SOLAR REUSE ASSESSMENT AND FEASIBILITY STUDY REPORT

Agriculture Street Landfill Site
New Orleans, LA

FINAL
JULY 2021

INTRODUCTION

EPA's Superfund Redevelopment and RE-Powering America's Land programs supported a renewable energy reuse assessment and solar feasibility study for the city of New Orleans (the City) to help advance recommendations from an Urban Resilience Report for this former municipal disposal area. The focus of the project is the 95-acre Agriculture Street Landfill Superfund site (Site), which includes an undeveloped 45-acre landfill and residential properties. A Microgrid Opportunities Report funded by the U.S. Department of Energy highlighted the Site's capacity to host a solar renewable energy project that could help power an adjacent water and drainage infrastructure pumping station. Following up on this finding, EPA's consulting team, Skeo Solutions, Inc. and National Renewable Energy Laboratory (NREL), provided technical assistance to evaluate suitable areas for locating a solar photovoltaic (solar PV, or PV) system at the Site.

Overview

The project started in November 2020 as EPA, City stakeholders and the consulting team initiated a phased solar suitability evaluation. The project finished in July 2021 with the solar feasibility study, which refines the potential PV system capacity and evaluates financial feasibility. This report summarizes the consulting team's analysis and key considerations to support the City in further determining options to advance site reuse and resilience efforts.

SITE BACKGROUND

Site Location: The Site is located in the Desire neighborhood on the City's east side. It is bounded on the north by Higgins Boulevard, on the northwest by Almonaster Boulevard, and on the south and west by the Southern Railroad rights-of-way.

Community Context: The Site is located in a historically African American community that faces the compound impacts of low lying area flood damage and the fact that many homes and neighborhood amenities were built in an area later designated as a federal Superfund site. The City's interest in a solar development at the Site meets several goals, including improving

Contents

Stakeholders Involved

The stakeholders listed below participated in reuse discussions via teleconference in 2020 and 2021.

- City of New Orleans Environmental Affairs
- City of New Orleans Office of Resilience and Sustainability
- Sewer and Water Board of New Orleans
- City of New Orleans Department of Property Management, Real Estate Division
- National Renewable Energy Laboratory
- RE-Powering America's Land Program, EPA
- Superfund Redevelopment Program, EPA
- EPA Region 6

resiliency against natural disasters, greening New Orleans, addressing historical environmental justice concerns in the Desire neighborhood, and decreasing the City's carbon footprint.

Land Use Context: The area previously supported a vibrant community with 67 single-family homes, multi-family dwellings, retail businesses, an elementary school, a community center, and a recreation center. In 2005, Hurricanes Katrina and Rita destroyed many structures on site. After these hurricanes, only single-family homes, several in-home businesses and the electrical substation remained. The former elementary school and community center are currently vacant. Currently, most of the site properties are vacant, and the property ownership is fragmented.

Cleanup Status: EPA placed the Site on the National Priorities List (NPL) in 1994. Clean-up occurred over several years through a series of time-critical removal actions to address lead contamination in the soil. During the process, several residents requested that EPA include buyouts as part of the remedy. However, EPA's human health risk assessment did not indicate that buyouts were necessary to protect human health so buyouts were not includedin EPA's selected remedy for the Site.

Cleanup Activities:

- In 1994, EPA installed a fence around the former landfill to restrict access.
- In 1995, EPA removed playground equipment and covered contaminated soil.
- In 1996, EPA repaired fencing at the Site that had been damaged by trespassers.
- Between 1997 and 2001, EPA excavated and disposed of nearly 70,000 tons of material from multiple parts of the Site. EPA replaced this material with a permeable layer below ground, clean fill and sod.
- The cleanup protected the health of over 1,000 people living on site. The cleanup addressed 179 Housing Authority of New Orleans (HANO) townhomes, 128 Gordon Plaza apartments, seven retail businesses, and 58 out of 67 single-family homes in the Gordon Plaza subdivision.
- The Site was addressed through federal, state and municipal actions. The Louisiana Department of Environmental Quality continues to perform bi-annual inspections of the Site to ensure the integrity of the permeable cap is maintained and is intact. Findings are shared with the City and addressed as needed.
- EPA also conducts Five-Year Reviews to confirm human health and the environment continue to be protected. The fourth Five-Year Review Report was completed in September 2018 and determined that the Site remedy is protective.

REUSE SUITABILITY

To identify areas suitable for solar development, Skeo conducted a suitability analysis that evaluated the Site's remedy features, current land use, and property ownership status.

Site Remedy Features

The Site includes five operable units (OUs), which EPA defined in order to guide site remedial investigation and evaluate cleanup options. The OUs are generally defined by prior land use type and are a useful guide to understand existing conditions and characteristics across the Site.

- **OU1:** Includes the former landfill disposal area, which is a vacant open space area with grass vegetation. Cleanup activities at OU1 included waste removal, grading and placement of 12 inches of soil cover. Restrictions in place limit future development in the OU1 area; utility trenching and maintenance protocols are in place as described below.
- **OU2 and OU3:** Include residential and community center properties. EPA removed the top 24 inches of existing soil and waste material and backfilled the excavated areas with 24 inches of clean fill and vegetation. Playground equipment from the community center was removed to address contaminated areas and new equipment was installed. Central parts of OU2 are occupied residential single-family properties. Northern and eastern parts are vacant former multi-family housing properties.

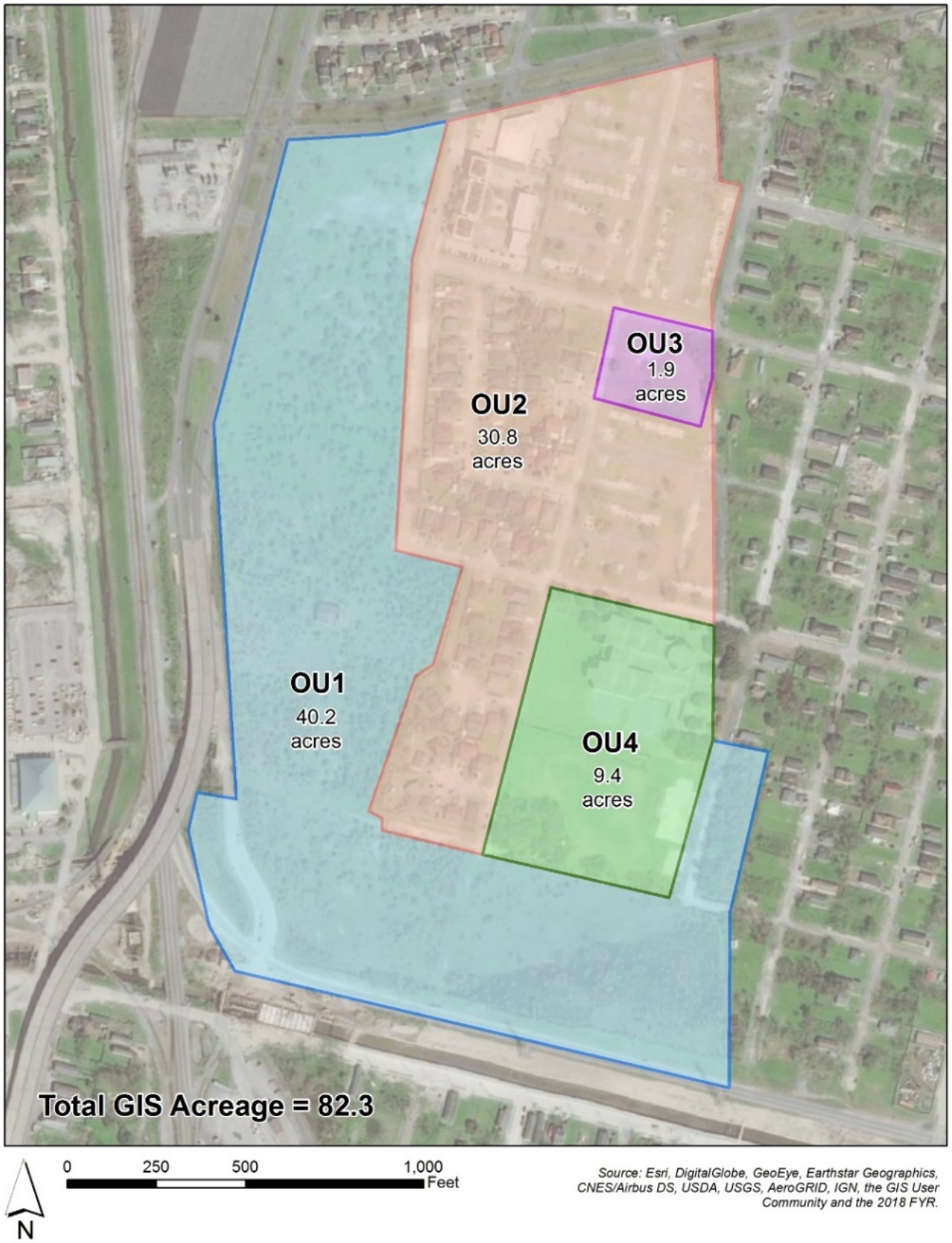

Figure 1. Site Operable Units.

- **OU4:** At the former Moton Elementary School and adjacent Magruder Park areas, EPA selected a remedy that determined no action was required, because there was no risk to human health or the environment. The southern part of OU4 includes vacant open space, which was formerly Magreur Park, and the northern part includes the unoccupied and deteriorating former Moton Elementary School.

OU1 Landfill Area Excavation Protocol (Per 2008 Consent Decree)

EPA's 2008 Consent Decree and Administrative Settlement includes specific provisions for utility excavation within the OU1 landfill area.

- The utility company shall notify the city of New Orleans that excavation below and penetration of the geotextile mat is necessary.
- Soils excavated within the top 2 feet of the excavation (above the geotextile) may be set aside and used as backfill in the same area.
- The geotextile is to be cut to provide access below the mat.
- Soil excavated from below the mat is considered to be landfill material. Each utility company is to determine, after consulting with a Certified Industrial Hygienist, the proper personal protective equipment required to accomplish the work.
- After completion of the work, the excavated soil (that from below the mat) may be placed back into the excavation as backfill (to an elevation not to exceed the elevation of the adjacent geotextile mat) or may be tested by the utility company and disposed of properly at a facility designated by the city of New Orleans.
- After completion of the backfill below the remedy area, the geotextile and marker is to be restored. The geotextile is to be patched by cutting a piece of new fabric so that there is an overlap of 3 feet on all sides. The fabric used as the patch shall be of the same quality and properties as the original fabric.
- The soils excavated from the top 2 feet shall be used as backfill above the geotextile mat.

Key Remedial Considerations:

- EPA's cleanup at the Site is protective of human health and the environment for current and anticipated future uses.
- The selected remedy and Consent Decree for OU1 require specific excavation protocols, which are closely aligned with common utility excavations and trenching work that would likely be needed to extend electrical connections to a solar PV system at the Site. OUs 2 and 3 also have excavation limitations below 2 feet. A majority of OU2 is privately-owned and currently in residential use. OU4 has few limitations regarding soil excavation or access.
- Based on site remedy and current uses, OU1, OU3 and OU4 could be suitable for siting a solar PV. Due to occupied housing on the western side of OU2, only northern and eastern vacant areas would be suitable for siting a solar PV system.

