

## **Appendix I**

### **Project Emissions Estimate**

Lemon Hill Solar, LLC  
Lemon Hill Solar Project  
Construction and Operating Emission Calculations  
Greenhouse Gas Summary

| Emissions From Construction Equipment |                                                                    |
|---------------------------------------|--------------------------------------------------------------------|
| Description                           | Emissions (tons per project)<br>Greenhouse Gas (CO <sub>2</sub> e) |
| Off-Road Engine Emissions             | 2,154                                                              |
| Construction Worker Vehicles          | 1,202                                                              |
| Construction Delivery Vehicles        | 280                                                                |
| <b>Construction Equipment</b>         | <b>3,635</b>                                                       |

| Operating Emissions              |                                                                 |
|----------------------------------|-----------------------------------------------------------------|
| Description                      | Emissions (tons per year)<br>Greenhouse Gas (CO <sub>2</sub> e) |
| Electricity Use - O&M Building   | 7                                                               |
| Commuter Vehicles - Gasoline     | 8                                                               |
| Maintenance Trucks - Diesel      | 0                                                               |
| <b>Total Operating Emissions</b> | <b>16</b>                                                       |

Lemon Hill Solar, LLC  
Lemon Hill Solar Project  
Construction Emission Calculations  
Emission Factors for Construction Engines

| Off-Road Construction Engines |                       |               |                |                               |                |                          |                   |        |        |       |                                           |                   |                 |                 |                 |                  |
|-------------------------------|-----------------------|---------------|----------------|-------------------------------|----------------|--------------------------|-------------------|--------|--------|-------|-------------------------------------------|-------------------|-----------------|-----------------|-----------------|------------------|
| Equipment                     | Quantity <sup>a</sup> | Hours per Day | Number of Days | Total Hours Used <sup>b</sup> | Max Power (HP) | Load Factor <sup>c</sup> | Loaded Power (HP) | VOC    | CO     | NOx   | Emission Factors <sup>d,e</sup> (g/hp hr) |                   |                 |                 |                 |                  |
|                               |                       |               |                |                               |                |                          |                   |        |        |       | PM <sub>10</sub>                          | PM <sub>2.5</sub> | SO <sub>2</sub> | CO <sub>2</sub> | CH <sub>4</sub> | N <sub>2</sub> O |
| ATV                           | 42                    | 8             | 155            | 52,080                        | 20             | 0.5                      | 10                | 0.438  | 2.161  | 4.440 | 0.267                                     | 0.267             | 0.002           | 188.262         | 0.008           | 0.002            |
| Backhoe                       | 2                     | 8             | 300            | 4,800                         | 75             | 0.8                      | 60                | 0.367  | 2.366  | 4.700 | 0.240                                     | 0.240             | 0.002           | 188.262         | 0.008           | 0.002            |
| Bulldozer                     | 2                     | 8             | 50             | 800                           | 250            | 1                        | 250               | 0.309  | 0.748  | 4.000 | 0.132                                     | 0.132             | 0.002           | 188.262         | 0.008           | 0.002            |
| Compactor, Vibratory          | 4                     | 8             | 155            | 4,960                         | 100            | 1                        | 100               | 0.338  | 0.867  | 4.100 | 0.180                                     | 0.180             | 0.002           | 188.262         | 0.008           | 0.002            |
| Fork Lift                     | 8                     | 8             | 155            | 9,920                         | 120            | 1                        | 120               | 0.167  | 0.843  | 4.335 | 0.132                                     | 0.132             | 0.002           | 188.262         | 0.008           | 0.002            |
| Concrete Mixer Truck          | 6                     | 8             | 40             | 1,920                         | 325            | 1                        | 325               | 0.338  | 0.867  | 4.100 | 0.180                                     | 0.180             | 0.002           | 188.262         | 0.008           | 0.002            |
| Dump Truck                    | 2                     | 8             | 75             | 1,200                         | 325            | 0.8                      | 260               | 0.338  | 0.867  | 4.100 | 0.180                                     | 0.180             | 0.002           | 188.262         | 0.008           | 0.002            |
| Excavator                     | 4                     | 8             | 200            | 6,400                         | 138            | 1                        | 138               | 0.309  | 0.748  | 4.000 | 0.132                                     | 0.132             | 0.002           | 188.262         | 0.008           | 0.002            |
| Front End Loader              | 3                     | 8             | 100            | 2,400                         | 196            | 1                        | 196               | 0.309  | 0.748  | 4.000 | 0.132                                     | 0.132             | 0.002           | 188.262         | 0.008           | 0.002            |
| Generator                     | 10                    | 8             | 155            | 12,400                        | 250            | 0.5                      | 125               | 0.167  | 0.843  | 4.335 | 0.132                                     | 0.132             | 0.002           | 188.262         | 0.008           | 0.002            |
| Pickup Truck                  | 20                    | 8             | 275            | 44,000                        | 150            | 0.25                     | 38                | 0.167  | 0.843  | 4.335 | 0.132                                     | 0.132             | 0.002           | 188.262         | 0.008           | 0.002            |
| Skid steer loader             | 4                     | 8             | 155            | 4,960                         | 50             | 1                        | 50                | 0.309  | 0.748  | 4.000 | 0.132                                     | 0.132             | 0.002           | 188.262         | 0.008           | 0.002            |
| Water truck                   | 4                     | 9             | 250            | 9,000                         | 100            | 0.5                      | 50                | 0.637  | 2.366  | 4.700 | 0.240                                     | 0.240             | 0.002           | 188.262         | 0.008           | 0.002            |
| Grader                        | 2                     | 8             | 300            | 4,800                         | 35             | 0.8                      | 28                | 0.438  | 2.161  | 4.440 | 0.267                                     | 0.259             | 0.002           | 188.262         | 0.008           | 0.002            |
| Medium Crane                  | 2                     | 4             | 40             | 320                           | 450            | 0.7                      | 315               | 0.3085 | 0.7475 | 4.000 | 0.132                                     | 0.128             | 0.002           | 188.262         | 0.008           | 0.002            |
| Pile Driver                   | 7                     | 8             | 155            | 8,680                         | 49             | 1                        | 49                | 0.2789 | 1.5323 | 4.728 | 0.339                                     | 0.339             | 0.002           | 188.262         | 0.008           | 0.002            |
| 100 HP Tractor                | 5                     | 8             | 200            | 8,000                         | 100            | 0.21                     | 100               | 0.338  | 0.867  | 4.100 | 0.180                                     | 0.180             | 0.002           | 188.262         | 0.008           | 0.002            |

