



LODESTAR ENERGY

CARBON DEBT ANALYSIS

The proposed solar Project has an area of disturbance (including panels, electrical equipment, access roads, and related ground clearing) that is designed to cover approximately 14.28 acres of an approximately 51-acre parcel. About a 10.78-acre footprint of the proposed solar project is comprised of unforested terrain. In total, the project calls for 3.5 acres of tree clearing for placement of the array and shade mitigation in select areas within the vicinity of the array. Selective tree topping to minimize shading will take place within an additional 1.35-acre area. This topping will not materially impact the carbon footprint. There are demonstrable net benefits to the construction and operation of the solar Project which significantly offset the proposed 3.5 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 3.5 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 3.5 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 CO₂ (MT CO₂) (EPA 2020). This means that the existing condition scenario will offer a “carbon debt” of 2.9 MT CO₂ annually (3.5 acres * 0.84 MT CO₂/acre).

Solar Project Scenario: The proposed solar project is calculated to produce 6,492.5 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 6,492.5 MWh is equivalent to a “carbon offset” of 4,601 MT CO₂ in the first year ((6,492.5 MWh*1,562.4lbs CO₂/MWh)/(2,204.6 lbs/MT)).

Analysis: In comparing the existing condition scenario offering a carbon debt of 2.9 MT and the solar Project scenario offering a carbon offset of 4601 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 4,598.1 MT CO₂ annually.

4,601 MT CO₂ - 2.9 CO₂ = 4,598.1 MT CO₂

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

$(2.9 \text{ MT CO}_2 / 4,601 \text{ MT CO}_2) * 365 \text{ days} = 0.23 \text{ days}$

(3) The carbon offset from the solar project in a year is the equivalent of 5,445 acres of U.S. forests, which is approximately 1,556x the acres of forest that will be removed for this project.

$5,445 \text{ acres U.S. forest} / 3.5 \text{ acres U.S. forest} = 1,556x$

(4) It would take less than five (5) days to recover the loss of carbon sequestration by the 3.5 acres of cleared trees over 20 years.

Carbon debt over 20 years = 2.9 MT CO₂ per year * 20 years = 58 MT CO₂

Carbon offset over 20 years = 4,601 MT CO₂ per year * 20 years = 92,020 MT CO₂

$58 \text{ MT CO}_2 / 92,020 \text{ MT CO}_2 * 20 \text{ years} * 365 \text{ days per year} = \mathbf{4.6 \text{ days}}$

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>