Property Ownership

Property ownership at the Site is significantly fragmented. Solar PV requires contiguous areas of land under single ownership or where agreements can be reached with landowners for the purchase or lease of land. Renewable energy development is generally not a short-term use; property associated with a PV system can be expected to remain in active solar reuse for 20 to 30 years. Current ownership status and reuse considerations are included below.

The Site includes large contiguous areas in its western and southern areas that are mostly owned by the City or the Orleans Parish School District. These areas are within site areas OU1 and OU4.

To the north and east, former HANO multi-family housing properties include hundreds of individual parcels under various ownership. After structures were damaged in 2005 and demolished, many of the properties were abandoned.

Key Ownership Considerations:

- OU1 and OU4 areas offer the largest number of publicly-owned properties that could be assembled into a contiguous area for solar development.
- The City owns the majority of OU1 property. OU1 includes several privately-owned properties in the central and southern area. The City Real Estate Division is conducting title searches and evaluating options to purchase three privately-owned properties within the former landfill area.
- OU4 includes property owned by Orleans Parish School District and the City. The City Real Estate Division has identified several parcels designated as City-owned property that require title work, including Parcels labeled 8 and 9 below.

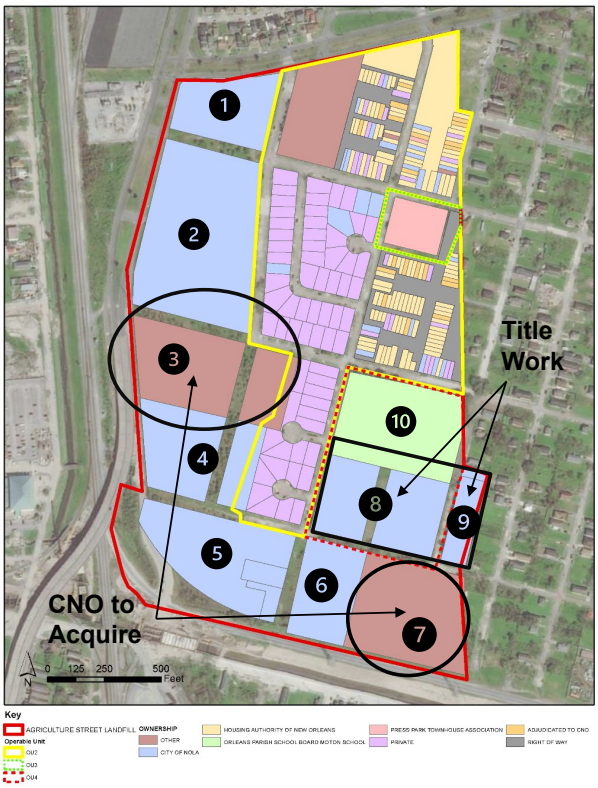

Figure 2. Property Ownership.

Map ID #	Address	Owner	Actions Needed	Other Considerations
1	2800 Higgins	City of New Orleans (CNO)		
2	2801 Abundance	CNO		
3	2800, 2850 Abundance	EASTERN VENTURES LLC	Title search, acquisition	Old Maintenance Shed (vacant)
4	2801, 2903 Industry	CNO		
5	2900 Industry			
	2722 Press			
	2941 Florida			
	3000 Industry			
6	3100 Industry	KM PERRE, LEGLUE & CO	Title search, acquisition	
7	7879 Abundance	CNO	Title work	
8	2900 Feliciana	CNO	Title work	Concrete slab foundations
9	3101 Industry	CNO	Title work	
10	3000 Abundance	Orleans Parish SB	Not part of solar footprint	Moton School Building (vacant)

Potential Solar Footprint

Based on the site remedy, land use and property ownership, an approximately 40-acre portion encompassing OU1 and part of OU4 offers a solar footprint that could accommodate a potential solar PV system.

Figure 3. Potential Solar Footprint and Electric Transmission Lines.

SOLAR FEASIBILITY

Feasibility Study Overview

The purpose of this screening is to evaluate the techno-economic viability of a stand-alone ground mount solar PV behind the meter (BTM) system at OU1 and part of the OU4 parcels of the Site under two financing scenarios: Direct Purchase and Third-party Ownership (or power purchase agreement (PPA) model). PV system size was estimated based on the potential solar footprint presented in the reuse suitability analysis. The following section presents the findings of this screening evaluation and should be treated as an initial step to prioritize and focus additional, in-depth analysis of potential renewable energy projects.

Analysis Assumptions

Total land area available for ground mount PV installation on OU1 and part of OU4: 40.8 acres (with 50 feet buffer).

Utility Rate: Sewerage and Water Board of New Orleans (SWBNO) provided the average of cost per kilo-watt hours (kWh). Based on SWBNO's feedback, the blended average energy rate of $0.0937 per kWh was used in the analysis. Rate structure is one of the most important parameters for the economic analysis. For the screening analysis, SWBNO utility rate charge is a constant. If this utility rate assumption changes, the overall project economics will change.

Electric Load: The electric load is the amount of energy used. This a key factor that determines the optimal size of a solar PV system that would be needed to offset current electricity costs. The SWBNO provided NREL with 2019 load data. The total annual 2019 load data for the SWBNO pumping station(s) evaluated was 40,680,252 kWh[1] of all the central control feeders.

Technical Assumptions:

For detailed technical and financial assumptions utilized in modeling, please see the Appendix, pages 22-32.

- Fixed Axis, ground mount ballasted system
- Panel tilt 30 degrees
- Azimuth:180 degrees (facing south)
- Installed Cost: $1.35/WDC[2] (cost assumes ballasted system adds 25% in site costs)
- Operations and Maintenance Cost: $16/kW[3]/year
- Solar Irradiance: 5.46 kWh/m^2/day[4]
- **PV System Sizing:** Given the available 40.8 acres of land area, the anticipated solar PV capacity is estimated at 6,400 kW or 6.4 MW[5].

Financing Scenarios

NREL modeled two financial scenarios for solar project ownership. The scenarios were developed as a PV screening analysis and should be treated as an initial step to help prioritize. Additional, in-depth analysis is warranted. Scenarios were evaluated under a baseline set of assumptions along with feedback from SWBNO in order to identify financial impacts represented as Net Present Value (NPV)[6] of the investment and Simple Payback Period (in years). In addition, NREL performed a parametric analysis that evaluated what would happen if the baseline assumptions changed. The parametric analysis is presented in a detailed table, which tests the sensitivity of different input parameters, such as Simple Payback Period and Power Purchase Agreement Price on the overall financial impact measured as Net Present Value. The scenarios presented under baseline assumptions are described below along with the results and key considerations from the parametric analysis.

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1 SWBNO provided 2019 load data for all central control feeders in the Gentilly Resilience District.
2 Watts measured as Direct Current
3 Kilowatt
4 Kilowatt hours per meter squared per day is a measure of the sun's power at a specific location.
5 1000 Kilowatts
6 Net Present Value is the value of all future cash flows (positive and negative) over the entire life of an investment discounted to the present.

Direct Purchase – One option is for the City or a related agency to own the solar PV system. Under this scenario, the City would fund the construction and operation and maintenance of the system, utilizing the power produced by the PV system to offset a portion of the load defined above. Neither loan costs nor interest were factored into the financing model for this scenario; it was assumed that the PV system would be purchased outright. The solar PV system would be City-owned, so it would not be eligible for any federal tax incentives.

Key Considerations for Direct Purchase Scenario

Under the direct purchase financing model, the PV system at the Site is economically favorable (NPV is positive) under a payback period of 20 years with the current set of assumptions, except if the installed cost goes above $1.7/WDC[7] or if the analysis period is reduced to 10 years.

Third-party Financing (or PPA) Scenario – Under this scenario, a solar developer and its investor partners would finance the construction, own the solar PV system, and pay for operation and maintenance. The developer and investor partners are eligible for several key tax incentives (bonus depreciation, Federal Investment Tax Credit [ITC]), and the benefits of these incentives can be passed to the City through a lower PPA price than current utility pricing.

Key Considerations for Third-Party Financing Scenario

Under baseline assumptions, the PPA financing scenario would be favorable for the City but results in a negative NPV for the developer. Detailed parametric analyses in the Appendix identify conditions that would be favorable (NPV positive) for both the developer and the City under a PPA financing mechanism. NPV is positive for both developer and the City under a PPA financing mechanism if the developer discount rate is 5% or lower, inflation rate is below 3% and rate of return for the developer is above 9%.

Feasibility Study Summary Table

Financing Mechanism	Annual Site Load (kWh)	PV System Size (kW)	% of load met by the PV system in year 1 on an annual basis	Net Present Value ($)	Simple Payback Period (years)
Direct Purchase	40,680,252	6,400	23%	$2,558,884	10
Financing Mechanism	**Annual Site Load (kWh)**	**PV System Size (kW)**	**PPA Price – Year 1 (cents/kWh)**	**Net Present Value ($) - Developer**	**Net Present Value ($) – Host (City)**
3rd Party (PPA)	40,680,252	6,400	8.76	-$86,793	$2,648,369

7 Watts measured in direct current.

CONCLUSIONS AND NEXT STEPS

The reuse suitability and solar feasibility sections above identify potential for a 40-acre potential solar footprint. A solar PV system of this size could generate 6.4 MW of electricity. Two potential financial scenarios were evaluated. Based on baseline assumptions, the City Owned/Direct Purchase Scenario offered a potential cost savings of approximately $2.5 million over a 20-year period. A Third-Party Purchase or PPA scenario has the potential to save the City costs and under certain conditions the PPA could also be a profitable investment for private-sector developers and investors. The project economics are likely to change if any of the assumptions are varied.

The information presented above and in the Appendix is intended to support the City and Sewer and Water Board of New Orleans in evaluating options for advancing reuse at the Agriculture Street Landfill site that also addresses key renewable energy development and climate resilience priorities for local stakeholders.

CONTACT INFORMATION

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EPA RE-Powering America's Land
https://www.epa.gov/re-powering

EPA Superfund Redevelopment Program
https://www.epa.gov/superfund-redevelopment

Disclaimer

- The analysis is based on projections, estimates or assumptions made on a best-effort basis, based upon expectations of current and future conditions at the time they were developed.
- The analysis was prepared with information available at the time the analysis was conducted. Analysis results could be different if new information becomes available and is incorporated.
- This analysis relies on site information provided to NREL that has not been independently validated by NREL.

