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Carbon Debt Analysis of Middletown - Middlefield Photovoltaic Systems

Citrine Power LLC and its project affiliates CP Middletown Solar I, LLC and CP Middletown Solar II, LLC (collectively the "Petitioner") have performed a carbon debt analysis for the PV Facilities proposed in the City Middletown and Town of Middlefield. The purpose of this analysis is to determine whether the PV Facilities can have a net improvement in carbon reduction compared to the loss of 0.55 acres of trees. The Site is approximately 8.7 acres and the Project will require the removal of 0.55 acres of trees representing 0.6 percent of the project Site.

The analysis relied upon a United States Environmental Protection Agency ("EPA") conversion factor to identify the amount of carbon sequestered in one year by one acre of average U.S. forest: 0.85 metric tons (MT) CO₂ (EPA, 2017). As the PV Facilities together require the removal of approximately 0.55 acres of trees, the associated "carbon debt" is estimated to be 0.4675 MT CO₂ per year. Over twenty (20) years, this would equate to the sequestration of 9.35 MT CO₂.

Each PV Facility is expected to produce approximately 1,660 MWh of energy in its first year of operation for a total of about 3,320 MWh between the two (2) PV Facilities. Using the EPA Greenhouse Gas Equivalencies Calculator, the estimated annual carbon offset of the Project is 2,348 MT CO₂. Attachment A provides greenhouse gas equivalencies for this estimated offset, examples of which include:

- 498 passenger vehicles driven for one year;
- 264,177 gallons of gasoline consumed; and
- 281 homes' energy use for one year.

Anticipating an annual "carbon debt" of 0.4675 MT CO₂ and an annual carbon offset of 2,348 MT CO₂, Petitioner performed the following calculation to determine the duration of time to offset the carbon debt of the tree clearing:

$$\text{Offset Time in Days} = \text{Annual Carbon Debt} / (\text{Annual MT CO}_2 \text{ Offset} / \text{days per year})$$

Using this formula, Petitioner has determined that it would take approximately 0.072 days to produce a net improvement in carbon reduction. It would take approximately 1.44 days to recover the loss of carbon sequestration by the 0.55 acres of cleared trees over 20 years.

This analysis does not account for energy used as part of material extraction; solar panel manufacturing and production; manufacturing of balance of system components or project installation. It also does not include the carbon dioxide that is expected to be released from the tree removal.



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References

United States Environmental Protection Agency (EPA). (2017). Greenhouse Gases Equivalencies Calculator - Calculations and References. Retrieved April 7, 2019. from <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>

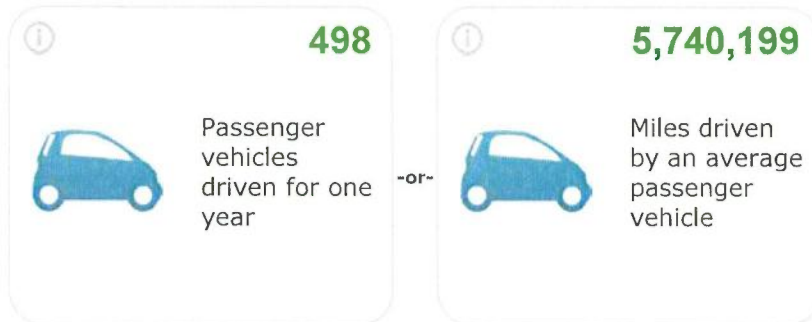
Equivalency Results

[How are they calculated?](#)

The sum of the greenhouse gas emissions you entered above is of Carbon Dioxide Equivalent. This is equivalent to:

2,348 Metric Tons

Greenhouse gas emissions from



CO₂ emissions from





coal-fired
power plants
in one year

-or-



number of
smartphones
charged

Greenhouse gas emissions avoided by



819



Tons of waste
recycled
instead of
landfilled

-or-



117



Garbage
trucks of
waste recycled
instead of
landfilled

-or-



102,436



trash bags of
waste recycled
instead of
landfilled

-or-



0.498



Wind turbines
running for a
year

-or-



89,176



Incandescent
lamps switched
to LEDs

Carbon sequestered by



38,820



tree seedlings
grown for 10
years

-or-



2,763



acres of U.S.
forests in one
year

-or-



19.1



acres of U.S.
forests
preserved from
conversion to
cropland in one
year