

**Climate Pollution Reduction Grants – Implementation Grants**  
**City of Concord Climate Pollution Reduction Solar Project**  
**Climate Pollution Reduction Grant Work Plan**

Applicant:

City of Concord, California

Funding Opportunity Title:

Climate Pollution Reduction Grants Program: Implementation Grants (General Competition)

Funding Opportunity Number:

EPA-R-OAR-CPRGI-23-07

CFDA Number(s):

66.046 -- Climate Pollution Reduction Grants

Workspace ID:

WS01272142

Grant Package Number:

PKG00283194

## **1. OVERALL PROJECT SUMMARY AND APPROACH**

*Recognizing the importance and urgency to address greenhouse gas (“GHG”) impacts locally, the City of Concord (“the City”) intends to install renewable solar energy at four municipal facilities in the building decarbonization efforts reducing its overall carbon footprint. The City’s Climate Pollution Reduction Solar Project’s (the “Project”) installation of renewable solar energy is in alignment with the San Francisco Bay Regional Climate Action Planning Initiative, part of the Bay Area region’s Priority Climate Action Plan (“PCAP”) by the San Francisco Bay Area Air Quality Management District (“BAAQMD”), to prioritize GHG reduction measures. The Project includes solar panel installation at the Public Works Corporation Yard at 1455 Gasoline Alley (1MW), the Senior Citizens Center at 2727 Parkside Circle (1MW), the Concord Police Complex at 1350 Galindo Street (1MW), and the Civic Center Complex at 1950 Parkside Drive (1MW) respectively.*

*These solar array installations will be equipped with solar photovoltaic carports or rooftops and large battery systems to increase their energy resiliency and bolster their capacity to operate during utility grid power outages. The independency from the utility grid will allow the city and its operating departments increased capacity and readiness responding to service calls and to better serving its citizens especially the disadvantaged and vulnerable population during emergencies.*

*Three of the four facilities also provide public access to electric vehicle (“EV”) charging stations. The project accelerates decarbonization efforts across three major sectors responsible for GHG emissions including electric power generation, transportation, and commercial buildings.*

*Together, these systems offset an estimated maximum of 63.88% and minimum of 52.26% with an average of 57.88% over the life of 26 years on the city’s electricity consumption at the four listed municipal facilities (using January 2024 PG&E billing data). They further eliminate and reduce an estimated 105,640 metric tons of greenhouse gas generation (using National Renewable Energy Laboratory (“NREL”) PVWatts Calculator.*

## **a. Description of GHG Reduction Measures**

*The project plans include the installation and deployment of renewable, solar powered, low carbon-based micro-grids at four facilities. Each micro-grid consists of an advanced cost-effective micro-grid controller, elevated parking-lot canopy solar photovoltaic system, smart inverters, and a battery energy storage system. The micro-grid is designed and intended to provide at least three hours of power a day for critical loads during a utility grid power outage. On an on-grid operation, the system optimizes the use of clean and renewable energy from the solar photovoltaic generation and battery energy storage system to save energy costs at these facilities.*

*The project plans also include the installations of EV charging infrastructure for the city's electrified fleet and for the general public's uses. This allows the city to implement its fleet electrification plan in an accelerated pace.*

*Strengths/Weaknesses/Opportunities/Treats Analysis ("SWOT"): - Risk management is an integral part of program management and systems engineering. A project manager must align risk appetite with organizational capacity to manage risks and allocate limited resources to the best effect. We identified the following underlying assumptions, risks, and proposed solutions associated with this project:*

*1. Public Policy changes<sup>\*1</sup>*

*Public policy changes can affect the project's outcomes. For example, the California Public Utilities Commission's solar regulations changes ("NEM 3.0") would reduce the payments on excess power supply but provided more incentives to encourage more solar projects for low-income households. Local municipalities should set an example on reducing carbon emissions and encouraging clean energy generation and consumption. The city's project team shall work with its elected officials, regulatory authorities, and the local communities to plan and implement the project.*

*2. Technical difficulties*

*Original specifications fail to meet the original estimates. For example, the efficiency of the solar panels not producing the estimated or expected results. A one (1) megawatt (MW) solar plant typically produces around 1,500-1,700 megawatt-hours (MWh) of electricity per year, depending on the geographic location of the plant and its tilt angle. With a typical capacity factor of around 15-20 percent for solar, this would mean that a 1 MW plant would produce around 225-340 MWh of energy per year. The project's estimates are using National Renewable Energy Laboratory ("NREL") PVWatts Calculator with a DC Capacity Factor of 19%. The Project shall work with local solar installers on procuring the most efficient and environmental-friendly products.*

*3. High initial capital and maintenance cost photovoltaic ("PV") energy system*

*Although the installation of solar panels would bring immense benefits in the long run, the upfront costs can be punitive and prohibitive. Due to the considerable sum of financial investments, the City has not been able to implement these projects. The Project is seeking federal assistance through this grant funding opportunity.*

*4. Scarcity of materials and supply-chain related issues*

*Certain solar technologies require rare materials in their production. We shall also anticipate supply-chain related issues. The Project shall plan ahead and work with local solar installers on procuring the required parts and materials to avoid project delays.*

**5. Intermittency-power quality issues**

*One of the biggest problems that solar energy technology poses is that energy is only generated while the sun is shining. That means nighttime and overcast days can interrupt the supply. The Project's installations will be equipped with solar photovoltaic carports and large battery systems to increase their energy resiliency and bolster their capacity to operate including days of overcast and during utility grid power outages.*

*The City of Concord's Climate Pollution Reduction Solar Project installs electric utility independent micro-grids supplying 24/7 clean and renewable energy to maintain critical facilities and public services in the city. The project assists the city achieving its GHG emissions reduction goals, serving the communities, while optimizing the city's fiscal sustainability.*

*The project is in concert with the BAAQM Bay Area Regional Climate Action Planning Initiative's PCAPs on climate equity, commercial building decarbonization, workforce and economic development, and creating a safe, accessible, clean, and equitable multi-modal transportation system in the region.*

**b. Demonstration of Funding Need**

*The city previously explored various grant funding opportunities including those offered by the federal Environmental Protection Agency (such as EPA's Solar for All" grant opportunity), the Department of Energy (such as the SETO program funding opportunities), the California Energy Commission (such as the various grant funding solicitations offered by the Commission), and other federal and state agencies. However, the city failed to secure any funding for this project. Due to the considerable sum of financial investments, the City has not been able to implement these projects. The Project is seeking federal assistance through this grant funding opportunity.*

**c. Transformative Impact**

*Solar energy is an environmentally friendly technology. It is a sustainable green energy supply that is an economical environmental-friendly replacement of traditional fossil-fuel supported electricity generation. It plays a substantial role in achieving sustainable development energy solutions.*

*In recent years, many domestic and international regulations have been established to control the gas emissions and pollutants that impact the environment. However, the negative effects of increased carbon in the atmosphere have grown in the last 10 years. Production and use of fossil fuels emit methane (CH<sub>4</sub>), carbon dioxide (CO<sub>2</sub>) and carbon monoxide (CO), which are the most significant contributors to environmental emissions on our planet. Additionally, coal and oil, including gasoline, coal, oil and methane, are commonly used in energy for transport or for generating electricity. Therefore, burning these fossil fuels is deemed the largest emitter when used for electricity generation, transport, etc. However, these energy resources are considered depleted energy sources being consumed to an unsustainable degree according to CleanEnergy\*<sup>2</sup>.*

The advantages of solar energy technology are a renewable and clean energy source that is plentiful, cheaper costs, less maintenance and environmentally friendly. The installations and formations of a mini-grids or micro-grids, further the individual usages' independence on the utility grids allowing local municipalities the ability and flexibility to respond to emergencies and better serving the communities in an emergency situation.