APPENDIX:
Final Solar Reuse Suitability Assessment and Solar Feasibility Study Presentation

7/1/2021

Agriculture Street Landfill Site Solar Reuse Assessment

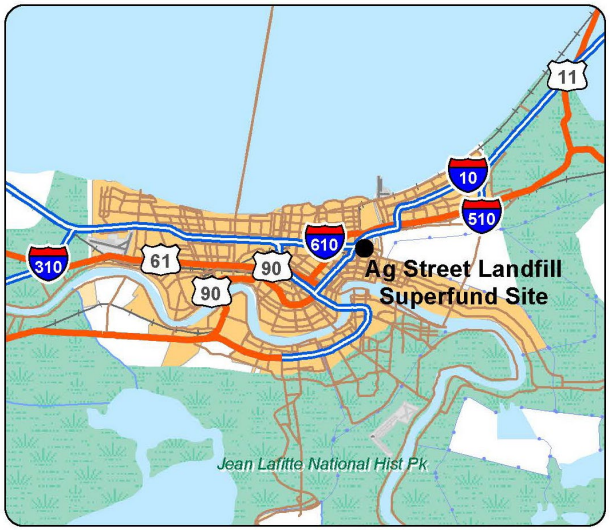
New Orleans, LA

Prepared for EPA Region 6,
and the City of New Orleans

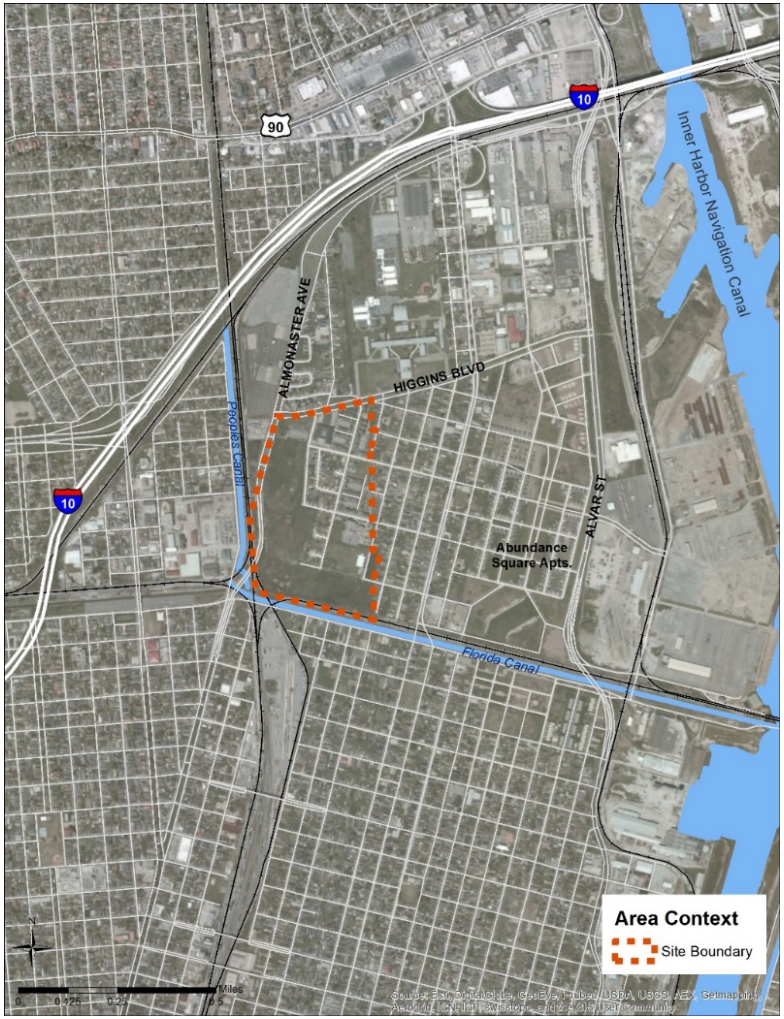
July 2021

Background and Site Context

Site Location



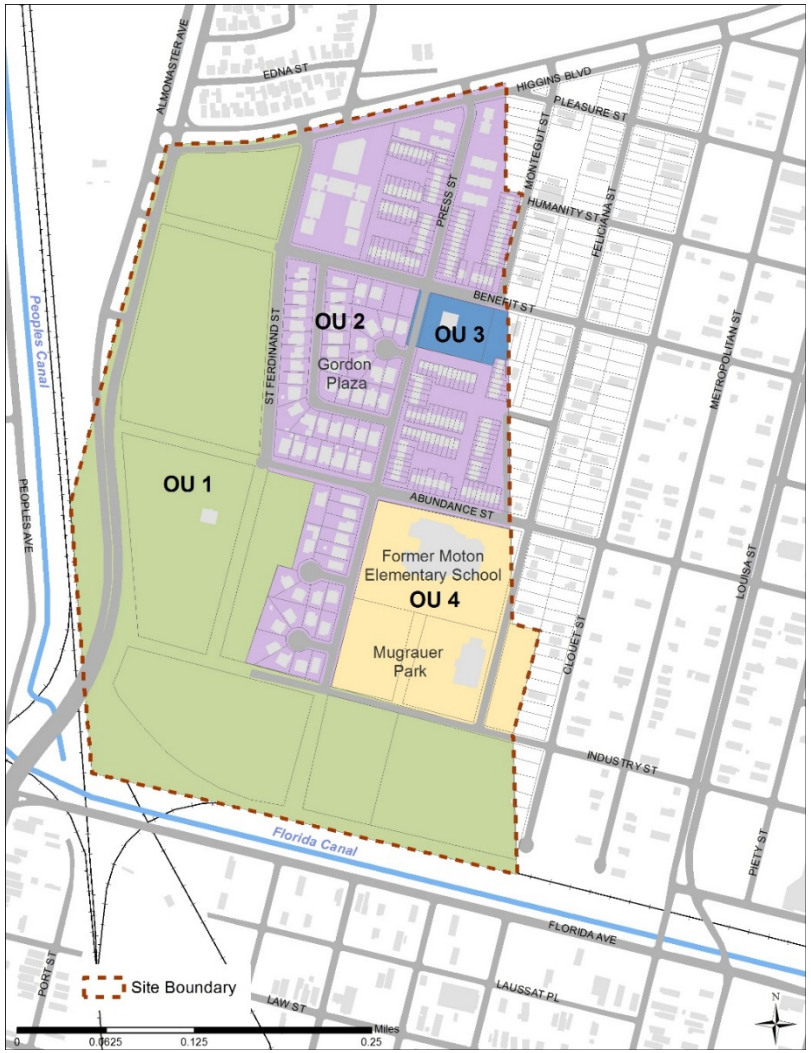
- The 95-acre site is located in eastern New Orleans.
- The site is bounded on the north by Higgins Boulevard, on the northwest by Almonaster Blvd., and on the south and west by the Southern Railroad rights-of-way.



Site Remedial History

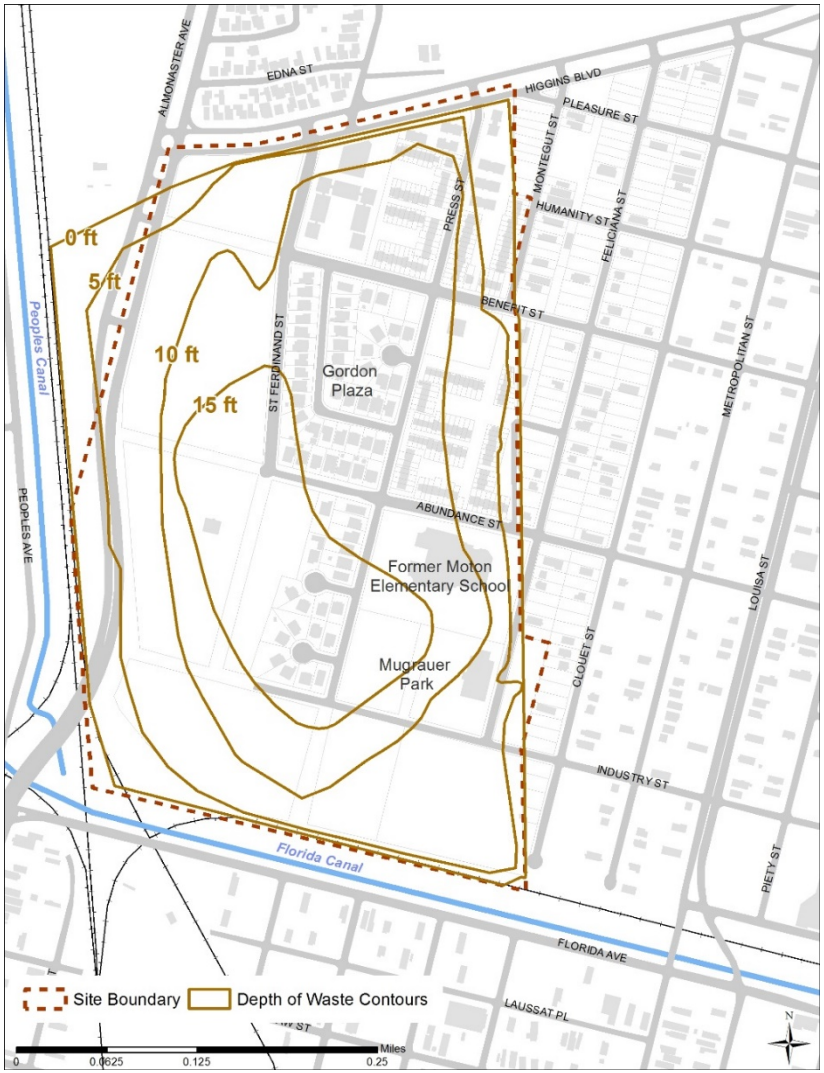
Date	Activity
1986	EPA completed a site investigation.
1993	EPA initiated an Expanded Site Investigation.
1994	Site listed on National Priorities List.
1997	Removal/Remedial Action - Removal and/or capping of contaminated soil for Operable Units 1, 2 and 3.
1997	Record of Decision Signed for OU4 and OU5. No action required due to lack of risk to human health.
2000	OUs 4 and 5 Deleted From the National Priorities List
2002	Record of Decision Signed for OU1, OU2 and OU3
2008	Consent Decree lodged with the court to protect the site remedy and specify site use and activity restrictions.

