

Noise Study

Front Range-Midway Solar Project

Introduction

The Front Range-Midway Solar Project (Project) is a proposed photovoltaic solar facility located approximately 9 miles south of the City of Fountain, El Paso County, Colorado. The Project is located on Rancho Colorado Boulevard, approximately 0.5 mi. west of Interstate 25 (I-25). The Project consists of a 100 MW photovoltaic solar array, a substation, energy storage, an operations and maintenance building, a transmission line connecting the Project with either an existing, adjacent Public Service Company of Colorado (PSCo) or Western Area Power Administration (WAPA) substation, a meteorological station, up to 50 inverters, site access roads, and other necessary ancillary features. The proposed Project would encompass approximately 939 acres.

The purpose of this noise study was to determine the level of noise impact the Project at nearby residences and to ensure that the Project complies with state and county regulations. The level of impact has been determined based on the El Paso County Noise Ordinance and applicable Colorado law. This report addresses noise emitted from equipment from stationary operations.

State of Colorado Noise Law

25-12-103. Maximum permissible noise levels.

1. Every activity to which this article is applicable shall be conducted in a manner so that any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Sound levels of noise radiating from a property line at a distance of twenty-five feet or more therefrom in excess of the dB(A) established for the following time periods and zones shall constitute prima facie evidence that such noise is a public nuisance:
2. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in subsection (1) of this section may be increased by ten dB(A) for a period of not to exceed fifteen minutes in any one-hour period.
3. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five dB(A) less than those listed in subsection (1) of this section.

Table 1. Maximum Allowable Noise Sound Pressure Levels for Specified Premises

Zone	7am to next 10pm	10pm to next 7am
Residential	55 dB(A)	50 dB(A)
Commercial	60 dB(A)	55 dB(A)
Light Industrial	70 dB(A)	65 dB(A)
Industrial	80 dB(A)	75 dB(A)

El Paso County Ordinances

El Paso County Ordinance 02-1, Sections 4, 5, and 6.

Section 4. Prohibited Activities

- A. It shall be unlawful to engage in any of the following activities, whether by use of a sound producing device, other device, or other means (either natural or artificial):
 - 1. To knowingly permit, make, cause to be made or continue any noise disturbance, as defined in Section 3(e) of this Ordinance.
 - 2. To exceed the sound levels provided for in Section (5) and as measured as provided for in Section (6), below.
 - 3. To operate a motor vehicle in a public right of way and exceed the sound level provided for in Section (5) and as measured as provided for in Section (6), below.
 - 4. Knowingly and repeatedly sounding any horn or other auditory signaling device on or in any motor vehicle on any public right-of-way or public space, except as a warning of either danger or emergency

Section 5. Maximum Permissible Noise Levels

- A. Sound levels shall be measured in dB(A) as provided for in Section 6 of this Ordinance.
- B. During the time periods indicated below, and on the types of property indicated below, the sound levels permitted by this Ordinance shall be observed:

[Information from table in ordinance provided in Table 2 below].

Table 2. Maximum Allowable Sound Levels

Land Use	7am to 7pm	7pm to 7am
Residential property or Commercial Area	55 dB(A)	50 dB(A)
Industrial area or Construction activities	80 dB(A)	75 dB(A)
Non-specified areas	55 dB(A)	50 dB(A)

- C. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted by this section may be increased by ten (10) dB(A) for a period of not to exceed fifteen (15) minutes in any one (1) hour period.
- D. Vehicles operating in the public right of way shall observe the following sound levels:
[Information from table in ordinance provided in Table 3 below].

Table 3. Maximum Vehicular Sound Levels

Vehicle Class (GVWR)	Maximum noise in Speed Limit 35 mph or less zone	Maximum noise in Speed Limit over 35 mph zone
Over 10,000 lbs.	86 dB(A)	90 dB(A)
Any other vehicle	80 dB(A)	84 dB(A)

Section 6. Classification and Measurement of Noise: For the purposes of measuring any noise to determine whether a person has violated Section 4(a)(2) or 4(a)(3) of this Ordinance, the following test measurements and requirements shall be applied:

- A. Any noise originating within a public right of way or other public land shall be measured at a distance of at least 25 feet from the noise source.
- B. Any noise originating on private property shall be measured at or within the boundary of the property from which the noise complaint is made.
- C. The noise shall be measured on a weighting scale on a sound level meter of standard design and quality and in accordance with the standards promulgated with the American National Standards Institute.
- D. For the purposes of this Ordinance, measurements with sound level meters shall be made when a wind velocity at the time and place of such measurement is not more than five (5) miles per hour, or more than twenty-five (25) miles per hour with a windscreen appropriately attached to the microphone.
- E. Vehicle noise shall be measured at a distance of at least twenty-five (25) feet from the near side of the nearest lane being monitored and at a height of at least four (4) feet above the immediate surrounding surface.

Project Equipment

Equipment utilized for the Project includes the solar array, Grid-Connected Battery Energy Storage System (BESS), inverters (which convert electricity from AC-to-DC, and DC-to-AC), transformers (which “step up” and “step down” the system voltage), cooling systems similar to HVAC units used on commercial buildings and apartment complexes (batteries generate heat when charging and discharging), control instrumentation, a fire detection and suppression system, and electric grid interconnection switchgear. Table 4 includes typical sound levels from inverters associated with battery energy storage systems. The model in Table 4 is not necessarily the model that will be chosen for the Project design but provides an example of noise levels measured within 1 meter of the inverter.