The project plans also include the installations of EV charging infrastructure for the city's electrified fleet and for the general public's uses. This allows the city to implement its fleet electrification plan in an accelerated pace which creates transformative opportunities that can lead to significant additional GHG emission reductions.

## 2. IMPACT OF GHG REDUCTION MEASURES

Per the Intergovernmental Panel on Climate Change ("IPCC") Sixth Assessment Report ("AR6") of 2023, human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming<sup>\*3</sup>. This has led to widespread adverse impacts on food and water security, human health and on economies and society and related losses and damages to nature and people. Vulnerable communities who have historically contributed the least to current climate change are disproportionately affected.

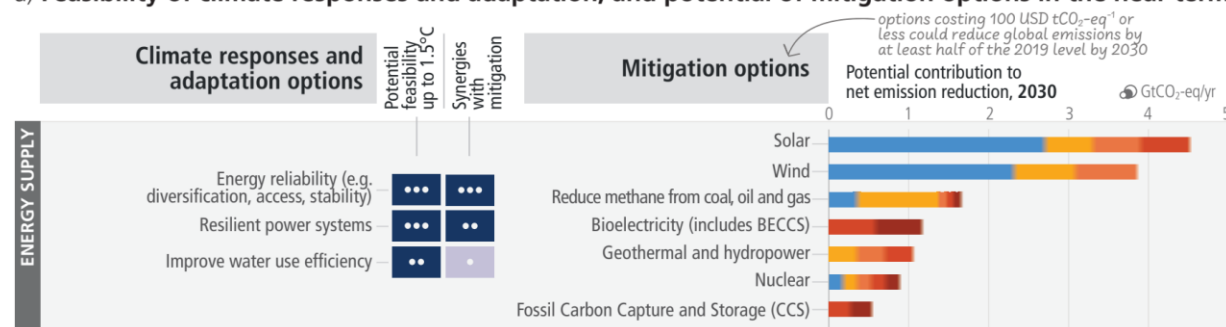
Global warming will continue to increase in the near term in nearly all considered scenarios and modelled pathways. Deep, rapid, and sustained GHG emissions reductions, reaching net zero CO<sub>2</sub> emissions and including strong emissions reductions of other GHGs, in particular CH<sub>4</sub>, are necessary to limit warming to 1.5°C (>50%) or less than 2°C (>67%) by the end of century<sup>\*3</sup>.

There are multiple opportunities for scaling up climate action including feasible climate responses and adaptation, and mitigation options in the near term according to IPCC. One of these opportunities identified by IPCC is to manage energy supply using solar, wind, geothermal/hydropower, among others as indicated in the below table which presents selected mitigation and adaptation options across different systems. Solar is identified as the one with the most potential contribution to net emission reduction by 2030.

Near-Term Responses in a Changing Climate

### There are multiple opportunities for scaling up climate action

#### a) Feasibility of climate responses and adaptation, and potential of mitigation options in the near term

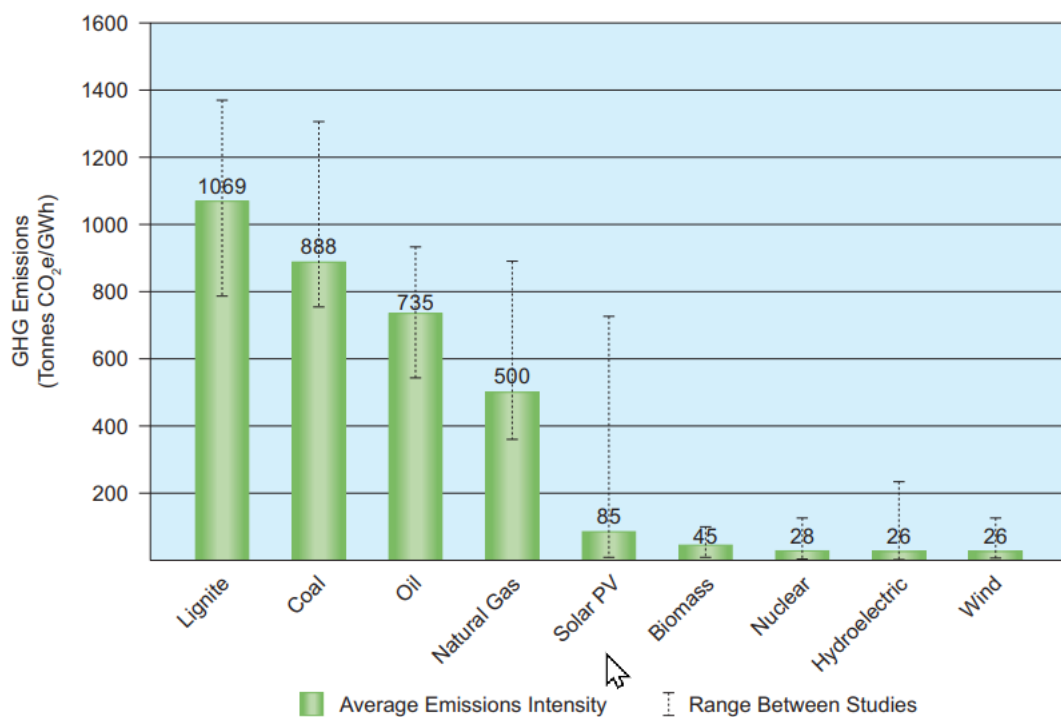


Although electricity is a clean and relatively safe form of energy when it is used, the generation and transmission of electricity affects the environment. Nearly all types of electric power plants have an effect on the environment, but some power plants have larger effects than others<sup>\*15</sup>. The

impacts and magnitude of both near-term and long-term cumulative GHG emission reductions and their relative cost-effectiveness can be viewed in the comparison of the lifecycle GHG emissions of different electricity generation facilities using different fuel types; namely, nuclear, coal, natural gas, oil, solar photovoltaic, biomass, hydroelectric, and wind.

World Nuclear Association (“WNA”) is the international organization that promotes nuclear power and supports the companies that comprise the global nuclear industry. In its report on the subject matter, WNA listed 21 studies, analyses, and findings, including 13 focused solely on solar PV, from various government agencies and academic institutions around the world to support its conclusions that hydroelectric, nuclear, wind, solar PV, and biomass are among the lowest in GHG emissions. It was most prevalent for solar power due to its rapid advancement of solar photovoltaic panels over the past decade. As the technology and manufacturing processes become more efficient, the lifecycle emissions of solar photovoltaic panels will continue to decrease.

*Lifecycle GHG Emissions Intensity of Electricity Generation Methods\*<sup>16</sup>*



In the United States, about 61% of total electricity generation in 2021 was produced from fossil fuels (coal, natural gas, and petroleum), materials that come from plants (biomass), and municipal and industrial wastes. The substances that occur in combustion gases when these fuels are burned include carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), particulate matter (PM), and heavy metals such as mercury\*<sup>15</sup>.