Remedy Components



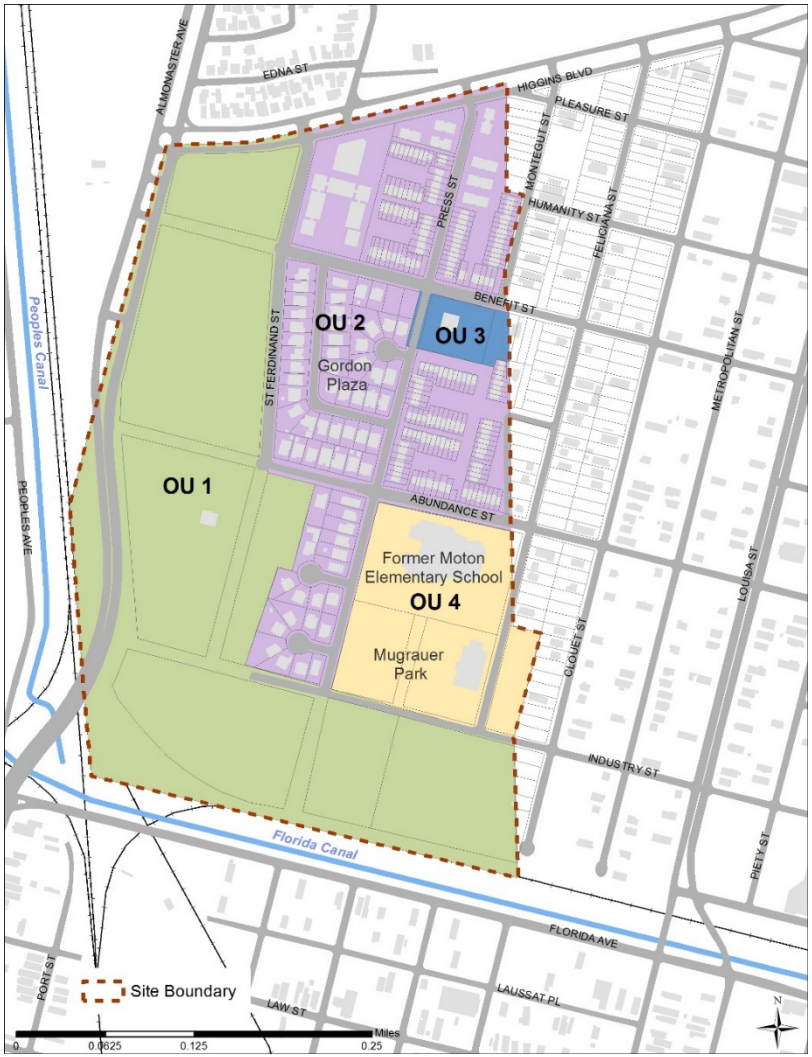
- **OU1:** Removal, grading and placement of 12 inches of soil.
- **OU2 and OU3**: Removal of top 24 inches of existing soil and waste material on the residential properties and community center, and backfilling the excavated areas with 24 inches of clean fill and vegetation.
- **OU3**: Playground equipment was removed to address contaminated area and new equipment was installed.
- **OU4 and OU5**: No action required because there was no risk to human health or the environment.

Depth of Waste



- Depth of waste ranges from 5 to 15 feet.
- Settlement may occur over time.

Remedy Considerations



- Any excavation below 2 feet or filter fabric marker will require coordination with the City to follow proper protocol (next slide).
- Future use plans should be coordinated closely with EPA Region 6 to ensure consistency with any use restrictions.

Excavation Protocol (Per 2008 Consent Decree)

1. The utility company shall notify the city of New Orleans that excavation below and penetration of the geotextile mat is necessary.
2. Soils excavated within the top two feet of the excavation (above the geotextile) may be set aside and used as backfill in the same area.
3. The geotextile is to be cut to provide access below the mat.
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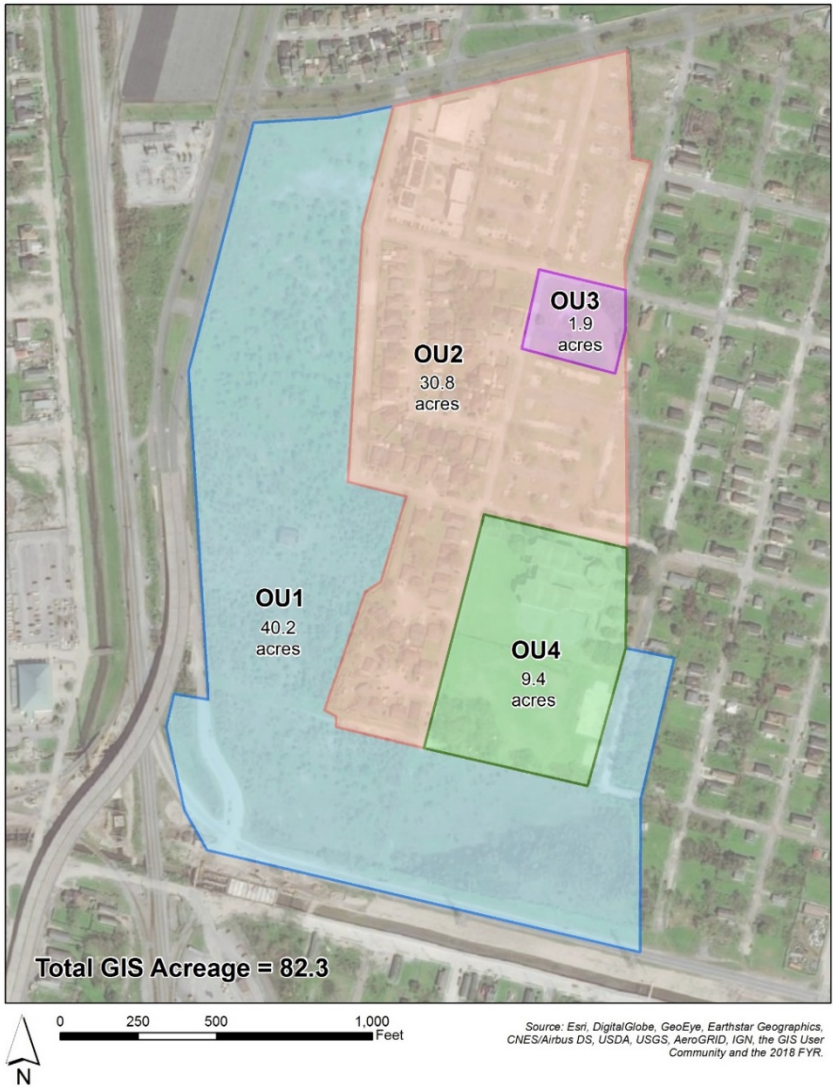
5. After completion of the work, the excavated soil (that from below the mat) may be placed back into the excavation as backfill (to an elevation not to exceed the elevation of the adjacent geotextile mat) or may be tested by the utility company and disposed of properly at a facility designated by the City of New Orleans.
6. After completion of the backfill below the remedy area, the geotextile and marker is to be restored. The geotextile is to be patched by cutting a piece of new fabric so that there is an overlap of 3 feet on all sides. The fabric used as the patch shall be of the same quality and properties as the origin fabric.
7. The soils excavated from the top two feet shall be used as backfill above the geotextile mat.

Site Acreage



Total site acreage estimated at ~82.3 acres

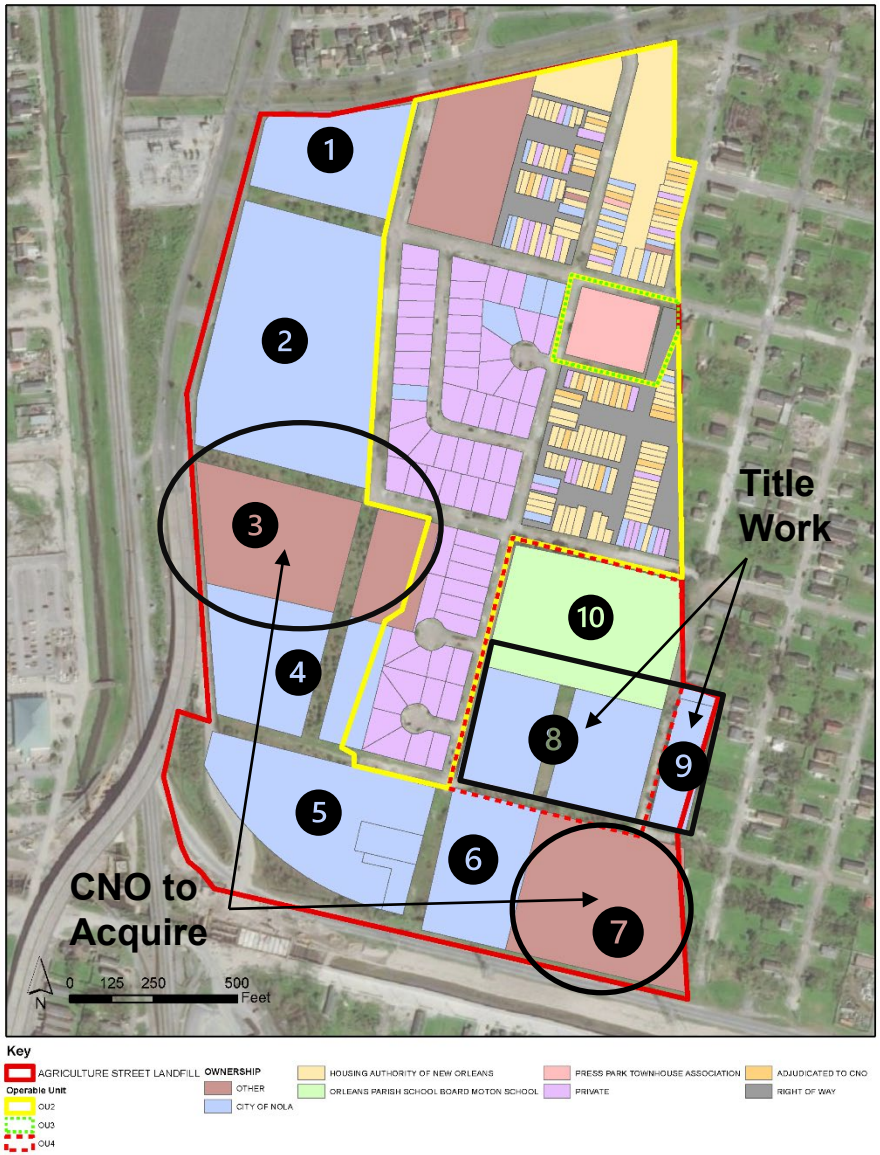
Projection: NAD 1983 State Plane Louisiana South FIPS 1702 Feet

Potential Solar Development Footprint

Available acreage estimated at

~40 acres (OU1 and part of OU4)

Site OUs and Property Ownership



Property Acquisition and Title Work

- 40-acre solar footprint requires some property assembly and title work.
- CNO conducting title search and planning to acquire parcels 3 and 7.
- CNO anticipates additional title work for parcels 8 and 9.