Table 4. Example Battery Inverter Noise Levels

Example Facility	Measured Noise Level (dBA) ¹ at one (1) meter	Measured Noise level (dBA) ¹ at ninety (90) meters	Time Period	EPC Noise Ordinance threshold at residential parcel boundary (dBA)
Battery Inverter (HEMK)	71 - 77	< 50	Day (7AM – 7PM)	55
Battery Inverter (HEMK)	NA	NA	Night (7PM – 7AM)	50

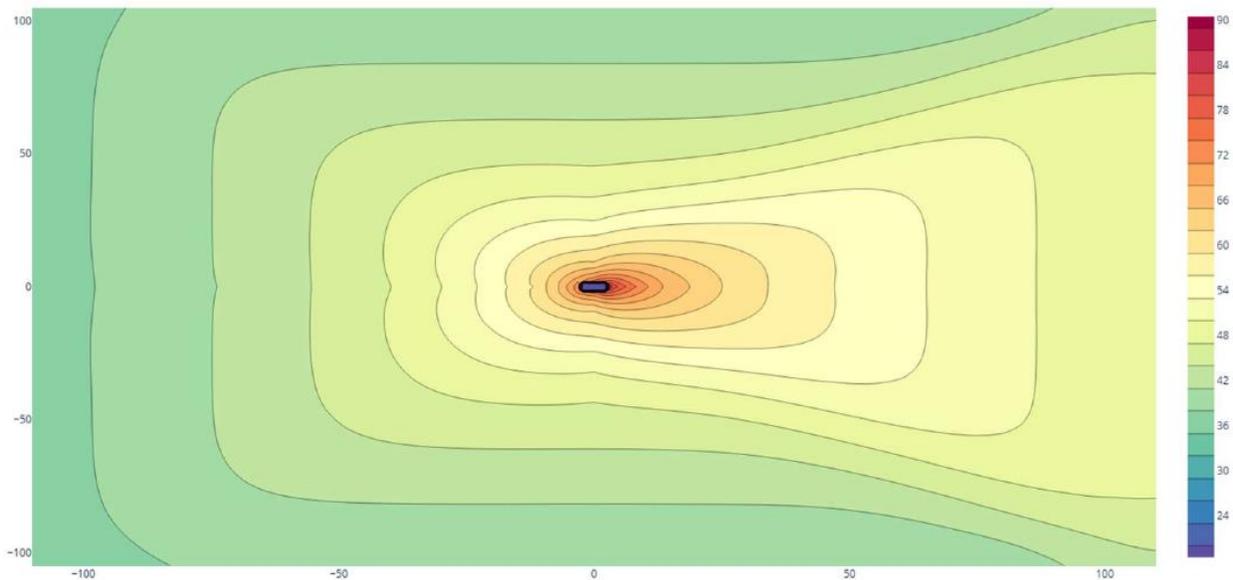
¹ Power Electronics Technical Report for Freesun PCSK/HEMK Inverters, April 2019.

The inverters for solar panels have the potential for noise levels to range between 45 dBA and 79 dBA when sound receptor is located between 1-meter and 50-meters from the inverter. Ground-mounted solar array PV inverters and transformers produce a humming sound during daylight hours when the array

generates electricity. Battery storage inverters have the potential for noise levels to range between 64 dBA and 84 dBA when the sound receptor is located 5-feet from the inverters. Finally, the HVAC system designed for cooling batteries has the potential for noise levels up to 68 dBA when sound receptor is located 80-feet from unit. For comparison, a garbage disposal can get around 80 dB, a vacuum cleaner around 70dB, and an air conditioner around 60 dB (CCOHS 2020).

The El Paso County Noise Ordinances identifies the lowest sound limit at residential property. Sound decreases over distance from the source. Figure I shows the propagation of noise produced by the HEMK inverter included in Table 4 above. At 90 meters away from the equipment, the noise level is under 50dBA (Power Electronics 2019).

Figure I. Noise Propagation with Distance from Equipment



Source: Power Electronics Technical Report for Freesun PCSK/HEMK Inverters, April 2019

In the preliminary Project design, the BESS is located approximately 180 meters from the WSE-O boundary, therefore the sound levels at the property boundary would be expected to meet the El Paso County Noise Ordinance and state statute for residential property. PV inverters are located in various locations among the solar array, most of them at least 90 meters from the WSE-O boundary, with a select few closer to approximately 60 meters from the WSE-O boundary. With the solar panels placed in between the inverter and the boundary, sound levels are expected to be dissipated to below the sound thresholds at the WSE-O boundary as permitted by Colorado and county law.

Conclusion

The purpose of this noise review was to determine the level of noise impact the Project will produce and ensure that the Project will comply with state and county regulations. This level of impact has been determined based on the El Paso County noise ordinance and state law. Based on typical solar energy facility equipment, it is expected that the noise levels from Project facilities will meet or exceed the El Paso County Noise Ordinance and state law during construction and operation of the Project.

References

CCOHS (Canadian Centre of Occupational Health and Safety). 2020. Noise – Basic Information. Available at https://www.ccohs.ca/oshanswers/phys_agents/noise_basic.html. Accessed June 8, 2020.

Power Electronics. 2019. Technical Report. Sound Pressure Level in Freesun PSCK/HEMK Inverters. April 2019.