The City of Concord’s Climate Pollution Reduction Solar Project will provide more than 151,620,921 MWh of electricity in its lifecycle of 26 years in this calculation. However, the 26-year lifespan of a solar panel may be a significant underestimation of the actual performance in the field. In reality, the power capacity decreases only 6 to 8% after 25 years, as compared to the 0.8% decrease used to estimate the 26-year lifespan. A more accurate lifespan may be 35-40 years according to OYA Renewables\*<sup>17</sup>. As a result, the City of Concord’s Climate Pollution Reduction

*Solar Project will continue to contribute to the region's GHG reduction efforts significantly and tremendously after the original estimated lifecycle.*

**a. Magnitude of GHG Reductions from 2025 through 2030**

*The Project uses the EPA Greenhouse Gas Equivalencies Calculator\*<sup>4</sup> and the National Renewable Energy Laboratory's ("NREL") PVWatts Calculator\*<sup>14</sup> to calculate the magnitude of the GHG reductions in the given period. 32,792.212 MWh of electricity generated in this period is equivalent to the reduction of 22,851 metric tons of carbon dioxide in this period. Aging equipment will continue to reduce the generation rate by 0.8% every year. These calculations and estimates are based on the Project's on-time implementation and completion as highlighted (in yellow) in the table below.*

**b. Magnitude of GHG Reductions from 2025 through 2050**

*The Project uses the EPA Greenhouse Gas Equivalencies Calculator\*<sup>4</sup> and the National Renewable Energy Laboratory's ("NREL") PVWatts Calculator\*<sup>14</sup> to calculate the magnitude of the GHG reductions in the given period. 151,620.921 MWh of electricity generated in this period is equivalent to the reduction of 105,640 metric tons of carbon dioxide\*<sup>4</sup> in this period. Aging equipment will continue to reduce the generation rate by 0.8% every year until the end-of-life cycle of the solar arrays, assuming a system lifetime of 26 years. These calculations and estimates are based on the Project's on-time implementation and completion as highlighted (in yellow) in the table below.*

**c. Cost Effectiveness of GHG Reductions**

*In the United States, the emissions intensity of electricity produced by natural gas-fired power plants is about 1,071 pounds per megawatt-hour (MWh) on a lifecycle basis, whereas the emissions intensity of solar PV is about 95 pounds per MWh, a difference of 976 pounds per MWh. According to the Lawrence Berkeley National Laboratory\*<sup>5</sup> and RystadEnergy\*<sup>6</sup>. In comparison, an average coal-fired power plant emits about 2,000 pounds of CO<sub>2</sub> per megawatt-hour (MWh).*

*Please note that on December 15, 2022, the California Public Utilities Commission ("CPUC") voted unanimously to approve California's third iteration of net metering, or NEM 3.0. Under the new tariff, NEM 3.0 has significantly reduced net metering compensation rates for new California solar customers (by about 75 percent). This drastic reduction in value of solar energy credits will result the reduction in revenue generation of the systems. However, In January, all three of the investor-owned utilities in California raised their electricity rates significantly. This might result in a net zero of the solar energy credit value reduction. As a new project under these rules, when the city installs a solar battery and store excess surplus energy onsite, the city can charge its battery system for use later, maximizing the value of the solar power and minimizing what the city exports to the local utility company through self-consumption, especially when the time of use rates are higher.*

2025-2030 Estimate

*Using EPA Greenhouse Gas Equivalencies Calculator\*<sup>4</sup> DC Capacity Factor 19%*

*Cost effectiveness of GHG reductions = (Requested CPRG funding) /*

*(Sum of Quantified GHG reductions from CPRG funding from 2025-2030)*

*Cost effectiveness of GHG reductions = \$27,912,100/22,851 = \$1,221.48/MT*

### 2025-2050 Estimate

Using EPA Greenhouse Gas Equivalencies Calculator\*<sup>4</sup> DC Capacity Factor 19%

Cost effectiveness of GHG reductions = (Requested CPRG funding) /  
(Sum of Quantified GHG reductions from CPRG funding from 2025-2050)

Cost effectiveness of GHG reductions = \$27,912,100/105,640 = \$264.22/MT

#### **d. Documentation of GHG Reduction Assumptions – Up to 10 additional pages as an appendix to the workplan (see Appendix C of the NOFO)**

*The sun provides a tremendous resource for generating clean and sustainable electricity without toxic pollution or global warming emissions. Using solar energy can have a positive, indirect effect on the environment when solar energy replaces or reduces the use of other energy sources that have larger effects on the environment\*<sup>7</sup>.*

*The City of Concord's Climate Pollution Reduction Solar Project uses the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy and its PVWatts calculator to calculate and estimate the GHG reductions. Each of the four project locations are entered to obtain the annual kWh generations. The cumulative annual generations are based on the estimated solar array's commissioning and generation timeline per the project schedule listed under Section 3.c of this Work Plan. Aging equipment will continue to reduce the generation rate by 0.8% every year; therefore, a deduction of 0.8% on the annual total generation due to equipment degradation was included in the calculations.*

*GHG reduction was based on the following:*

- 1. Project solar arrays on-time installation and commissioning per proposed schedule.*
- 2. Solar arrays' production meets the manufacturer's specifications.*
- 3. No unusual weather patterns that could adversely impacting the solar arrays' generation.*
- 4. EPA's Greenhouse Gas Equivalencies calculator provided accurate numbers.*
- 5. No other activities or events that could adversely impacting the solar arrays' generation.*

### **3. ENVIRONMENTAL RESULTS – OUTPUTS, OUTCOMES, AND PERFORMANCE MEASURES**

*The City of Concord's Climate Pollution Reduction Solar Project supports the U.S. Environmental Protection Agency's Strategic Plan goals reducing greenhouse gas by producing and using renewal energy.*

*Goal 1 – “Tackle the Climate Crisis”*

*Objective 1.1 – Reduce Emissions that Cause Climate Change*

*The project installs renewable clean energy generation and energy storage systems on municipal facilities, as part of the city's building decarbonization efforts reducing its carbon footprint and promotes electrification of government-owned and commercial buildings, and further expands electric vehicle charging infrastructure for the public uses.*

*Goal 1 – “Tackle the Climate Crisis”*

*Objective 1.2 – Accelerate Resilience and Adaptation to Climate Change Impacts*

*The Project installs renewable clean energy generation and energy storage systems on municipal facilities. It allows the city an opportunity to anticipate, prepare for, adapt to, and recover from the impacts of climate change; namely, utility grid power outages and rolling black outs.*

## Goal 2 – “Take Decisive Action to Advance Environmental Justice and Civic Rights”

### Objective 2.1 – Promote Environmental Justice and Civic Rights at the Federal, Tribal, State, and Local Levels

The Project prioritizes program resources, allocates funding, implements statutory authorities, and engages the communities, as identified in Section 4 Disadvantaged Communities below, most affected by environmental and public health threats, especially as the climate changes.

## Goal 4 – “Ensure Clean and Healthy Air for All Communities”

### Objective 4.1 – Improve Air Quality and Reduce Localized Pollution and Health Impacts

The project installs renewable clean energy generation and energy storage systems on municipal facilities, ensuring the overall carbon footprint reduction locally.

## Goal 6 – “Safeguard and Revitalize Communities:

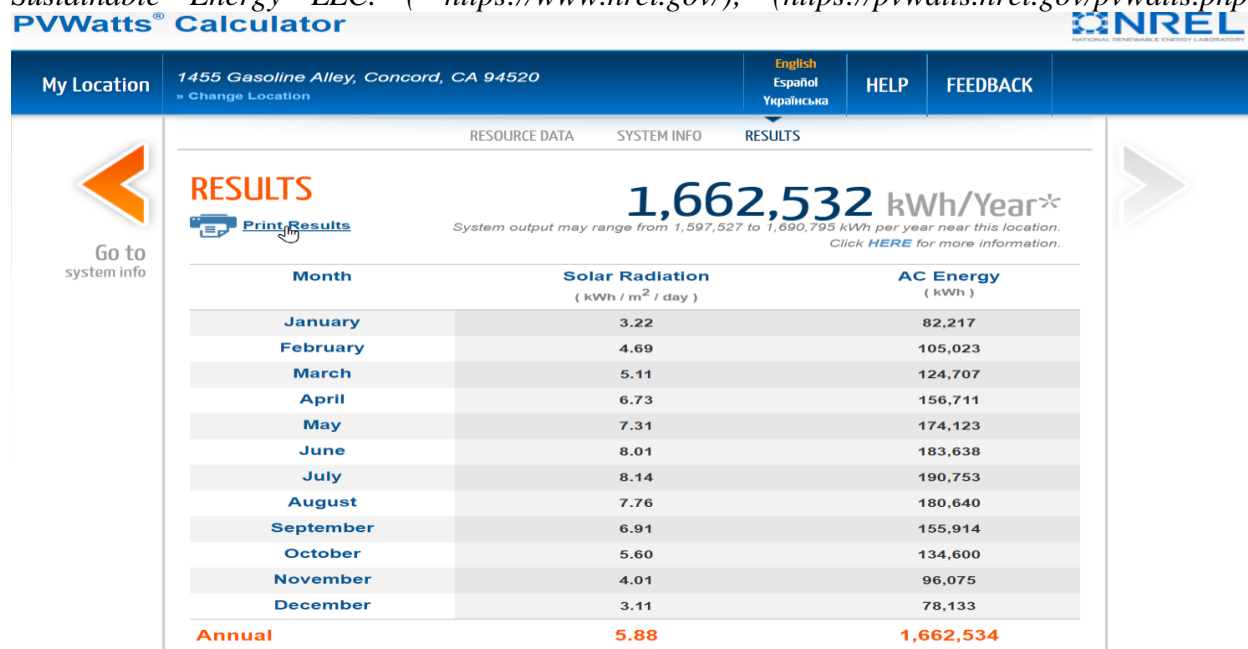
### Objective 6.3 – Prepare for and Respond to Environmental Emergencies

