

## **Appendix G      Greenhouse Gas Emissions Estimates**

Elk Creek Solar, LLC  
Elk Creek Solar Project  
Construction and Operating Emission Calculations  
Summary

| Emissions From Construction Equipment |                                                                    |
|---------------------------------------|--------------------------------------------------------------------|
| Description                           | Emissions (tons per project)<br>Greenhouse Gas (CO <sub>2</sub> e) |
| Off-Road Engine Emissions             | 1,764                                                              |
| Construction Worker Vehicles          | 962                                                                |
| Construction Delivery Vehicles        | 224                                                                |
| <b>Construction Equipment</b>         | <b>2,949</b>                                                       |

| Emissions From Equipment Fabrication |                                                                 |
|--------------------------------------|-----------------------------------------------------------------|
| Description                          | Emissions (tons per year)<br>Greenhouse Gas (CO <sub>2</sub> e) |
| Equipment Fabrication                | 15,556                                                          |
|                                      |                                                                 |

| Operating Emissions              |                                                                 |
|----------------------------------|-----------------------------------------------------------------|
| Description                      | Emissions (tons per year)<br>Greenhouse Gas (CO <sub>2</sub> e) |
| Electricity Use - O&M Building   | 8                                                               |
| Commuter Vehicles - Gasoline     | 8                                                               |
| Maintenance Trucks - Diesel      | 0                                                               |
| <b>Total Operating Emissions</b> | <b>17</b>                                                       |