<sup>a</sup> Equipment counts based on experience with construction of similar projects.

<sup>b</sup> Hours based on estimates from similar projects.

<sup>c</sup> Load Factors from Appendix A of EPA 420\_P 04 005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, USEPA, April 2004.

<sup>d</sup> EPA 420 P 04 009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling Compression Ignition, USEPA, April 2004 Tier 2 Engines.

<sup>e</sup> GHG emission factors from Title 40 Subchapter C Part 98 Subpart C Table C-1 and C-2 to Subpart C.

Lemon Hill Solar, LLC  
Lemon Hill Solar Project  
Construction Emission Calculations  
Emission Estimates from Construction Engines

| Equipment            | Potential Emissions (ton/yr) |              |              |                  |                   |                 |                 |                 |                  |                   |
|----------------------|------------------------------|--------------|--------------|------------------|-------------------|-----------------|-----------------|-----------------|------------------|-------------------|
|                      | VOC                          | CO           | NOx          | PM <sub>10</sub> | PM <sub>2.5</sub> | SO <sub>2</sub> | CO <sub>2</sub> | CH <sub>4</sub> | N <sub>2</sub> O | CO <sub>2</sub> e |
| ATV                  | 2.51E-01                     | 1.241        | 2.549        | 0.153            | 0.153             | 0.001           | 108.08          | 4.4E-03         | 8.8E-04          | 108.43            |
| Backhoe              | 1.17E-01                     | 0.751        | 1.492        | 0.076            | 0.076             | 0.001           | 59.77           | 2.4E-03         | 4.8E-04          | 59.96             |
| Bulldozer            | 6.80E-02                     | 0.165        | 0.882        | 0.029            | 0.029             | 0.000           | 41.50           | 1.7E-03         | 3.4E-04          | 41.64             |
| Compactor, Vibratory | 1.85E-01                     | 0.474        | 2.242        | 0.098            | 0.098             | 0.001           | 102.93          | 4.2E-03         | 8.3E-04          | 103.27            |
| Fork Lift            | 2.19E-01                     | 1.106        | 5.688        | 0.173            | 0.173             | 0.003           | 247.04          | 1.0E-02         | 2.0E-03          | 247.85            |
| Concrete Mixer Truck | 2.33E-01                     | 0.596        | 2.820        | 0.124            | 0.124             | 0.001           | 129.49          | 5.3E-03         | 1.1E-03          | 129.92            |
| Dump Truck           | 1.16E-01                     | 0.298        | 1.410        | 0.062            | 0.062             | 0.001           | 64.75           | 2.6E-03         | 5.3E-04          | 64.96             |
| Excavator            | 3.00E-01                     | 0.728        | 3.894        | 0.128            | 0.128             | 0.002           | 183.28          | 7.4E-03         | 1.5E-03          | 183.89            |
| Front End Loader     | 1.60E-01                     | 0.388        | 2.074        | 0.068            | 0.068             | 0.001           | 97.62           | 4.0E-03         | 7.9E-04          | 97.94             |
| Generator            | 2.85E-01                     | 1.439        | 7.407        | 0.225            | 0.225             | 0.003           | 321.66          | 1.3E-02         | 2.6E-03          | 322.72            |
| Pickup Truck         | 3.04E-01                     | 1.532        | 7.885        | 0.239            | 0.239             | 0.004           | 342.41          | 1.4E-02         | 2.8E-03          | 343.54            |
| Skid steer loader    | 8.43E-02                     | 0.204        | 1.093        | 0.036            | 0.036             | 0.001           | 51.47           | 2.1E-03         | 4.2E-04          | 51.63             |
| Water truck          | 3.16E-01                     | 1.173        | 2.331        | 0.119            | 0.119             | 0.001           | 93.39           | 3.8E-03         | 7.6E-04          | 93.69             |
| Grader               | 6.49E-02                     | 0.320        | 0.658        | 0.040            | 0.038             | 0.000           | 27.89           | 1.1E-03         | 2.3E-04          | 27.98             |
| Medium Crane         | 3.43E-02                     | 0.083        | 0.444        | 0.015            | 0.014             | 0.000           | 20.92           | 8.5E-04         | 1.7E-04          | 20.99             |
| Pile Driver          | 1.31E-01                     | 0.718        | 2.217        | 0.159            | 0.159             | 0.001           | 88.26           | 3.6E-03         | 7.2E-04          | 88.55             |
| 100 HP Tractor       | 2.98E-01                     | 0.765        | 3.616        | 0.159            | 0.159             | 0.002           | 166.02          | 6.7E-03         | 1.3E-03          | 166.56            |
| <b>TOTAL</b>         | <b>3.17</b>                  | <b>11.98</b> | <b>48.70</b> | <b>1.90</b>      | <b>1.90</b>       | <b>0.02</b>     | <b>2,146.48</b> | <b>8.7E-02</b>  | <b>1.7E-02</b>   | <b>2,153.53</b>   |