The installation of micro-grid solar arrays with built-in independency from the utility grid will allow the city and its operating departments increased capacity and readiness responding to service calls and to better serving its citizens especially the disadvantaged and vulnerable population during emergencies.

#### a. Expected Outputs and Outcomes

Per Sky Stream Energy, a one (1) megawatt (MW) solar plant typically produces around 1,500-1,700 megawatt-hours (MWh) of electricity per year, depending on the geographic location of the plant and its tilt angle. With a typical capacity factor of around 15-20 percent for solar, this would mean that a 1 MW plant would produce around 225-340 MWh of energy per year. We use one (1) MW solar plant producing up to 1,668 MWh of electricity per year, which is enough to power approximately 167 average U. S. homes for a year<sup>\*8</sup>, as the base of our calculations. The City’s Climate Pollution Reduction Solar Project includes solar panel installation at four (4) locations. The estimated and expected outputs and outcomes are listed below tables.

The National Renewable Energy Laboratory is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy LLC. ( <https://www.nrel.gov/>); ( <https://pvwatts.nrel.gov/pvwatts.php>)





*EPA Greenhouse Gas Equivalencies Calculator\*<sup>4</sup> Capacity Factor of 19%:*

Year	Solar PW Generation kWh	Solar SC Generation kWh	Solar PD Generation kWh	Solar CC Generation kWh	Annual Generation kWh	Annual GHG Reduction Metric Tons
2024						
2025	1,662,532	0	0	0	1,662,532	1161
2026	1,649,232	1,662,532	1,662,532	0	4,974,296	3475
2027	1,636,038	1,649,232	1,649,232	1,662,532	6,597,033	4609
2028	1,622,950	1,636,038	1,636,038	1,649,232	6,544,257	4572
2029	1,609,966	1,622,950	1,622,950	1,636,038	6,491,903	4535
2030	1,597,086	1,609,966	1,609,966	1,622,950	6,439,968	4499
2031	1,584,310	1,597,086	1,597,086	1,609,966	6,388,448	4463
2032	1,571,635	1,584,310	1,584,310	1,597,086	6,337,341	4427
2033	1,559,062	1,571,635	1,571,635	1,584,310	6,286,642	4392
2034	1,546,590	1,559,062	1,559,062	1,571,635	6,236,349	4357
2035	1,534,217	1,546,590	1,546,590	1,559,062	6,186,458	4322
2036	1,521,943	1,534,217	1,534,217	1,546,590	6,136,966	4287
2037	1,509,768	1,521,943	1,521,943	1,534,217	6,087,870	4253
2038	1,497,689	1,509,768	1,509,768	1,521,943	6,039,167	4219
2039	1,485,708	1,497,689	1,497,689	1,509,768	5,990,854	4185
2040	1,473,822	1,485,708	1,485,708	1,497,689	5,942,927	4152
2041	1,462,032	1,473,822	1,473,822	1,485,708	5,895,384	4118
2042	1,450,335	1,462,032	1,462,032	1,473,822	5,848,221	4086
2043	1,438,733	1,450,335	1,450,335	1,462,032	5,801,435	4053
2044	1,427,223	1,438,733	1,438,733	1,450,335	5,755,024	4020
2045	1,415,805	1,427,223	1,427,223	1,438,733	5,708,983	3988
2046	1,404,479	1,415,805	1,415,805	1,427,223	5,663,312	3956
2047	1,393,243	1,404,479	1,404,479	1,415,805	5,618,005	3925
2048	1,382,097	1,393,243	1,393,243	1,404,479	5,573,061	3893
2049	1,371,040	1,382,097	1,382,097	1,393,243	5,528,477	3862
2050	1,360,072	1,371,040	1,371,040	1,382,097	5,484,249	3831
					151,219,161	105,640

Solar panel efficiency declines over time through a process called degradation.

This is a natural process due to prolonged exposure to sun, heat, ice, wind and other elements.

The reduction in power efficiency begins from the first year of installation is calculated at 0.8%/year.

Excluding the first year 0.80% annual reduction rate

<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results>

Solar 1	Public Works Corp Yard				
Solar 2	Senior Citizens Center				
Solar 3	Concord Police Complex				
Solar 4	Civic Center Complex				

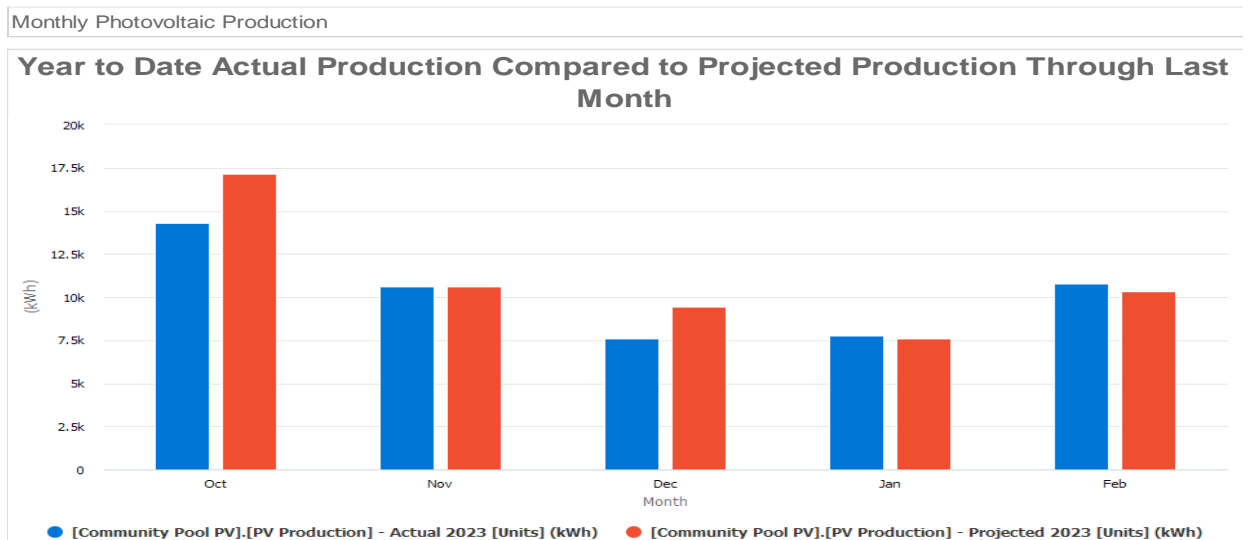
## b. Performance Measures and Plan

*The City's Climate Pollution Reduction Solar Project includes solar panel installation at the Public Works Corporation Yard at 1455 Gasoline Alley (1MW), the Senior Citizens Center at 2727 Parkside Circle (1MW), the Concord Police Complex at 1350 Galindo Street (1MW), and the Civic Center Complex at 1950 Parkside Drive (1MW) respectively.*