Land Control Considerations

Map ID #	Address	Owner	Actions Needed	Other Considerations
1	2800 Higgins	City of New Orleans (CNO)		
2	2801 Abundance	CNO		
3	2800, 2850 Abundance	EASTERN VENTURES LLC	Title search, acquisition	Old Maintenance Shed (vacant)
4	2801, 2903 Industry	CNO		
5	2900 Industry			
	2722 Press			
	2941 Florida			
	3000 Industry			
6	3100 Industry	KM PERRE, LEGLUE & CO	Title search, acquisition	
7	7879 Abundance	CNO	Title work	
8	2900 Feliciana	CNO	Title work	Concrete slab foundations
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10	3000 Abundance	Orleans Parish SB	Not part of solar footprint	Moton School Building (vacant)

Solar Photovoltaic (PV) Feasibility Analysis at Agricultural Street Landfill Superfund site

New Orleans, Louisiana

Gail Mosey
Jal Desai
July 2021

Disclaimer

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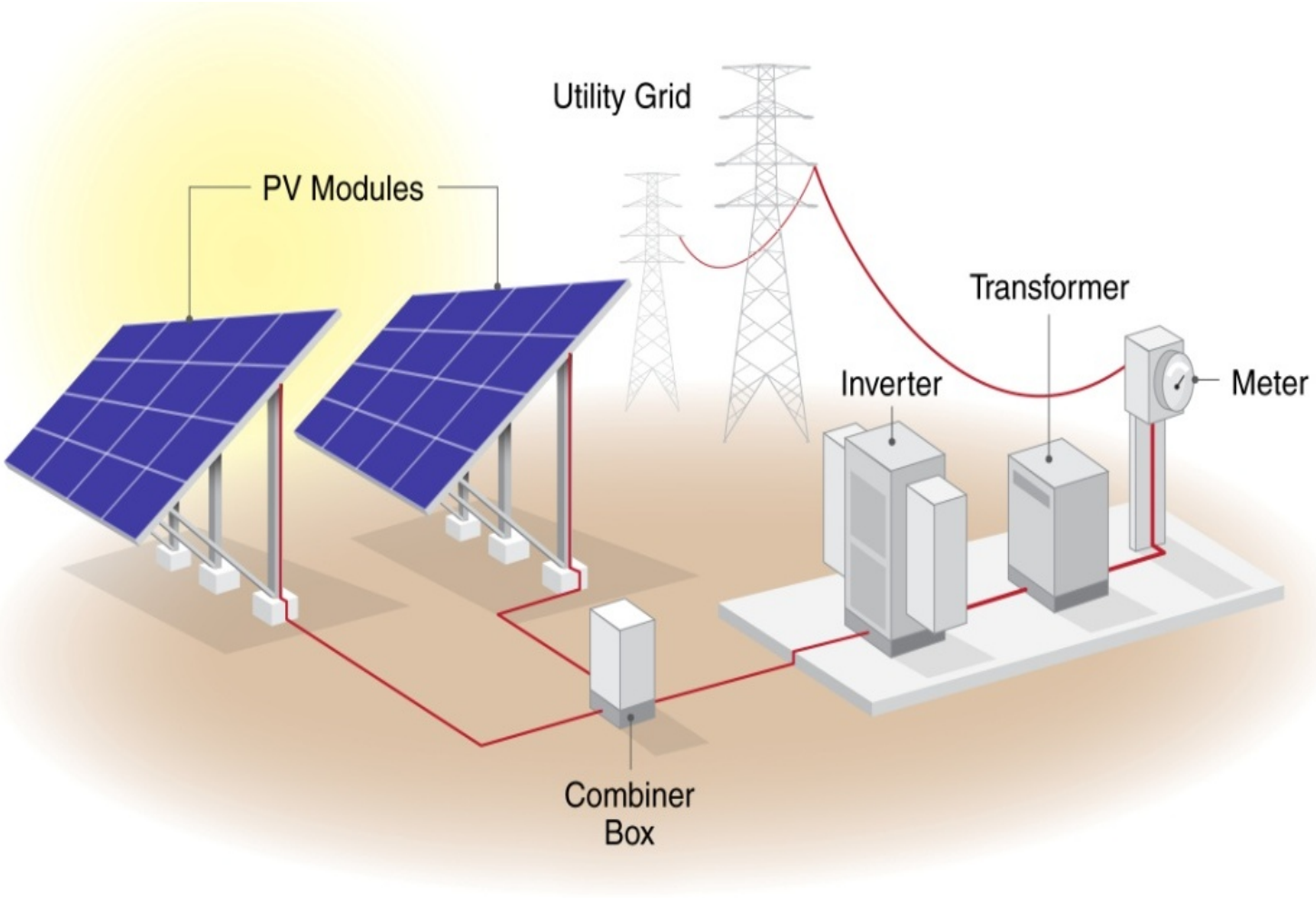
- The analysis is based on projections, estimates or assumptions made on a best-effort basis, based upon expectations of current and future conditions at the time they were developed.
- The analysis was prepared with information available at the time the analysis was conducted. Analysis results could be different if new information becomes available and is incorporated.
- This analysis relies on site information provided to NREL that has not been independently validated by NREL.

Contents

Study Overview

- This analysis was prepared in partnership with the Environmental Protection Agency (EPA) for the RE-Powering America's Land Initiative.
- The purpose of this screening is to evaluate the techno-economic viability of a stand-alone ground mount solar PV behind the meter (BTM) system at OU 1 and part of OU 4 parcel of Agriculture Street Landfill in New Orleans under two financing scenarios:
    - Direct Purchase
    - Third-party Ownership aka PPA model
- PV system size was estimated based on the assessment and site map provided with potential area marked by SKEO.
- Stand-alone PV system (without battery) was considered at this stage of the analysis.
- *This screening should be treated as an initial step to prioritize and focus additional, in-depth analysis of potential renewable energy projects.*

PV System Overview



Source: NREL

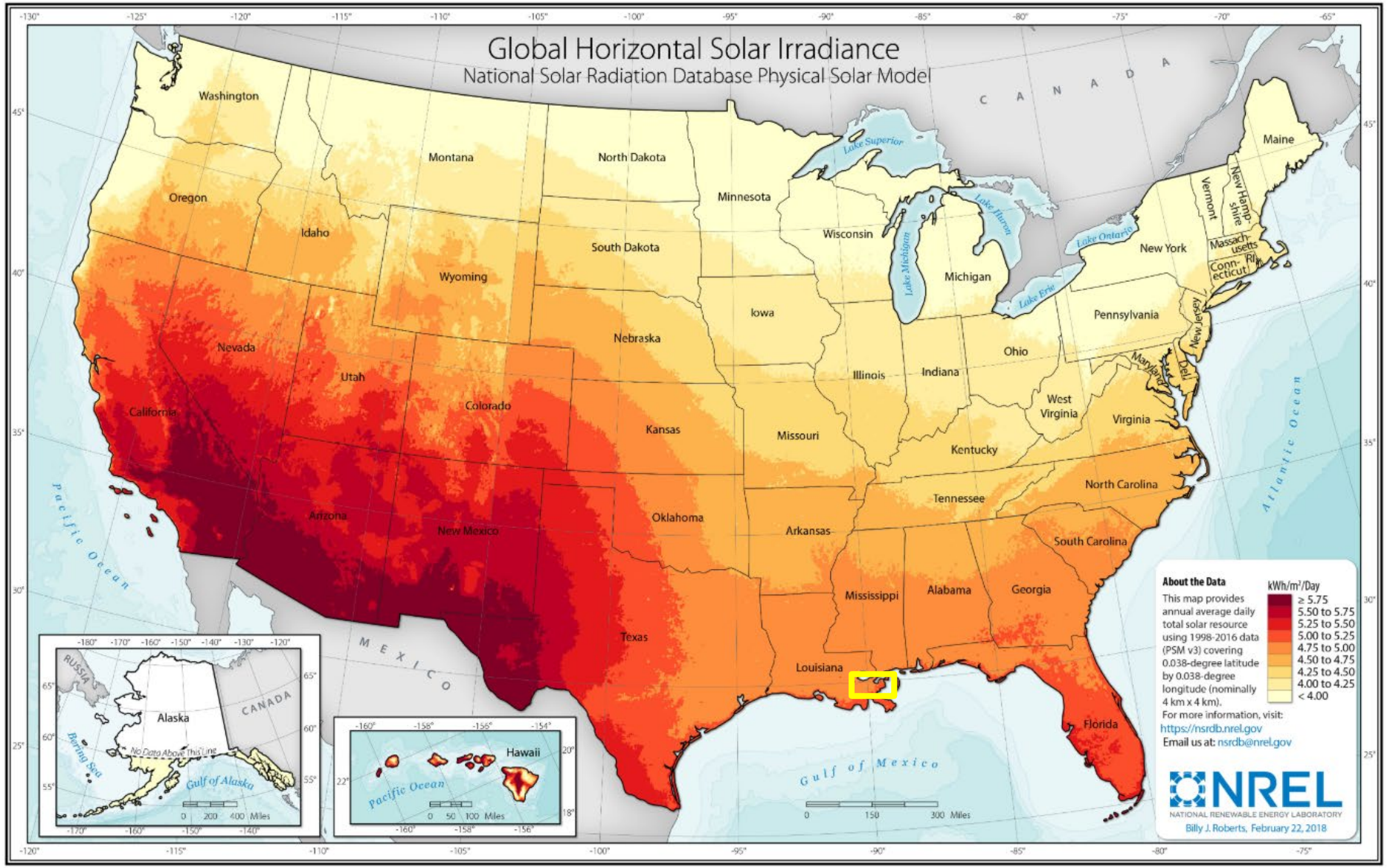
PV Resource

Month	Solar Radiation (kWh / m^2 / day)
January	4.52
February	5.00
March	5.65
April	6.09
May	6.19
June	5.73
July	5.68
August	5.53
September	5.72
October	5.86
November	5.25
December	4.30
Annual	5.46

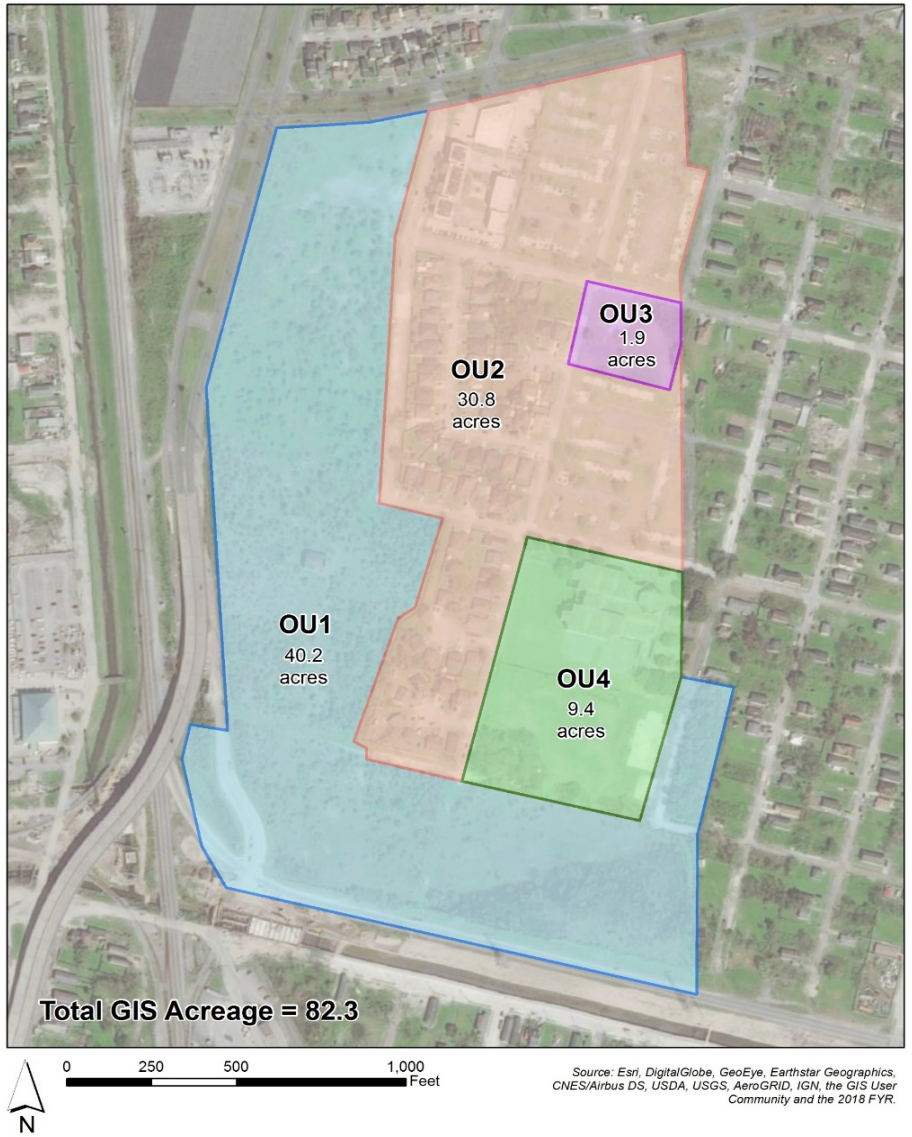
Source: PV Watts

- Average annual solar radiation at this site is 5.46 kWh/m^2/day.