Elk Creek Solar, LLC  
Elk Creek Solar Project  
Construction and Operating 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) | Emission Factors <sup>d,e</sup> (g/hp-hr) |                 |                  |
|                               |                       |               |                |                               |                |                          |                   | CO <sub>2</sub>                           | CH <sub>4</sub> | N <sub>2</sub> O |
| Air Compressor                | 0                     | 0             | 0              | 0                             | 80             | 1                        | 80                | 188.262                                   | 0.008           | 0.002            |
| ATV                           | 42                    | 8             | 124            | 41,664                        | 20             | 0.5                      | 10                | 188.262                                   | 0.008           | 0.002            |
| Backhoe                       | 2                     | 8             | 240            | 3,840                         | 75             | 0.8                      | 60                | 188.262                                   | 0.008           | 0.002            |
| Bulldozer                     | 2                     | 8             | 40             | 640                           | 250            | 1                        | 250               | 188.262                                   | 0.008           | 0.002            |
| Compactor                     | 0                     | 0             | 0              | 0                             | 300            | 1                        | 300               | 188.262                                   | 0.008           | 0.002            |
| Compactor, Vibratory          | 4                     | 8             | 124            | 3,968                         | 100            | 1                        | 100               | 188.262                                   | 0.008           | 0.002            |
| Fork Lift                     | 8                     | 8             | 154            | 9,856                         | 120            | 1                        | 120               | 188.262                                   | 0.008           | 0.002            |
| Concrete Mixer Truck          | 6                     | 8             | 30             | 1,440                         | 325            | 1                        | 325               | 188.262                                   | 0.008           | 0.002            |
| Concrete Pump                 | 0                     | 0             | 0              | 0                             | 300            | 1                        | 300               | 188.262                                   | 0.008           | 0.002            |
| Dump Truck                    | 2                     | 8             | 60             | 960                           | 325            | 0.8                      | 260               | 188.262                                   | 0.008           | 0.002            |
| Excavator                     | 4                     | 8             | 160            | 5,120                         | 138            | 1                        | 138               | 188.262                                   | 0.008           | 0.002            |
| Front End Loader              | 3                     | 8             | 80             | 1,920                         | 196            | 1                        | 196               | 188.262                                   | 0.008           | 0.002            |
| Generator                     | 10                    | 8             | 124            | 9,920                         | 250            | 0.5                      | 125               | 188.262                                   | 0.008           | 0.002            |
| Guided Bore Machine           | 0                     | 0             | 0              | 0                             | 150            | 0.8                      | 120               | 188.262                                   | 0.008           | 0.002            |
| Light Tower                   | 0                     | 0             | 0              | 0                             | 50             | 1                        | 50                | 188.262                                   | 0.008           | 0.002            |
| Manlift                       | 0                     | 0             | 0              | 0                             | 50             | 1                        | 50                | 188.262                                   | 0.008           | 0.002            |
| Pickup Truck                  | 20                    | 8             | 220            | 35,200                        | 150            | 0.25                     | 38                | 188.262                                   | 0.008           | 0.002            |
| Piping Truck                  | 0                     | 0             | 0              | 0                             | 300            | 1                        | 300               | 188.262                                   | 0.008           | 0.002            |
| Skid steer loader             | 4                     | 8             | 124            | 3,968                         | 50             | 1                        | 50                | 188.262                                   | 0.008           | 0.002            |
| Water truck                   | 4                     | 9             | 200            | 7,200                         | 100            | 0.5                      | 50                | 188.262                                   | 0.008           | 0.002            |
| Welding machine               | 0                     | 0             | 0              | 0                             | 35             | 0.8                      | 28                | 188.262                                   | 0.008           | 0.002            |
| Grader                        | 2                     | 8             | 240            | 3,840                         | 35             | 0.8                      | 28                | 188.262                                   | 0.008           | 0.002            |
| Large Crane                   | 0                     | 0             | 0              | 0                             | 15             | 0.21                     | 3                 | 188.262                                   | 0.008           | 0.002            |
| Medium Crane                  | 2                     | 4             | 30             | 240                           | 450            | 0.7                      | 315               | 188.262                                   | 0.008           | 0.002            |
| Fuel Truck                    | 0                     | 0             | 0              | 0                             | 200            | 0.59                     | 118               | 188.262                                   | 0.008           | 0.002            |
| Hydrovac Truck                | 0                     | 0             | 0              | 0                             | 200            | 0.59                     | 118               | 188.262                                   | 0.008           | 0.002            |
| Road Bore Machine             | 0                     | 0             | 0              | 0                             | 260            | 0.79                     | 205               | 188.262                                   | 0.008           | 0.002            |
| 6-inch Water Pump             | 0                     | 0             | 0              | 0                             | 30             | 0.69                     | 21                | 188.262                                   | 0.008           | 0.002            |
| 4-inch Water Pump.            | 0                     | 0             | 0              | 0                             | 10             | 0.69                     | 7                 | 188.262                                   | 0.008           | 0.002            |
| 2-inch Water Pump             | 0                     | 0             | 0              | 0                             | 5              | 0.69                     | 3                 | 188.262                                   | 0.008           | 0.002            |
| Pile Driver                   | 7                     | 8             | 124            | 6,944                         | 49             | 1                        | 49                | 188.262                                   | 0.008           | 0.002            |
| 100 HP Tractor                | 5                     | 8             | 160            | 6,400                         | 100            | 0.21                     | 100               | 188.262                                   | 0.008           | 0.002            |
| Light Tower                   | 0                     |               |                | 0                             | 50             | 1                        | 50                | 188.262                                   | 0.008           | 0.002            |

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

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

<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.

Elk Creek Solar, LLC  
 Elk Creek Solar Project  
 Construction and Operating Emission Calculations  
 Emission Estimates from Construction Engines