*We use one (1) MW solar plant producing up to 1,668 MWh of electricity per year, which is enough to power approximately 167 average U. S. homes for a year\*<sup>8</sup>, as the base of our calculations. The project accelerates decarbonization efforts across three major sectors responsible for GHG emissions including electric power generation, transportation, and commercial buildings.*

*Together, these systems offset an estimated maximum of 63.88% and minimum of 52.26% with an average of 57.88% over the life of 26 years on the city's electricity consumption at the four listed municipal facilities (using January 2024 PG&E billing data). They further eliminate and reduce an estimated 105,640 metric tons of greenhouse gas generation (using National Renewable Energy Laboratory ("NREL") PVWatts Calculator.*

*The project team shall monitor the system performance using the Actual vs. Production analysis. A sample of our other solar project report is listed below:*



Period : 10/1/2023 12:00 AM - 2/29/2024 11:59 PM

Month	[Community Pool PV].[PV Production] - Actual 2023 [Units] (kWh)	[Community Pool PV].[PV Production] - Actual 2023 [Units] (Cumulative)	[Community Pool PV].[PV Production] - Projected 2023 [Units] (kWh)	[Community Pool PV].[PV Production] - Projected 2023 [Units] (Cumulative)	Gross Variance	Relative Variance (%)	Cumulative Gross Variance	Cumulative Relative Variance (%)
Oct	14,321.25	14,321.25	17,161.00	17,161.00	-2,839.75	-16.55	-2,839.75	-16.55
Nov	10,638.25	24,959.50	10,605.00	27,766.00	33.25	0.31	-2,806.50	-10.11
Dec	7,606.25	32,565.75	9,453.00	37,219.00	-1,846.75	-19.54	-4,653.25	-12.50
Jan	7,751.50	40,317.25	7,581.00	44,800.00	170.50	2.25	-4,482.75	-10.01
Feb	10,756.00	51,073.25	10,349.00	55,149.00	407.00	3.93	-4,075.75	-7.39

Period : 10/1/2023 12:00 AM - 2/29/2024 11:59 PM

### **c. Authorities, Implementation Timeline, and Milestones**

*The City of Concord is a council-manager government form of local government. The city manager's office has approved this application. A later council resolution shall authorize and approve the acceptance of award and the grant agreement and financials. The project is to be managed by city staff directly.*

#### *Implementation Timeline and Milestones:*

- 1. Project Manager is appointed – upon receiving the award notice.*
- 2. List of participating departments and key stakeholders are identified – upon receiving the award notice within seven (7) days.*
- 3. Key participants' (Facilities, Legal, Finance, City Manager, Elected Officials, City Planning/Building Inspection, and other stakeholders including community outreach) consultation is made – within the next 30-day.*
- 4. Common understanding about the solar projects, financing, key metrics, timelines, and expectations is developed – within the same 30 days as Item #3 above.*
- 5. Grant agreement and financial are in order – pending EPA's schedule and timeline.*
- 6. Consolidated analysis of project sites is to be performed – within the subsequent 90 days per site.*
- 7. Environmental assessment is to be performed and reviewed - within the subsequent 90 days as Item #6 above.*
- 8. Council resolution for approval and acceptance is calendared – within the next 30 days.*
- 9. Design of procurement process (public works project) Request for Bid is to be drafted and issued – within 60 days.*
- 10. Proposal evaluation, negotiations, and award is to be completed - within 60 days.*
- 11. Contract with qualified awarded contractors is executed – within the next 15 working days.*
- 12. Project implementation and construction is undertaken – with the next three years.*
- 13. Quality assurance and project commissioning is conducted – within the next 2 weeks.*
- 14. Project documentation and closeout is conducted – within the next two weeks.*
- 15. Final audit and report is conducted – within required timeframes through completion.*
- 16. Performance management and equipment warranty is to be implemented – the next calendar year or warranty period.*

### **4. LOW-INCOME AND DISADVANTAGED COMMUNITIES**

*The United States is about to experience a huge wave of federal infrastructure investment under the U.S. Congress passed and President Biden signed Inflation Reduction Act of 2022.*

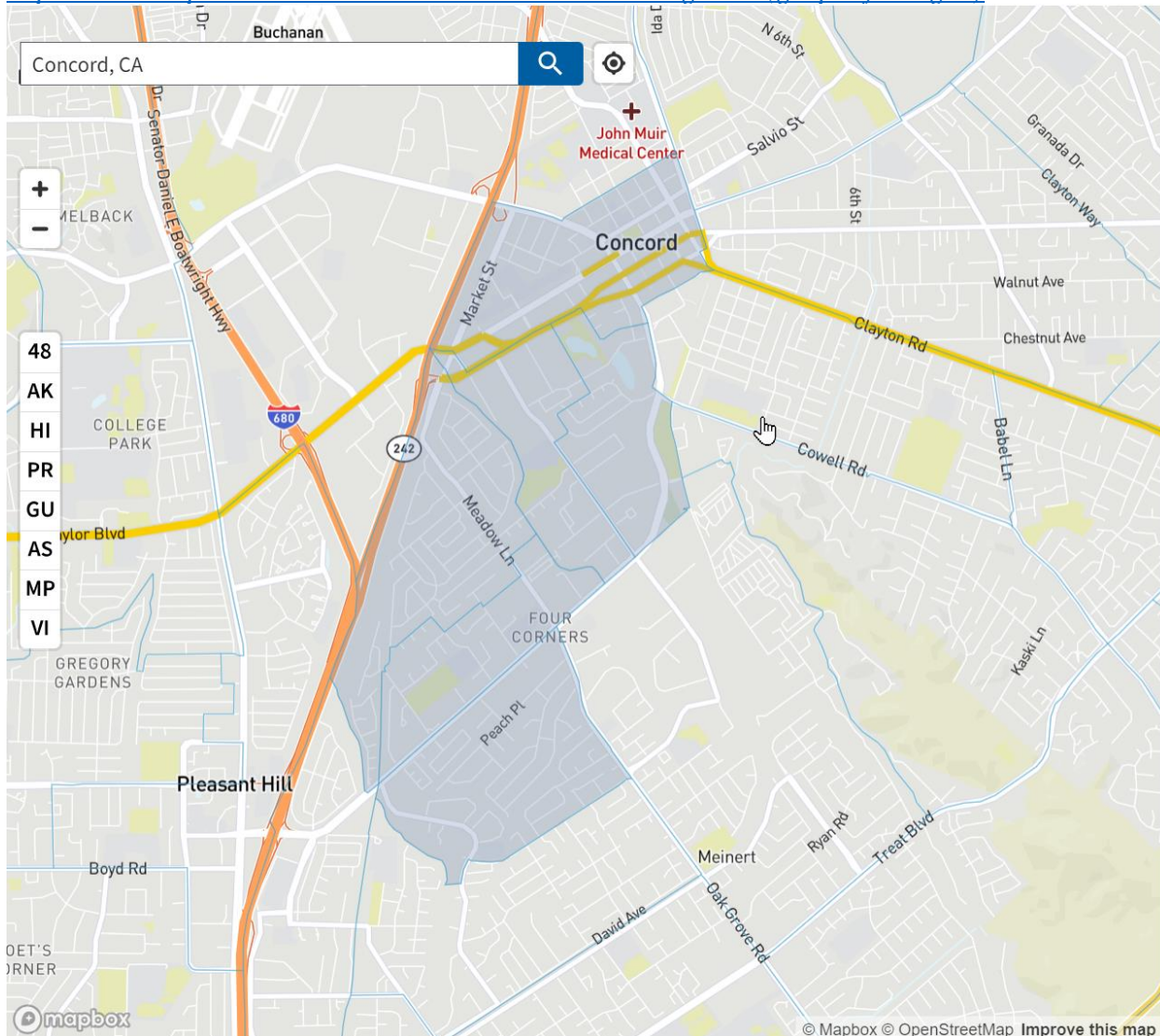
*Key Executive Orders and guidance are attempting to ensure that the benefits of federal investments accrue to all communities and that disadvantaged communities are visible and recognized in each relevant set of investments made according to Deloitte Insights<sup>\*9</sup>. Among the most notable and best documented of these efforts to date is the Justice40 Initiative. In January 2021, President Biden's Executive Order 14008 – Tackling the Climate Crisis at Home and Abroad announced Justice40, which mandates that at least 40% of the benefits of certain federal investments must flow to disadvantaged communities. Climate equity and environmental justice once again are brought to the forefront of a national conversation. This focus shifted from identifying the problems to making clear the difference between identifying injustice and doing*