Solar Irradiance Map



Agriculture Street Landfill Total Site Acreage

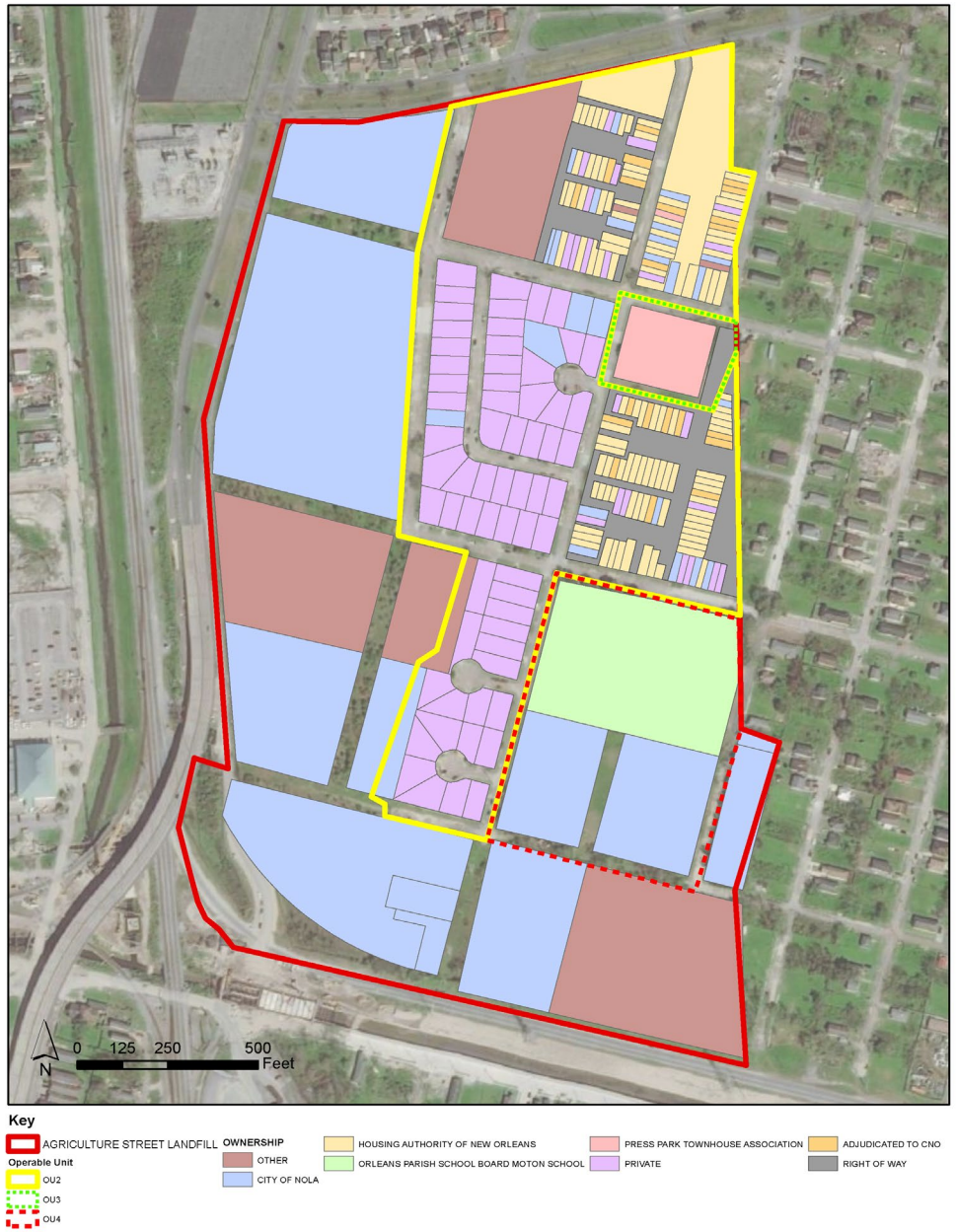


- Total site acreage estimated (OU 1, OU 2, OU 3, OU 4) at ~82.3 acres.

- *The focus of this analysis is siting solar PV on OU 1 and part of OU 4 land parcel.*

Projection: NAD 1983 State Plane Louisiana South FIPS 1702 Feet

Site OUs and Property Ownership



- OU1 and part of OU4 offer viable parcel configurations for solar PV installation.

Site Map

Total land area available for ground mount PV installation on OU 1 and part of OU 4 parcel:

- **40.8 acres** (with 50 feet boundary)

Utility Rate

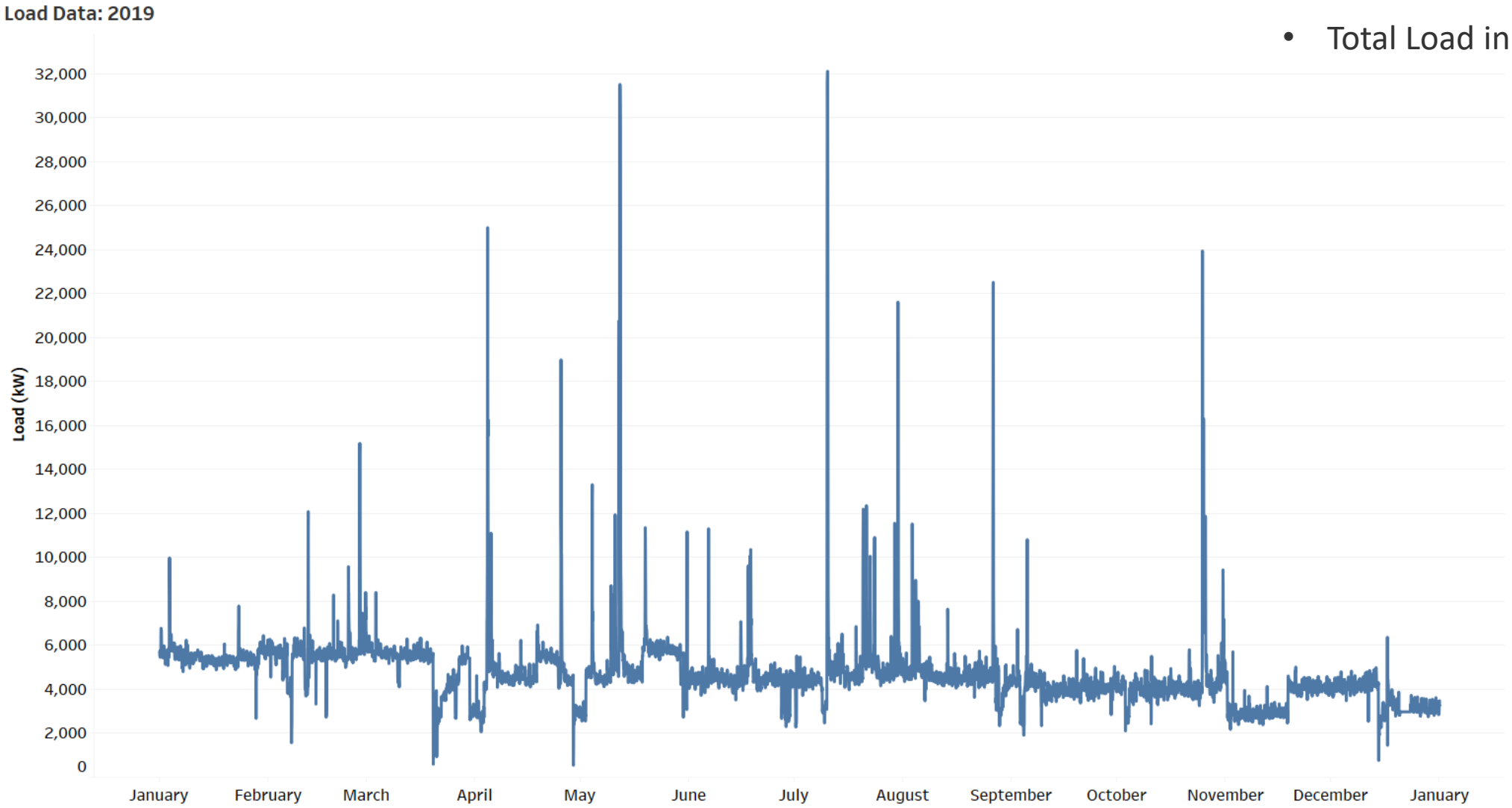
- Sewerage and Water Board of New Orleans (SWBNO) provided the below spreadsheet of average of cost per kilo-watt hours (kWh). **Based on SWBNO's feedback, the blended average energy rate was used in the analysis. Rate structure is one of the most important parameters for the economic analysis.**

YEAR	ELECTRIC POWER PURCHASED		
	KW-HRS	Cost / KWH	$ AMOUNT
2007	68,574,205	$ 0.1061	$ 7,278,339
2008	62,579,355	$ 0.1127	$ 7,051,655
2009	67,889,778	$ 0.0946	$ 6,422,589
2010	70,609,461	$ 0.0942	$ 6,653,752
2011	70,049,094	$ 0.0882	$ 6,180,373
2012	63,873,900	$ 0.0930	$ 5,941,992
2013	67,980,940	$ 0.0989	$ 6,725,811
2014	68,632,618	$ 0.1028	$ 7,052,078
2015	73,123,062	$ 0.0911	$ 6,660,862
2016	69,736,118	$ 0.1015	$ 7,081,051
TOTALS	1,066,010,245	$ 0.0939	$ 100,120,572
AVERAGE	66,625,640	$ 0.0937	$ 6,257,536

Site	
Utility	Entergy
Blended Average Rate ($/kWh)	$0.0937 per kWh

Results might change if detailed rate schedule is modeled rather than using blended energy rate.

Load Data



- Total Load in 2019: 40,680,252 kWh

Note: There were a few data gaps in the load data provided. The gaps were filled with the data from the preceding timestamp.

