



LODESTAR ENERGY

## **CARBON DEBT ANALYSIS**

The proposed solar Project area of disturbance, also referred to as “the Site,” (including panels, electrical equipment, access roads, and related ground clearing) is designed to cover approximately 10.67 acres of the 67.36-acre Property. About a 10.17-acre footprint of the proposed solar Project consists of unforested terrain. In total, the Project calls for 0.5 acres of tree clearing for placement of the arrays and shade mitigation in select areas within the vicinity of the arrays. There are demonstrable net benefits to the construction and operation of the solar Project which significantly offset the proposed 0.5 acres of clearing.

The United States Environmental Protection Agency (EPA) provides specific carbon sequestration data and conversion factor data to perform a Carbon Debt Analysis. As set forth in further detail herein, we will calculate and compare two carbon values by applying the prescribed sequestration data and conversion data. The first calculation establishes a baseline value as the “existing condition scenario.” This value is established by measuring the carbon sequestration capability of the Site without the proposed solar Project. The second calculation derives a value that is the “solar Project scenario.” This value is calculated based on the removal of 0.5 acres of vegetative cover and the installation of the proposed Project. This second value will be representative of the amount of carbon that will not be released from “typical” energy generating means due to the carbon free energy generation of the solar Project.

**Existing Condition Scenario:** The proposed solar Project requires site work that will result in the removal of 0.5 acres of vegetation. According to the EPA’s “conversion factor for carbon sequestered in one year by one acre of average U.S. forest,” the amount of carbon sequestered in one year by one acre of forest is 0.84 metric tons of CO<sub>2</sub> (MT CO<sub>2</sub>) (EPA 2020). This means that the existing condition scenario will offer a “carbon debt” of 0.4 MT CO<sub>2</sub> annually (0.5 acres \* 0.84 MT CO<sub>2</sub>/acre).

**Solar Project Scenario:** The proposed solar Project is calculated to produce 3,038 MWh of energy during the first operational year. According to the EPA Greenhouse gas electricity reduction equivalency conversion factor, 1 MWh of electricity is equivalent to a “carbon offset” of 1,562.4 lbs. of CO<sub>2</sub>. Therefore, the forecasted energy generation of 3,136 MWh is equivalent to a “carbon offset” of 2,153 MT CO<sub>2</sub> in the first year ((3,038 MWh\*1,562.4lbs CO<sub>2</sub>/MWh)/(2,204.6 lbs/MT)).

Analysis: In comparing the existing condition scenario offering a carbon debt of 0.4 MT CO<sub>2</sub> and the solar Project scenario offering a carbon offset of 2,153 MT CO<sub>2</sub> in the first year of generation, the following can be concluded:

(1) The installation of the solar Project will have a net carbon offset of 2,152.6 MT CO<sub>2</sub> annually.

$$2,153 \text{ MT CO}_2 - 0.4 \text{ CO}_2 = 2,152.6 \text{ MT CO}_2$$

(2) The solar Project will offer a net improvement in carbon reduction within 1 day of operation.

$$(0.4 \text{ MT CO}_2 / 2,153 \text{ MT CO}_2) * 365 \text{ days} = 0.07 \text{ days}$$

(3) The carbon offset from the solar Project in a year is the equivalent of 2,567 acres of U.S. forests, which is approximately 5,134x the acres of forest that will be removed for this Project.

$$2,567 \text{ acres U.S. forest} / 0.5 \text{ acres U.S. forest} = 5,134x$$

(4) It would take less than two (2) days to recover the loss of carbon sequestration by the 0.5 acres of cleared trees over 20 years.

$$\text{Carbon debt over 20 years} = 0.4 \text{ MT CO}_2 \text{ per year} * 20 \text{ years} = 8 \text{ MT CO}_2$$

$$\text{Carbon offset over 20 years} = 2,153.5 \text{ MT CO}_2 \text{ per year} * 20 \text{ years} = 43,061 \text{ MT CO}_2$$

$$8 \text{ MT CO}_2 / 43,061 \text{ MT CO}_2 * 20 \text{ years} * 365 \text{ days} = 1.4 \text{ days}$$

# Step 1 - Enter and convert data

Select data to convert: ⓘ

- Energy data ⓘ
- Emissions data

Enter data:

Unit

Amount

- Gallons of gasoline
- Gasoline-powered passenger vehicles ⓘ
- Kilowatt-hours avoided ⓘ
- Kilowatt-hours used ⓘ
- MCF of natural gas
- Therms of natural gas

Convert data

Clear Fields

## Step 2 - View results

2,153 Metric Tons of Carbon Dioxide (CO<sub>2</sub>) equivalent

This is equivalent to greenhouse gas emissions from:

479 gasoline-powered passenger vehicles driven for one year ⓘ	5,519,263 miles driven by an average gasoline-powered passenger vehicle ⓘ
242,261 gallons of gasoline consumed ⓘ	211,491 gallons of diesel consumed ⓘ
2,411,665 pounds of coal burned ⓘ	28.5 tanker trucks' worth of gasoline ⓘ
271 homes' energy use for one year ⓘ	419 homes' electricity use for one year ⓘ
11.9 railcars' worth of coal burned ⓘ	4,980 barrels of oil consumed ⓘ
98,906 propane cylinders used for home barbeques ⓘ	0.0006 coal-fired power plants in one year ⓘ
0.005 natural gas-fired power plants in one year ⓘ	261,893,864 number of smartphones charged ⓘ

This is equivalent to greenhouse gas emissions avoided by:



This is equivalent to carbon sequestered by:



## References:

U.S. Environmental Protection Agency (EPA) 2020. Greenhouse Gases Equivalencies Calculator - Calculations and References. <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>

<https://www.nrel.gov/docs/fy13osti/56487.pdf>