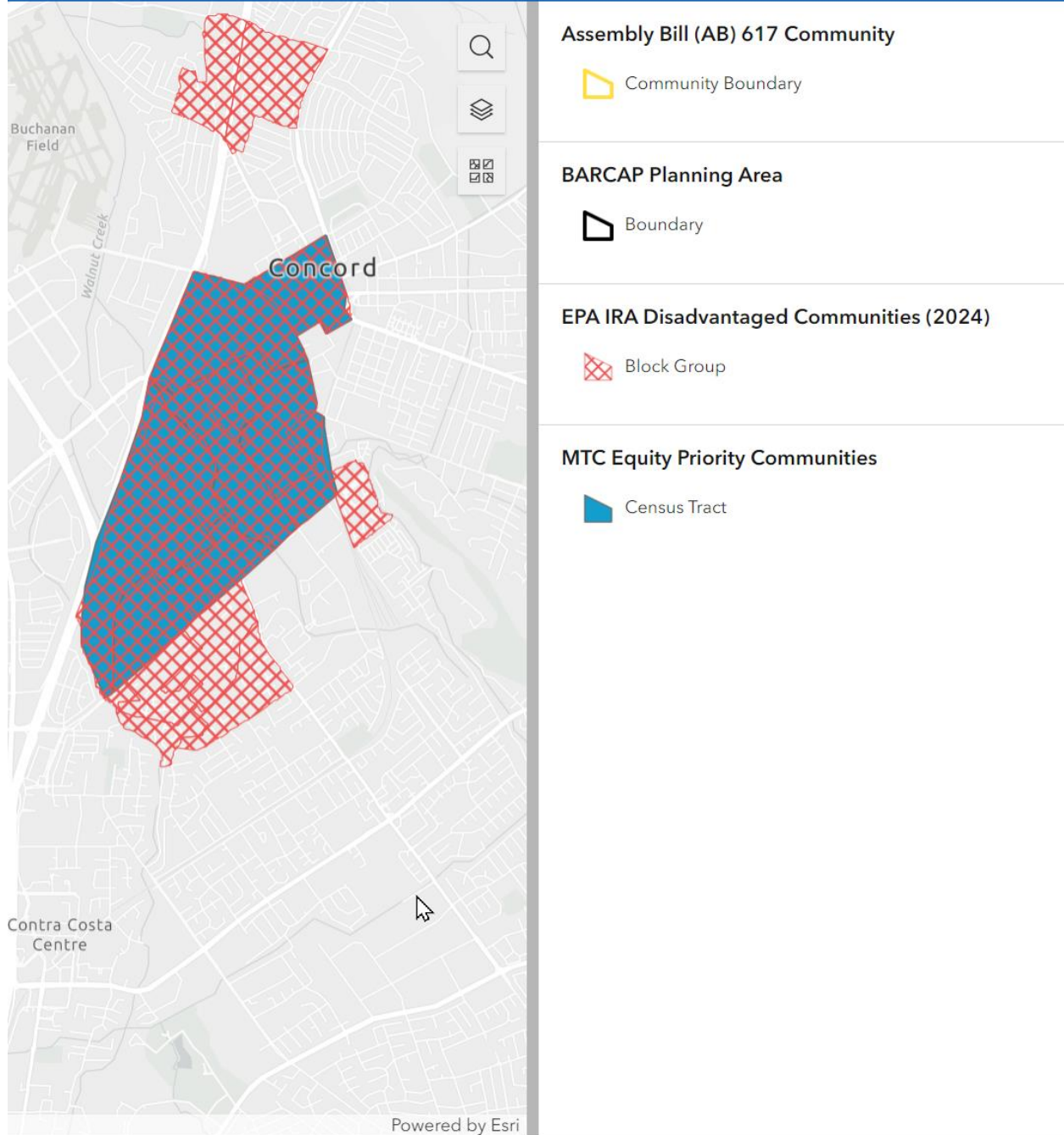
something meaningful to address the problems. For example, for the first time, EPA's final Strategic Plan includes a new strategic goal focused solely on addressing climate change and an unprecedented goal to advance environmental justice and external civil rights compliance\*<sup>10</sup>.

The City of Concord's Climate Pollution Reduction Solar Project benefits a significant premises in the city's disadvantaged and underserved communities as indicated in the 2020 U.S. Census Tracts 6013327000, 6013328000, 6013329000, 6013330000, 6013331000, 6013355200, 6013355200, 6013336102, 6013336202, and other disadvantaged and underserved communities in the city (Justice40 Communities as indicated on map below).

The Project will increase the city and its operating departments' capacity and readiness responding to service calls and to better serving its citizens especially the disadvantaged and vulnerable population during emergencies.

[Explore the map - Climate & Economic Justice Screening Tool \(geoplatform.gov\)](#)