Financing Scenarios and Incentives

Financing scenario:

1. Direct purchase ,no loan, no interest:
    - City-owned
    - Not eligible for any federal ITC and Modified Accelerated Cost-Recovery System (MACRS)
2. Third-party financing (aka PPA)
    - Developer and its investor partners are eligible for tax incentives (bonus depreciation, Federal Investment Tax Credit [ITC]), and the benefits of these incentives can be passed to the city through a lower Power Purchase Agreement (PPA) price.
    - Developer requires a rate of return assumed to be 9% [PV Project Finance in the United States (NREL, 2016), a report that benchmarks solar financing costs]

Incentives:

- Federal Investment Tax Credit: 26% of the installed cost of PV available to tax-paying entities in 2021. Table below shows the ITC % for the various solar technologies for current and future years

TECHNOLOGY	12/31/20	12/31/21*	12/31/22	12/31/23
PV, Solar Water Heating, Solar Space Heating/Cooling, Solar Process Heat	26%	26%	26%	22%

* Extended because of COVID-19

- Modified Accelerated Cost-Recovery System (MACRS): Ability to recover investments in solar PV systems through depreciation deductions; assume 5-year schedule and 100% bonus depreciation

Policies and Incentives

- **Interconnection Limit*:** 300 kW for commercial customers. **[SWBNO confirmed that this limit is not applicable to the city under their agreement].**

  https://programs.dsireusa.org/system/program/detail/1083/interconnection-guidelines

  * **Additional Resource:** https://www.epa.gov/re-powering/interconnection-plugging-re-powering-sites-electric-grid

- **Net Metering:**
  - Net Metering is available to residential generation facilities up to 25 kilowatts and commercial generation facilities up to 300 kilowatts who do not have any other generator connected to the grid.
  - In New Orleans Net Metering, the kilowatt-hours produced by the customer and sent to the grid offset the kilowatt-hours sold to the customer in that month. If the customer sends more kilowatt-hours to the grid than used, the Customer pays the minimum bill amount, and the excess is credited toward the next month. Any kilowatt-hours credit left over when the customer discontinues service will be paid at avoided cost.

  https://www.entergy-neworleans.com/net_metering/

Technical Assumptions

Item	Assumption
Technology	Ground mount (ballasted) PV; fixed; standard (crystalline silicon) PV modules
Panel Tilt	30 degrees
Azimuth	180 degrees (ideal)
Degradation Rate	0.5%
Total Installed Cost	1.35 $/Wdc (includes 25% because of ballasted system)
Operations and Maintenance Cost	$16/kW-year
Weather Data	5.46 kWh/m^2/day
Total System Losses	14.08%

Financial Assumptions: Direct Purchase

Item	Assumption
Debt Percentage	0% *
Loan %	0%/yr.*
Analysis Period	25 years
Inflation	3%
Federal Income Tax Rate	0%
State Income Tax Rate	0%
Sales Tax	0%
Property Tax	0%
Real Discount Rate (Host)	3.75%
Federal ITC	0%
MACRS	No
Electricity Escalation Rate (Nominal)	2.72% annually

*Assumes that the city will buy the PV system outright under this financing scenario.

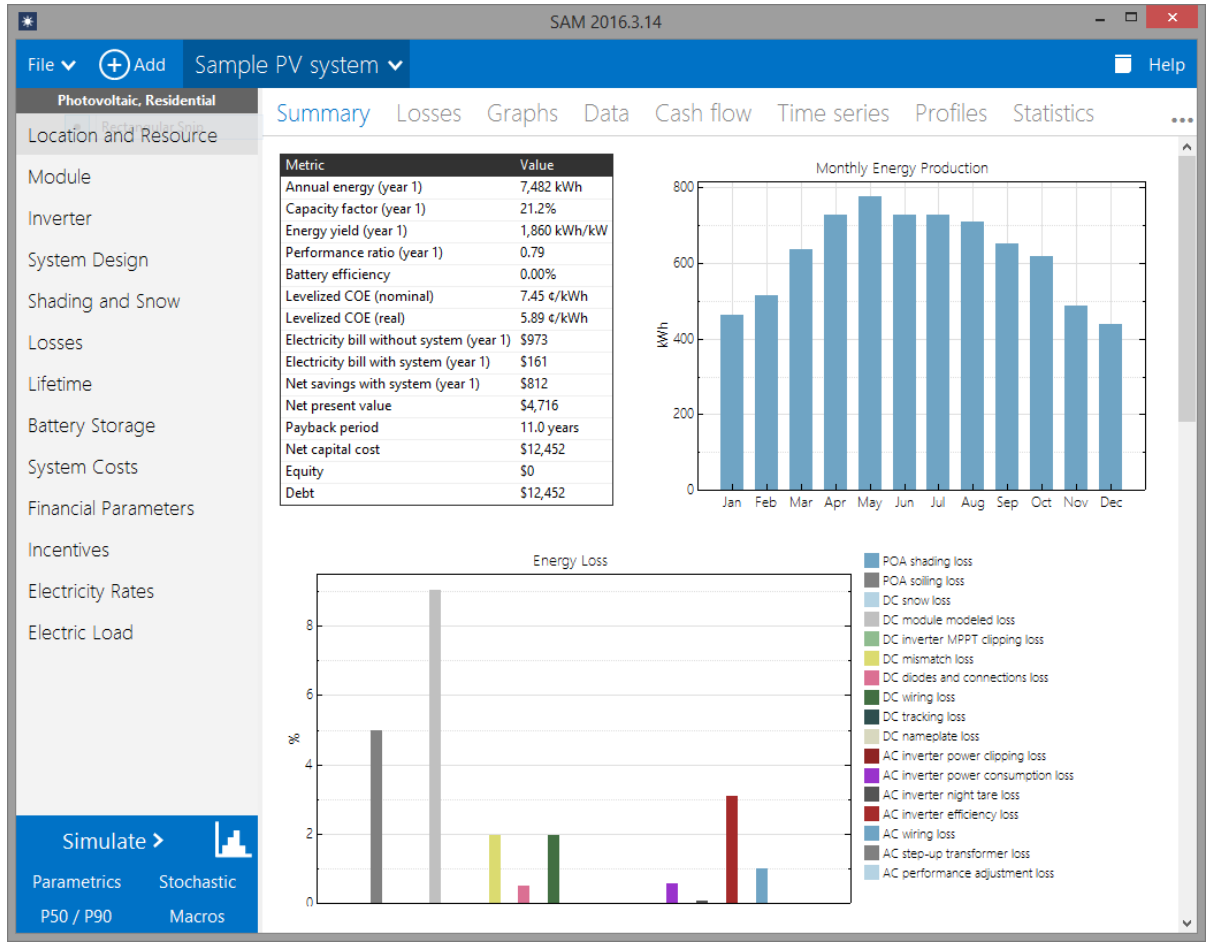
Financial Assumptions: 3rd Party (PPA)

Item	Assumption
IRR Target	9%
IRR Target Year	25
Analysis Period	25 years
Inflation	3%
Federal Income Tax Rate	21%/yr.
State Income Tax Rate	6%
Sales Tax	4.45%
Real Discount Rate (Developer)	6%
Real Discount Rate (Host)	3.75%
Federal ITC	26%
MACRS	Yes
PPA Escalation Rate	1% annually

System Advisor Model (SAM) Analysis

SAM

Free software that combines detailed performance and financial models to estimate the cost of energy for systems.



http://sam.nrel.gov/download

Technologies

- Photovoltaics, detailed & PVWatts
- Battery storage
- Concentrating solar power
- Wind
- Geothermal
- Biomass
- Solar water heating.

Financials

- Behind-the-meter
- Residential
- Commercial
- PPAs
- Single owner
- Equity flips
- Sale-leaseback
- Simple levelized cost of energy (LCOE) calculator.

SAM Assumptions

Generally, PV requires 5-7 contiguous acres/MW for the entire site footprint, depending on the type of PV system. Because we have the total land area, we would use **7.6 acres/MWac** for analysis purposes for a fixed system.

Table ES-1. Summary of Land-Use Requirements for PV and CSP Projects in the United States

Technology	Direct Area		Total Area	
	Capacity-weighted average land use (acres/MWac)	Generation-weighted average land use (acres/GWh/yr)	Capacity-weighted average land use (acres/MWac)	Generation-weighted average land use (acres/GWh/yr)
Small PV (>1 MW, <20 MW)	5.9	3.1	8.3	4.1
Fixed	5.5	3.2	7.6	4.4
1-axis	6.3	2.9	8.7	3.8
2-axis flat panel	9.4	4.1	13	5.5
2-axis CPV	6.9	2.3	9.1	3.1
Large PV (>20 MW)	7.2	3.1	7.9	3.4
Fixed	5.8	2.8	7.5	3.7
1-axis	9.0	3.5	8.3	3.3
2-axis CPV	6.1	2.0	8.1	2.8
CSP	7.7	2.7	10	3.5
Parabolic trough	6.2	2.5	9.5	3.9
Tower	8.9	2.8	10	3.2
Dish Stirling	2.8	1.5	10	5.3
Linear Fresnel	2.0	1.7	4.7	4.0

Ong et al. 2013 https://www.nrel.gov/docs/fy13osti/56290.pdf

Example of total vs. direct land use in a ground-mount PV system

In addition to the area covered by the PV array, additional land area is required for setbacks, access roads, fencing, and a possible substation.

SAM Results

SAM Results: Direct Purchase

- Under direct purchase scenario, city would own, operate, and maintain the PV system.
- The solar PV system is city owned, so it is ineligible for any federal tax incentives.
- The solar PV system was sized taking maximum available area into consideration.

Parameters	Results
Installation type	Ground mount
PV System Size (kW)	6,400
PV System Annual Energy Production Year 1 (kWh)	9,465,258
Site Load* (kWh)	40,680,252
% of Load met by PV (on an annual basis) in year 1	23%
Energy exported to the Grid (kWh)	0
LCOE Nominal (Cents/kWh)	9.57
Net Capital Cost of Constructing PV system ($)	$8,640,000
Net Present Value ($)	$2,558,884
Simple Payback (years)	10 yrs.

* All the Central Control Feeders

Direct Purchase: Parametric Analysis

Variables	Inputs Varied						Output	
	PV Installed Cost ($/Wdc)	Real Discount Rate (%)	Inflation Rate(%)	Analysis Period (yrs.)	Nominal Electricity Escalation Rate (%)	Nominal Loan Rate %	NPV ($)	Simple Payback Period (yr.)
PV Installed Cost	1.70	3.75%	3%	25	2.72%	0%	318,884	12.30
PV Installed Cost	1.75	3.75%	3%	25	2.72%	0%	-1,116	12.61
PV Installed Cost	2.5	3.75%	3%	25	2.72%	0%	-4,801,120	17.15
PV Installed Cost	3.5	3.75%	3%	25	2.72%	0%	-11,201,100	22.60
PV Installed Cost	4	3.75%	3%	25	2.72%	0%	-14,401,100	>25 yrs
PV Installed Cost	4.5	3.75%	3%	25	2.72%	0%	-17,601,100	>25 yrs.
Discount Rate	1.35	2%	3%	25	2.72%	0%	4,885,520	10.01
Discount Rate	1.35	4%	3%	25	2.72%	0%	2,276,350	10.01
Discount Rate	1.35	5%	3%	25	2.72%	0%	1,248,940	10.01
Discount Rate	1.35	6%	3%	25	2.72%	0%	364,750	10.01
Inflation Rate	1.35	3.75%	0.5%	25	2.72%	0%	2,828,820	11.23
Inflation Rate	1.35	3.75%	1%	25	2.72%	0%	2,773,790	10.95
Inflation Rate	1.35	3.75%	2.5%	25	2.72%	0%	2,611,850	10.22
Inflation Rate	1.35	3.75%	4%	25	2.72%	0%	2,454,430	9.61
Analysis Period	1.35	3.75%	3%	10	2.72%	0%	-2,608,970	>25 yrs.
Analysis Period	1.35	3.75%	3%	20	2.72%	0%	1,211,920	10.01
Analysis Period	1.35	3.75%	3%	30	2.72%	0%	3,630,150	10.01
Electricity Escalation Rate	1.35	3.75%	3%	25	3%	0%	2,904,670	9.88
Electricity Escalation Rate	1.35	3.75%	3%	25	4%	0%	4,252,050	9.45
Electricity Escalation Rate	1.35	3.75%	3%	25	5%	0%	5,796,770	9.09
Nominal Loan Rate*	1.35	3.75%	3%	25	2.72%	3%	5,344,431	10.01
Nominal Loan Rate*	1.35	3.75%	3%	25	2.72%	5%	3,965,530	10.01

* Debt percentage is 100% and loan term is 25 years (same as analysis period).