| Equipment            | Potential Emissions (ton/yr) |                 |                  |                   |
|----------------------|------------------------------|-----------------|------------------|-------------------|
|                      | CO <sub>2</sub>              | CH <sub>4</sub> | N <sub>2</sub> O | CO <sub>2</sub> e |
| ATV                  | 86.46                        | 3.5E-03         | 7.0E-04          | 86.76             |
| Backhoe              | 47.81                        | 1.9E-03         | 3.9E-04          | 47.98             |
| Bulldozer            | 33.20                        | 1.3E-03         | 2.7E-04          | 33.32             |
| Compactor, Vibratory | 82.35                        | 3.3E-03         | 6.7E-04          | 82.63             |
| Fork Lift            | 245.44                       | 1.0E-02         | 2.0E-03          | 246.28            |
| Concrete Mixer Truck | 97.12                        | 3.9E-03         | 7.9E-04          | 97.45             |
| Dump Truck           | 51.80                        | 2.1E-03         | 4.2E-04          | 51.98             |
| Excavator            | 146.63                       | 5.9E-03         | 1.2E-03          | 147.13            |
| Front End Loader     | 78.10                        | 3.2E-03         | 6.3E-04          | 78.36             |
| Generator            | 257.33                       | 1.0E-02         | 2.1E-03          | 258.21            |
| Pickup Truck         | 273.93                       | 1.1E-02         | 2.2E-03          | 274.87            |
| Skid steer loader    | 41.17                        | 1.7E-03         | 3.3E-04          | 41.31             |
| Water truck          | 74.71                        | 3.0E-03         | 6.1E-04          | 74.96             |
| Grader               | 22.31                        | 9.1E-04         | 1.8E-04          | 22.39             |
| Medium Crane         | 15.69                        | 6.4E-04         | 1.3E-04          | 15.74             |
| Pile Driver          | 70.61                        | 2.9E-03         | 5.7E-04          | 70.85             |
| 100 HP Tractor       | 132.81                       | 5.4E-03         | 1.1E-03          | 133.27            |
| <b>TOTAL</b>         | <b>1,757.48</b>              | <b>7.1E-02</b>  | <b>1.4E-02</b>   | <b>1,763.51</b>   |

| Global Warming Potentials |                 |                  |
|---------------------------|-----------------|------------------|
| CO <sub>2</sub>           | CH <sub>4</sub> | N <sub>2</sub> O |
| 1                         | 25              | 298              |

Source: Title 40 Part 98 Table A-1.

Elk Creek Solar, LLC  
 Elk Creek Solar Project  
 Construction and 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                   | 240               | 98,182                      | 962                               |
| Delivery Trucks - Diesel <sup>c</sup>     | 18                  | 60                   | 120               | 19,938                      | 224                               |

<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 commuters travel 30 miles each way (60 miles round trip) per day, with a fuel economy of 24 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

Elk Creek Solar, LLC  
 Elk Creek Solar Project  
 Construction and Operating Emission Calculations  
 Emissions from Equipment Fabrication

|                                                       | Solar - Utility <sup>a</sup><br>g CO <sub>2</sub> e / kWh | Elk Creek Solar Panel Fabrication Emissions<br>g CO <sub>2</sub> e / year | tons CO <sub>2</sub> e / year |
|-------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------|
| Direct Emissions                                      | 0                                                         | 0                                                                         | 0                             |
| Infrastructure and Supply Chain Emissions             | 42                                                        | 14,112,000,000                                                            | 15,556                        |
| Biogenic CO <sub>2</sub> emissions and Albedo Effect  | 0                                                         | 0                                                                         | 0                             |
| Methane Emissions                                     | 0                                                         | 0                                                                         | 0                             |
| Lifecycle emissions, including Albedo Effect (median) | 42                                                        | 14,112,000,000                                                            | 15,556                        |

<sup>a</sup> Intergovernmental Panel on Climate Change. 2014. Working group 3, Annual report 5, Annex III: Technology-specific Cost and Performance Parameters. Available online at: [https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc\\_wg3\\_ar5\\_annex-iii.pdf](https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_annex-iii.pdf)  
 Accessed April 2023.

Assumptions:

|                            |               |         |       |
|----------------------------|---------------|---------|-------|
| Elk Creek Power Generation | 336,000,000   | kWh     |       |
| Conversion:                | 1 short ton = | 907,185 | grams |
| Project Lifetime           | 30            | years   |       |

Elk Creek Solar, LLC  
Elk Creek 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 | 1,350       | 16,200     | 7.7                                                         |

<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>.

|                                           | Vehicles<br>per day | 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                   | 1                              | 43                     | 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 day, 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 day, with a fuel economy of 24 miles per gallon, per US EPA and US Department of Energy Fuel Economy data for combined city and highway driving of trucks in 2023, available online at: <https://www.fueleconomy.gov/feg/download.shtml>.