## White House Climate and Economic Justice Screening Tool (CEJST)

Tract Number: 06013328000

<https://screeningtool.geoplatform.gov/en/#13.92/37.9758/-122.03794>

Tract Number: 06013336102

<https://screeningtool.geoplatform.gov/en/#13.9/37.9656/-122.04062>

Tract Number: 06013336101

<https://screeningtool.geoplatform.gov/en/#13.96/37.96672/-122.03467>

Tract Number: 06013336201

<https://screeningtool.geoplatform.gov/en/#13.13/37.95936/-122.04733>

Tract Number: 06013336202

<https://screeningtool.geoplatform.gov/en/#13.96/37.95465/-122.04336>

Tract Number: 06013338101

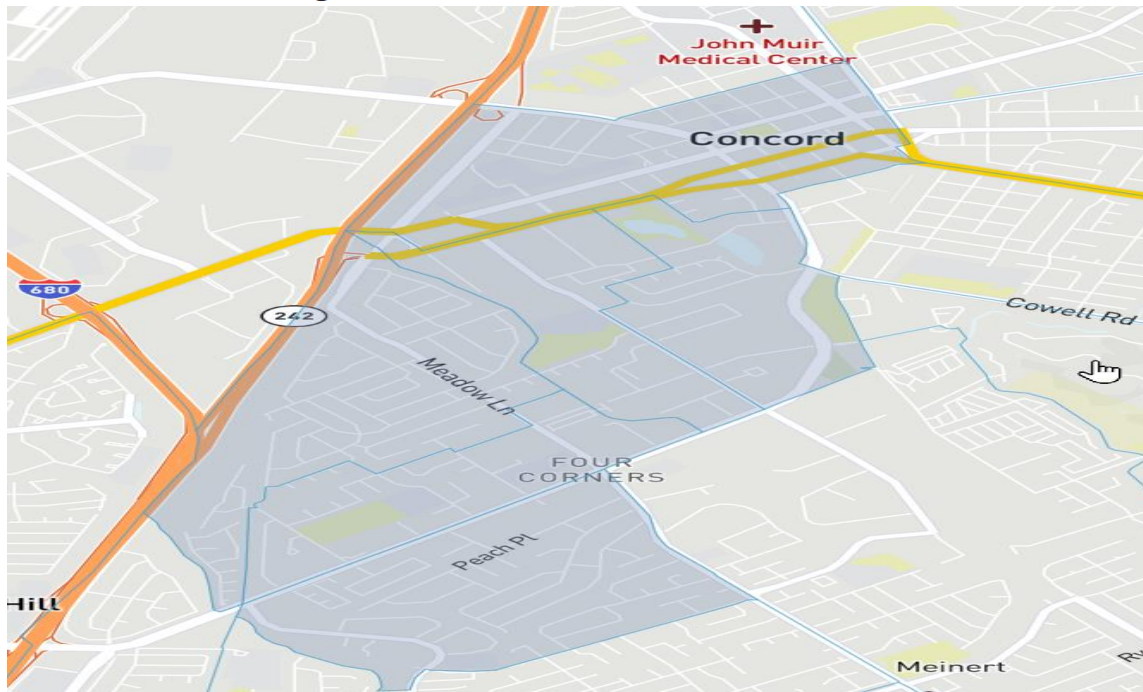
<https://screeningtool.geoplatform.gov/en/#13.91/37.94949/-122.04255>

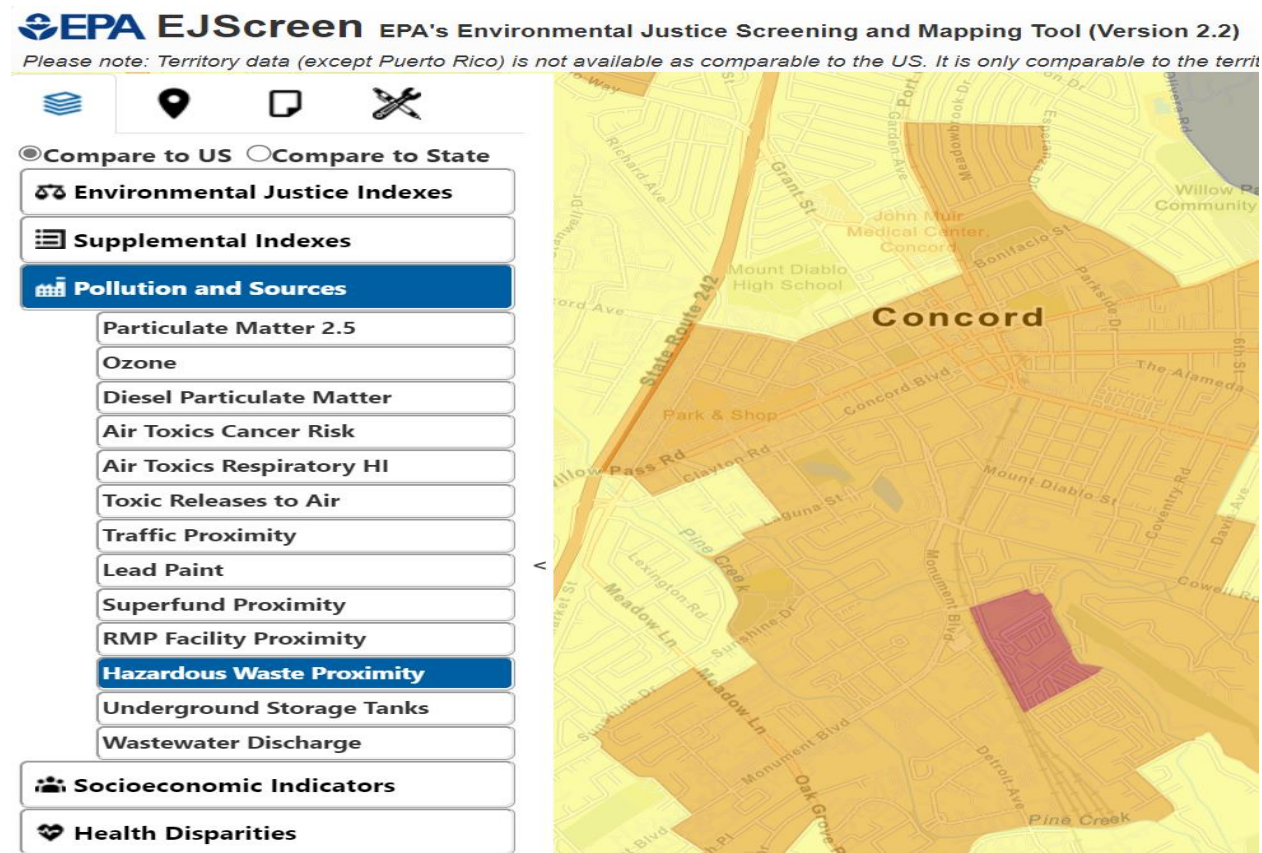
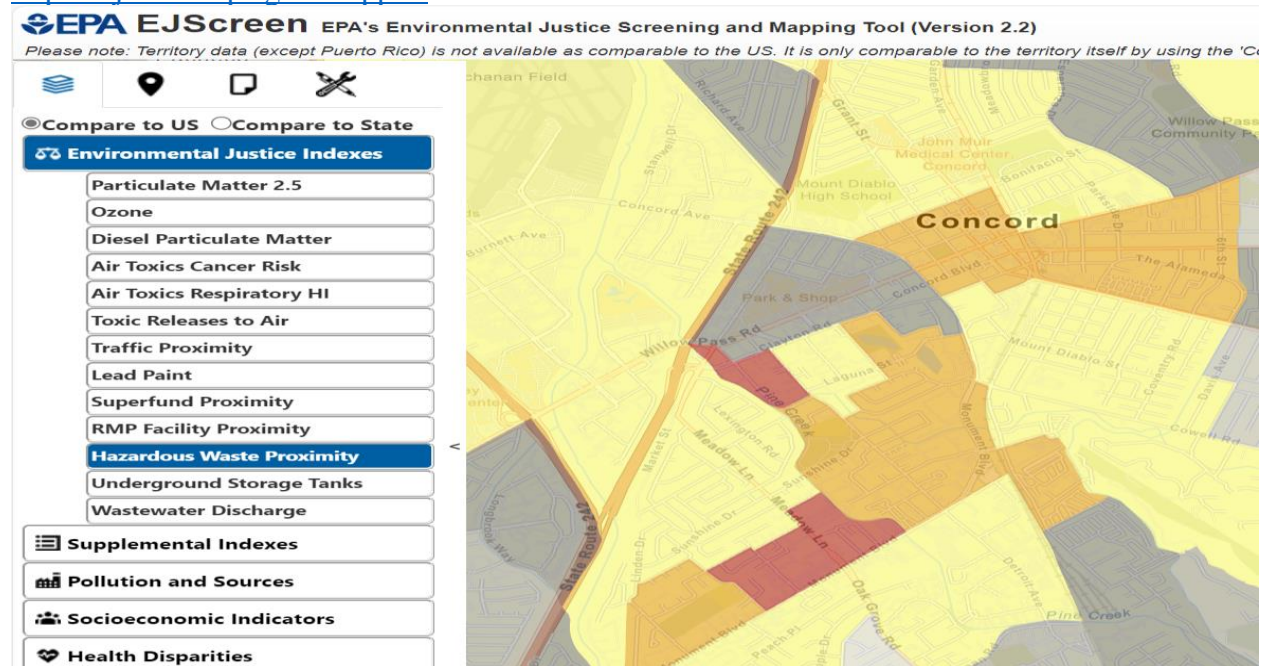
These tracts are considered disadvantaged because they meet at least one, or more than one burden thresholds and the associated socioeconomic thresholds.