| Global Warming Potentials |                 |                  |
|---------------------------|-----------------|------------------|
| CO <sub>2</sub>           | CH <sub>4</sub> | N <sub>2</sub> O |
| 1                         | 28              | 265              |

Source: Title 40 Part 98 Table A-1 (January 2025).

Example calculations:

$$\text{CO}_2 \text{ (ton/yr)} = [\text{Total hours}] * [\text{Loaded Power (hp)}] * [188.262 \text{ g CO}_2 / \text{hp-hr}] * [1 \text{ lb} / 453.5924 \text{ g}] * [1 \text{ ton} / 2000 \text{ lb}]$$

$$\text{CH}_4 \text{ (ton/yr)} = [\text{Total hours}] * [\text{Loaded Power (hp)}] * [0.008 \text{ g CH}_4 / \text{hp-hr}] * [1 \text{ lb} / 453.5924 \text{ g}] * [1 \text{ ton} / 2000 \text{ lb}]$$

$$\text{N}_2\text{O (ton/yr)} = [\text{Total hours}] * [\text{Loaded Power (hp)}] * [0.002 \text{ g N}_2\text{O} / \text{hp-hr}] * [1 \text{ lb} / 453.5924 \text{ g}] * [1 \text{ ton} / 2000 \text{ lb}]$$

$$\text{CO}_2\text{e (ton/yr)} = [\text{CO}_2 \text{ ton/yr} * 1] + [\text{CH}_4 \text{ ton/yr} * 28] + [\text{N}_2\text{O ton/yr} * 265]$$

Lemon Hill Solar, LLC  
Lemon Hill Solar Project  
Operating Emission Calculations  
Emissions Estimates for Construction Commuters and Delivery Vehicles

| On-Road Vehicles                          |                     |                      |                   |                             |                                   |
|-------------------------------------------|---------------------|----------------------|-------------------|-----------------------------|-----------------------------------|
|                                           | Vehicles<br>per day | Miles<br>per vehicle | Number<br>of Days | Gallons Used<br>per Project | CO <sub>2</sub> Emissions<br>Tons |
| Commuter Vehicles - Gasoline <sup>b</sup> | 150                 | 60                   | 300               | 122,727                     | 1,202                             |
| Delivery Trucks - Diesel <sup>c</sup>     | 18                  | 60                   | 150               | 24,923                      | 280                               |

<sup>a</sup> Assumes 1 gallon of gasoline = 8,887 grams CO<sub>2</sub> and 1 gallon of diesel = 10,180 g CO<sub>2</sub>, per US EPA's "Greenhouse Gas Emissions from a Typical Passenger Vehicle," available online at: <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockkey=P100U8YT.pdf>

<sup>b</sup> Assumes commuters travel 30 miles each way (60 miles round trip) per day, with a fuel economy of 22.0 miles per gallon, per US EPA and US Department of Energy Fuel Economy data for combined city and highway driving in 2023, available online at: <https://www.fueleconomy.gov/feg/download.shtml>.