SAM Results: Power Purchase Agreement (PPA)

- First year PPA price is less than what the site is currently paying for electricity
- Economics are favorable for the host (city).
- Year 1 PPA price is 8.86 cents and NPV is positive for the host (city) and negative for the developer which means the developer will lose money on this project even though it is favorable to the host which is the city in this case based on the assumptions used in this analysis

Metrics	Result
Installation type	Ground mount
Solar PV Size (kW)	6,400
PV System Annual Energy Production Year 1 (kWh)	9,465,258
Load data (kWh)	40,680,252
PPA Price (cents/kWh) Year 1	8.76
Net Present Value ($): Developer	-$86,793
Net Present Value ($) : Host (City)	$2,648,369

Parametric Analysis for PPA Purchase

Variables	Inputs Varied									Output		
	PV Installed Cost ($/Wdc)	Developer Real Discount Rate (%)	Inflation Rate(%)	IRR Target (%)	PPA Escalation (%)	PPA Tenure (yrs.)	Host Discount Rate (%)	ITC (%)	O&M ($/kW)	PPA Price (cents/kWh) Year 1	Developer's NPV	Host's (City) NPV
PV Installed Cost	1.70	6%	3%	9%	1%	25	3.75%	26%	16	10.68	-109,742	403,329
PV Installed Cost	1.75	6%	3%	9%	1%	25	3.75%	26%	16	10.95	-113,020	82,609
PV Installed Cost	2.5	6%	3%	9%	1%	25	3.75%	26%	16	15.08	-162,196	-4,728,190
PV Installed Cost	3.5	6%	3%	9%	1%	25	3.75%	26%	16	20.58	-227,764	-11,142,600
PV Installed Cost	4.5	6%	3%	9%	1%	25	3.75%	26%	16	26.08	-293,332	-17,557,000
Developer Discount Rate	1.35	5%	3%	9%	1%	25	3.75%	26%	16	8.76	**437,103**	**2,648,370**
Developer Discount Rate	1.35	7%	3%	9%	1%	25	3.75%	26%	16	8.76	-548,798	2,648,370
Developer Discount Rate	1.35	8%	3%	9%	1%	25	3.75%	26%	16	8.76	-958,442	2,648,370
O&M Cost	1.35	6%	3%	9%	1%	25	3.75%	26%	25	9.51	-85,823	1,771,400
O&M Cost	1.35	6%	3%	9%	1%	25	3.75%	26%	35	10.34	-84,746	796,986
Inflation Rate	1.35	6%	1%	9%	1%	25	3.75%	26%	16	8.55	**1,091,640**	**888,516**
Inflation Rate	1.35	6%	1.5%	9%	1%	25	3.75%	26%	16	8.59	**762,547**	**1,392,580**
Inflation Rate	1.35	6%	4%	9%	1%	25	3.75%	26%	16	8.86	-555,608	3,307,000
Internal Rate of Return	1.35	6%	3%	8%	1%	25	3.75%	26%	16	8.09	-556,596	3,423,050
Internal Rate of Return	1.35	6%	3%	10%	1%	25	3.75%	26%	16	9.45	**403,641**	**1,839,670**
Internal Rate of Return	1.35	6%	3%	11%	1%	25	3.75%	26%	16	10.17	**913,402**	**999,096**
Internal Rate of Return	1.35	6%	3%	12%	1%	25	3.75%	26%	16	10.91	**1,441,190**	**128,802**
PPA Escalation Rate	1.35	6%	3%	9%	0%	25	3.75%	26%	16	9.46	-82,554	2,736,010
PPA Escalation Rate	1.35	6%	3%	9%	2%	25	3.75%	26%	16	8.07	-91,181	2,557,230
PPA Tenure	1.35	6%	3%	9%	1%	10	3.75%	26%	16	12.83	-51,752	-1,889,594
PPA Tenure	1.35	6%	3%	9%	1%	20	3.75%	26%	16	9.33	-77,770	1,480,830
PPA Tenure	1.35	6%	3%	9%	1%	30	3.75%	26%	16	8.44	-93,709	3,575,757
Host Discount Rate	1.35	6%	3%	9%	1%	25	2%	26%	16	8.75	-86,793	3,381,550
Host Discount Rate	1.35	6%	3%	9%	1%	25	5%	26%	16	8.75	-86,793	2,247,600
ITC	1.35	6%	3%	9%	1%	25	3.75%	10%	16	10.17	-100,423	999,973

Key Considerations

Summary

Financing Mechanism	Annual Site Load (kWh)	PV System Size (kW)	% of load met by the PV system in year 1 on an annual basis	Net Present Value ($)	Simple Payback Period (years)
Direct Purchase	40,680,252	6,400	23%	$2,558,884	10

Financing Mechanism	Annual Site Load (kWh)	PV System Size (kW)	PPA Price – Year 1 (cents/kWh)	Net Present Value ($) - Developer	Net Present Value ($) – Host (City)
3rd Party (PPA)	40,680,252	6,400	8.76	-$86,793	$2,648,369

- Net metering and Interconnection should be taken into consideration when sizing and siting a PV system. Closely work with Entergy utility to find out best approach to install solar PV at this site.
- This screening should be treated as an initial step to prioritize. Additional, in-depth analysis would be required.
- Under the direct purchase financing model, the PV system at Agriculture Street Landfill is economically favorable (NPV is positive) with the current set of assumptions except if the installed cost goes above $1.7/Wdc or if the analysis period is reduced to 10 years.
- This project at Agriculture Street Landfill Superfund site is favorable (NPV positive) of both; developer and host under PPA financing mechanism if the developer discount rate is 5 % or lower; inflation rate is below 3%, or rate of return for the developer is above 9%

Thank you!

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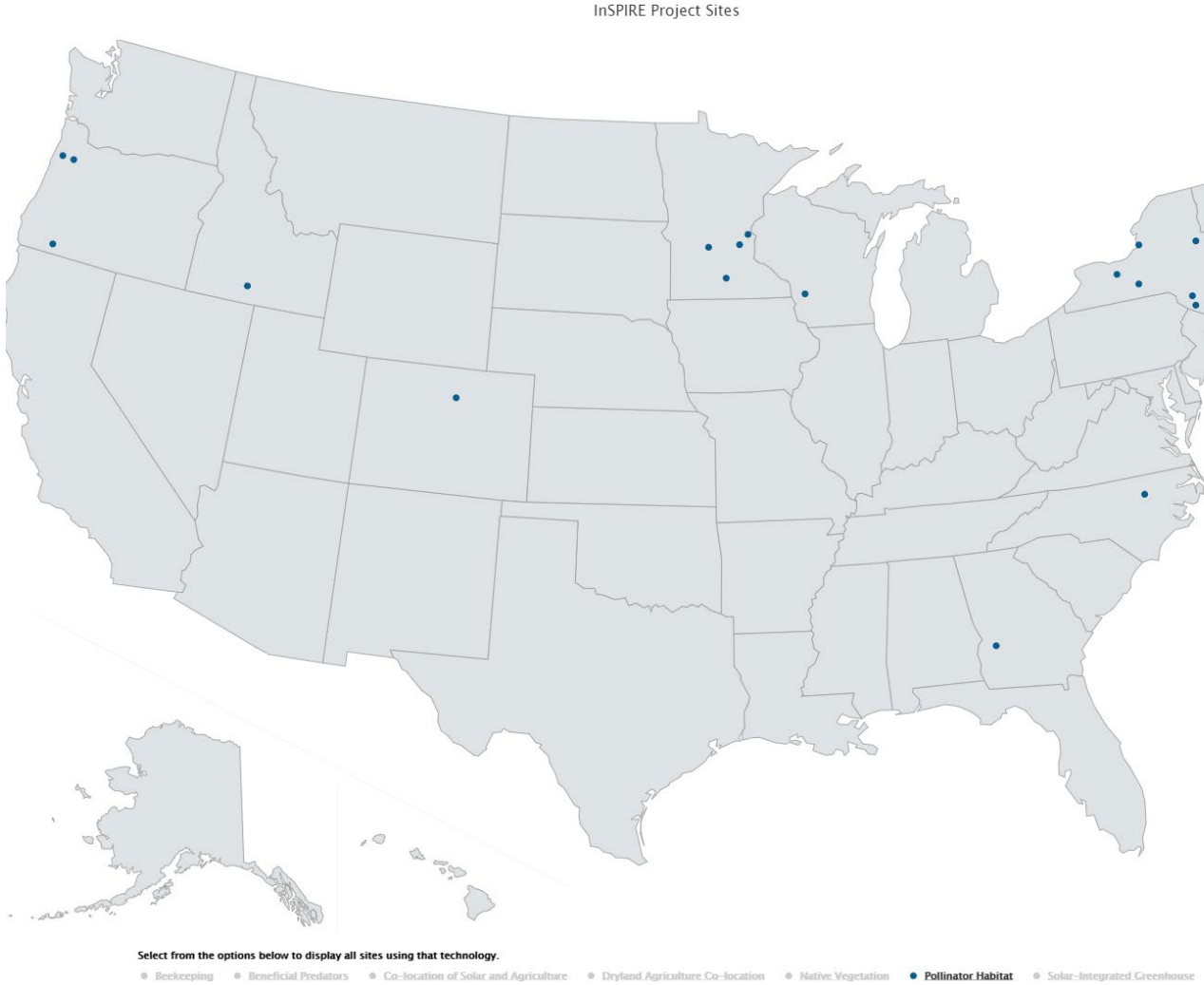
NREL/PR-7A40-78636, December 2020.

Appendix

Low-Impact Solar Development



Pollinator Habitat Sites

- By 2030, **utility-scale solar installations could cover almost 2 million acres** of land in the United States. Traditional solar development would monopolize this land for just one use: energy production

- Low-impact solar development, on the other hand, might also **improve soil health, retain water, nurture native species, produce food, and provide even lower-cost energy** to local communities

- Additional Resources:
  - https://www.nrel.gov/docs/fy19osti/73696.pdf
  - https://www.nrel.gov/docs/fy18osti/71901.pdf
  - https://pubs.acs.org/doi/pdf/10.1021/acs.est.8b00020

Source:
https://www.nrel.gov/news/features/2019/beneath-solar-panels-the-seeds-of-opportunity-sprout.html

Next Steps

- July 2 - Final reuse assessment/feasibility study slide deck presented to CNO.
- July 31 - Final summary report delivered to CNO.