



CARBON DEBT ANALYSIS

The proposed solar project area of disturbance (including panels, electrical equipment, access roads, and related ground clearing) is designed to cover approximately 8.02 acres of approximately 11.05 acres across the Project Site. About a 0.12-acre footprint of the proposed solar project consists of unforested terrain. In total, the project calls for 7.9 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 7.9 acres of clearing at the Site.

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 7.9 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 7.9 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 CO₂ (MT CO₂) (EPA 2020). This means that the existing condition scenario will offer a “carbon debt” of 6.6 MT CO₂ annually (7.9 acres * 0.84 MT CO₂/acre).

Solar Project Scenario: The proposed solar project is calculated to produce 1,758 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 CO₂. Therefore, the forecasted energy generation of 1,758 MWh is equivalent to a “carbon offset” of 1,228 MT CO₂ in the first year ((1,758 MWh*1,540.1lbs CO₂/MWh)/(2,204.6 lbs/MT)).

Analysis: In comparing the existing condition scenario offering a carbon debt of 6.6 MT CO₂ and the solar Project scenario offering a carbon offset of 1,228 MT CO₂ 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 1,221 MT CO₂ annually.

$$1,228 \text{ MT CO}_2 - 6.6 \text{ CO}_2 = 1,221 \text{ MT CO}_2$$



(2) The solar project will offer a net improvement in carbon reduction within 2 days of operation.

$$(6.6 \text{ MT CO}_2 / 1,221 \text{ MT CO}_2) * 365 \text{ days} = 1.97 \text{ days}$$

(3) The carbon offset from the solar project in a year is the equivalent of 1,434 acres of U.S. forests, which is approximately 182x the acres of forest that will be removed for this project.

$$1,434 \text{ acres U.S. Forest} / 7.9 \text{ acres U.S. forest} = 182x$$

(4) It would take less than forty (40) days to recover the loss of carbon sequestration by the 7.9 acres of cleared trees over 20 years.

$$\text{Carbon debt over 20 years} = 6.6 \text{ MT CO}_2 \text{ per year} * 20 \text{ years} = 133 \text{ MT CO}_2$$

$$\text{Carbon offset over 20 years} = 1,228 \text{ MT CO}_2 \text{ per year} * 20 \text{ years} = 24,562 \text{ MT CO}_2$$

$$133 \text{ MT CO}_2 / 24,562 \text{ MT CO}_2 * 20 \text{ years} * 365 \text{ days} = 39.4 \text{ days}$$

Step 1 - Enter and convert data

Select data to convert: ⓘ

- Energy data ⓘ
- Emissions data

Enter data:

Unit	Amount
<input type="radio"/> Gallons of gasoline	
<input type="radio"/> Gasoline-powered passenger vehicles ⓘ	
<input checked="" type="radio"/> Kilowatt-hours avoided ⓘ	1758000
<input type="radio"/> Kilowatt-hours used ⓘ	
<input type="radio"/> MCF of natural gas	
<input type="radio"/> Therms of natural gas	



Step 2 - View results

1,228 Metric Tons of Carbon Dioxide (CO₂) equivalent

This is equivalent to greenhouse gas emissions from:

292 gasoline-powered passenger vehicles driven for one year	3,141,004 miles driven by an average gasoline-powered passenger vehicle
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This is equivalent to CO₂ emissions from:

138,193 gallons of gasoline consumed	120,641 gallons of diesel consumed
1,353,484 pounds of coal burned	16.3 tanker trucks' worth of gasoline
160 homes' energy use for one year	242 homes' electricity use for one year
6.8 railcars' worth of coal burned	2,843 barrels of oil consumed
56,419 propane cylinders used for home barbeques	0.0003 coal-fired power plants in one year
0.003 natural gas-fired power plants in one year	81,076,510 number of smartphones charged

This is equivalent to greenhouse gas emissions avoided by:

426 tons of waste recycled instead of landfilled	60.9 garbage trucks of waste recycled instead of landfilled
53,345 trash bags of waste recycled instead of landfilled	0.323 wind turbines running for a year

This is equivalent to carbon sequestered by:

20,307 tree seedlings grown for 10 years	1,434 acres of U.S. forests in one year
7.9 acres of U.S. forests preserved from conversion to cropland in one year	

References:

U.S. Environmental Protection Agency (EPA) 2021. 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>