<sup>c</sup> Assumes delivery trucks travel 30 miles each way (60 miles round trip) per day, with a fuel economy of 6.5 miles per gallon, industry average.

|                  |         |                   |
|------------------|---------|-------------------|
| 1 short ton =    | 907,185 | grams             |
| 1 gal gasoline = | 8,887   | g CO <sub>2</sub> |
| 1 gal diesel =   | 10,182  | g CO <sub>2</sub> |

Lemon Hill Solar, LLC  
Lemon Hill Solar Project  
Operating Emission Calculations  
Emissions from Facility Operation

|                                | kWh / month | kWh / year | GHG Emissions <sup>a</sup><br>tons CO <sub>2</sub> e / year |
|--------------------------------|-------------|------------|-------------------------------------------------------------|
| Electricity Use - O&M Building | 1,358       | 16,301     | 7.5                                                         |

<sup>a</sup> Greenhouse gas emissions calculated using US EPA's Greenhouse Gas Equivalencies Calculator, available online at: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>. [Assumes 4.17 x 10<sup>-04</sup> metric tons CO<sub>2</sub> per kWh; 1 metric ton per 1.10231 US tons]

|                                           | Vehicles<br>per week | Fuel Usage<br>gal/vehicle/week | Fuel Usage<br>gal/year | GHG Emissions <sup>a</sup><br>tons CO <sub>2</sub> e / year |
|-------------------------------------------|----------------------|--------------------------------|------------------------|-------------------------------------------------------------|
| Commuter Vehicles - Gasoline <sup>b</sup> | 6                    | 16                             | 851                    | 8.3                                                         |
| Maintenance Trucks - Diesel <sup>c</sup>  | 2                    | 0.8                            | 42                     | 0.5                                                         |

<sup>a</sup> Assumes 1 gallon of gasoline = 8,887 grams CO<sub>2</sub> and 1 gallon of diesel = 10,180 g CO<sub>2</sub>, per US EPA's "Greenhouse Gas Emissions from a Typical Passenger Vehicle," available online at: <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100U8YT.pdf>

<sup>b</sup> Assumes six commuters travel 30 miles each way (60 miles round trip) per week, with a fuel economy of 22.0 miles per gallon, per US EPA's "Greenhouse Gas Emissions from a Typical Passenger Vehicle," available online at: <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100U8YT.pdf>

<sup>c</sup> Assumes two trucks travel 10 miles on site each week, with a fuel economy of 24.64 miles per gallon (1 gallon of low sulfur diesel is equivalent to 1.12 gallons of gasoline), per US Department of Energy Alternative Fuels Data Center Fuel Properties Comparison, available online at: [https://afdc.energy.gov/files/u/publication/fuel\\_comparison\\_chart.pdf](https://afdc.energy.gov/files/u/publication/fuel_comparison_chart.pdf).

Lemon Hill Solar, LLC  
Lemon Hill Solar Project  
Land Use Carbon Storage Capacity Calculation

| Area                |       | Conversions |                 | Carbon Storage Capacity |        |           |
|---------------------|-------|-------------|-----------------|-------------------------|--------|-----------|
|                     | Acres |             |                 | Mg C / ha               | Mg CO2 | Tons CO2e |
| Project area        | 966   | 12 g C =    | 44.00 g CO2     | Cropland                | 78.3   | 107,750   |
| Developed area      | 39    | 1 ton =     | 907,185 grams   | Grasslands              | 129.3  | 177,931   |
| Area for grasslands | 927   | 1 Mg =      | 1,000,000 grams |                         |        | 196,136   |
|                     |       | 1 acre =    | 4,046.86 m2     |                         |        |           |
|                     |       | 1 ha =      | 2.47 acres      |                         |        |           |
|                     |       | 1 ha =      | 10,000 m2       |                         |        |           |

Carbon storage capacity

Walston, et al, 2021 Walston, et al, Modeling the ecosystem services of native vegetation management practices at solar energy facilities in the Midwestern United States, Ecosystem Services, Volume 47, 2021:  
<https://doi.org/10.1016/j.ecoser.2020.101227>; [www.sciencedirect.com/science/article/pii/S2212041620301698](https://www.sciencedirect.com/science/article/pii/S2212041620301698)  
 Cropland 78.3 Mg C / ha  
 Grassland 129.3 Mg C / ha