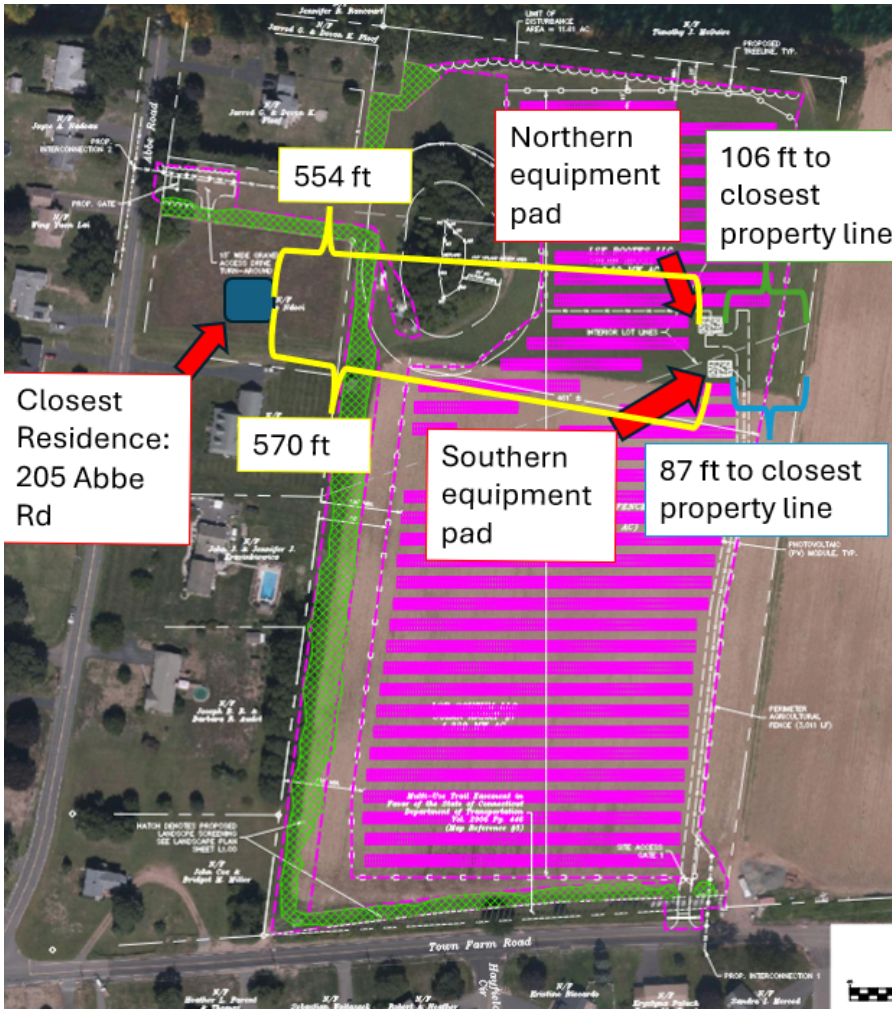
LODESTAR ENERGY

NOISE ANALYSIS

Introduction

This Project will require 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. The panels themselves are fixed tilt and will not emit any sound. A single Solectria inverter has an acoustic sound output of 73dBA measured at 1 meter (3.28 ft) from the unit, a single 1500kVA Maddox transformer has an acoustic sound output of 60 dBA measured at 1 meter (3.28 ft) from the unit, and a single 750kVA Maddox transformer has an acoustic sound output of 58 dBA measured at 1 meter (3.28 ft) from the unit.

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.

The previous layout would have met standards but noise levels would have been at 61 dBA at the closest abutting residence from the southern equipment pad and 45.2 dBA at the closest abutting property line from the northern equipment pad during the day. The revised layout now is 53.6 dBA at the closest abutting property line from the southern equipment pad and 48.8 dBA at the closest abutting property line from the northern equipment pad. This equates to a reduction of 7.4 dBA for the southern equipment pad. The noise level received at the nearest property line from the northern equipment pad increases modestly but more importantly, there are no residences at the nearest property line and noise received at the nearest residence has decreased as detailed below.

Previously, noise from the southern equipment pad at the nearest residence, 205 Abbe Rd, would have been 44.8 dBA. The revised layout will be 37.3 dBA at the nearest residence, a decrease of 7.5 dBA. Previously, noise from the northern equipment pad at the nearest residence, 203 Abbe Rd, would have been 40.1 dBA. The revised layout will be 34.4 dBA at the nearest residence, 205 Abbe Rd, a decrease of 5.7 dBA.

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 property line (87 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

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

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

$$DL = 20\, log(87/3.28)$$

DL= 28.5 dBA

82.1 dBA – 28.5 dBA = 53.6 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

The same method is used to quantify the reduction in sound from the point of origin to the closest residence at 205 Abbe Rd (570 ft away).

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

Calculation

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

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

$$DL = 20\,log(570/3.28)$$

DL= 44.8 dBA

82.1 dBA – 44.8 dBA = 37.3 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 residence)
R_1 = distance from source to location 1
R_2 = distance from source to location 2

Northern Equipment Pad:

Equation 1. Decibel Addition

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

(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 property line (106 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

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

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

$$DL = 20\ log(106/3.28)$$

DL= 30.2 dBA

79 dBA – 30.2 dBA = 48.8 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

The same method is used to quantify the reduction in sound from the point of origin to the closest residence at 205 Abbe Rd (554 ft away).

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

Calculation

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

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

$$DL = 20\ log(554/3.28)$$

DL = 44.6 dBA

79 dBA – 44.6 dBA = 34.4 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 southern equipment pad will be 53.6 dBA at the closest abutting property line and 37.3 dBA at the closest residence. The noise levels emitted from the inverters and transformers on the northern equipment pad will be 48.8 dBA at the closest abutting property line and 34.4 dBA at the closest residence. 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.