<https://screeningtool.geoplatform.gov/en/#13.92/37.9758/-122.03794>



Climate and Economic Justice  
Screening Tool





### **a. Community Benefits**

*The City of Concord intends to install renewable energy at four municipal facilities. These include solar projects at the Public Works Corporation Yard at 1455 Gasoline Alley, the Senior Citizens Center at 2727 Parkside Circle, the Concord Police Complex at 1350 Galindo Street, and the Civic Center Complex at 1950 Parkside Drive. In addition to achieving the GHG reduction goals, the project also benefits the local disadvantaged communities and the vulnerable population in the city-provided emergency responses and services. Our vision is a future with sustainable, equitable and resilient transportation, buildings, and communities in the city of Concord.*

#### *Public Works:*

*The members of the Concord Public Works Department (“PW”) are dedicated to providing the highest quality public services in order to enhance our community. The City of Concord’s Public Works Department manages the city’s infrastructure, facility operations and maintenance, parks, fleet, sewer service, traffic and transportation, and solid waste management through its five operating divisions. The department strives to provide a variety of services to meet the city’s needs, to protect the city’s investments, and to ensure the health and safety of Concord’s communities.*

*The proposed solar project at the Public Works Corporation Yard will be equipped with solar photovoltaic carports and large battery systems to increase their energy resiliency and bolster their capacity to operate during utility grid power outages. The separation and independency from the utility grid will allow the city’s PW to build a better response serving its citizens including disadvantaged and vulnerable population during emergencies.*

#### *Concord Senior Citizens Center:*

*The Concord Senior Center has been serving the senior community for over 20 years. As a local community focal point, the senior center has become one of the most widely used services among the city’s older adults. Providing recreation programs, trips & tours, educational seminars, Meals on Wheels services, Senior Club membership, and details about the Health & Human Service providers benefits all community citizens including the city’s disadvantaged and vulnerable population.*

*For the past 15 years, the City of Concord has designated the Senior Citizens Center as a cooling center during summer heat waves. It is the designated Clean Air Center by the Bay Area Air Quality Management District’s (“BAAQMD”) Wildfire Air Quality Response Program (“WAQRP”), a comprehensive program intended to prepare for and respond to catastrophic wildfires and ensure health-protective measures and strategies are in place. Through this program, the BAAQMD has provided heavy-duty portable air filtration machine(s) to the City of Concord to help protect residents from the harms of wildfire smoke that has the potential to impact outdoor air quality. The intent of the program is to provide resources that will allow the city to establish clean indoor air environments, protect public health, and improve indoor air quality in communities most vulnerable to wildfire smoke. The city has designated the Senior Center as a Clean Air Center in 2023. Furthermore, the city’s Recreation Services, the department managing the Senior Citizens Center, is designated in the City of Concord’s Emergency Plan as Care and*



*Shelter locations to provide care and first aid at shelters and assist in coordinating public health activities during declared emergencies.*

*The proposed solar project at the Concord Senior Citizens Center will be equipped with solar photovoltaic carports and large battery systems to increase their energy resiliency and bolster their capacity to operate during utility grid power outages. The separation and independency from the utility grid will allow the city's senior center to better serve its citizens including disadvantaged and vulnerable population during emergencies.*

#### *Concord Police Complex:*

*The members of the Concord Police Department ("PD") are dedicated to providing the highest quality police services in order to enhance community safety, protect life and property, and reduce crime and the fear of crime. To do this, we pledge to develop a partnership with the community, lead a community commitment to resolve problems, and improve the safety and quality of life in our city. The proposed solar project at the Concord Police Complex will be equipped with solar photovoltaic carports and large battery systems to increase their energy resiliency and bolster their capacity to operate during utility grid power outages. The separation and independency from the utility grid will allow the city's PD to better serve its citizens including disadvantaged and vulnerable population during emergencies.*

#### *Civic Center Complex:*

*The Civic Center Complex is home to the city's City Hall office buildings and the city Council Chamber. The Civic Center Complex is a local municipal government center (City of Concord). The proposed solar project at the Civic Center Complex will be equipped with solar photovoltaic carports and large battery systems to increase their energy resiliency and bolster their capacity to operate during utility grid power outages. The separation and independency from the utility grid will allow the city's government functions through its various operating departments to better serve its citizens including disadvantaged and vulnerable population during emergencies.*

### **b. Community Engagement**

*Solar development in local communities will be most effective and most equitable when trusted community organizations are actively involved. Those community-based organizations are well placed to know how to engage and communicate with residents most effectively. They can help design programs that are responsive to the needs of the community and empower the community. They can also help overcome some of the distrust that many community residents, especially those of underserved and disadvantaged communities, feel towards utilities, energy companies, and the solar industry<sup>\*11 \*12</sup>.*

*Partnering, engaging, collaborating with, and learning from community-based organizations brings an environmental justice perspective to the design and implementation of the project, it also ensures that voices that have historically been marginalized or underrepresented are able to be heard and to bring their concerns forward. Community engagement can lead to innovative, equitable, and inclusive partnerships by connecting the concerns of communities to the decisions that allocate public funds.*

*The City of Concord's project team shall follow these guidelines and best practices engaging the community and its elected officials allowing the communities and citizens to participate fully in a robust stakeholder engagement process in the project's design and implementation.*

*The city offers the following community engagement channels:*

- 1. City official website and social media accounts for information and city services*
- 2. City Council meetings*
- 3. City Clerk and Administrative Services*
- 4. City departments*
- 5. Subscription of news and alerts notifications*
- 6. Concord Connect – service requests and notifications*
- 7. Community Service Desk and Hotline (925-671-3220)*

## **5. JOB QUALITY**

*Per U.S. Department of Energy\*<sup>13</sup> and based on surveys of tens of thousands of U.S. energy sector employers, the U.S. Energy and Employment Report (USEER) is a comprehensive summary of national and state-level energy jobs, reporting by industry, technology, and region with data on unionization rates, demographics, and employer perspectives on growth and hiring. The USEER began in 2016 to better track and understand employment within key energy sectors that have been difficult to follow using other publicly available data sources. The study combines surveys of businesses with public labor data to produce estimates of employment and workforce characteristics.*

*As the private sector continues to announce major investments in American-made energy thanks in large part to President Biden's Investing in America agenda, the 2023 USEER shows that the energy workforce added almost 300,000 jobs from 2021 to 2022 (+3.8% growth), outpacing the growth rate of the overall U.S. workforce, which grew by 3.1%. Clean energy jobs increased in every state and grew 3.9% nationally. With the President's goal of an electrical grid run on 100% carbon-free sources by 2035 and a net zero economy by 2050, energy jobs are expected to see continued growth in every pocket of the America.*

*The proposed city project will add to the local creations of additional quality clean energy jobs supported by this grant funding. The City's project Request for Bid shall include the proposed labor utilization requirement that meets the State of California's Labor Code on Prevailing Wage.*

## **6. PROGRAMMATIC CAPABILITY AND PAST PERFORMANCE**

*The City of Concord's Public Works Department and the city's Community Development Department's engineering capital improvement program have sufficient resources to support this project including project implementation functions.*

### **a. Past Performance**

*The City of Concord's Public Works department is working with the U.S. Department of Agriculture, Forest Service on the City of Concord's Urban and Community Forestry Program grant award under Inflation Reduction Act (Notice of Funding Opportunity Number: USDA-FS-*

2023-UCF-IRA-01; Catalog of Federal Domestic Assistance No. 10.727) since 2023. Currently, the city is working with the UDSA program staff on the project's implementation.

The City's past performance included the Energy Efficiency and conservation grant (CFDA 81.128, Funding Opportunity Number DE-FOA-0002882) from the federal Department of Energy, upgrading the citywide LED traffic signals.

The City's Public Works also successfully managed and implemented the Safe Route 4 All grant (CFDA 20.939, Funding Opportunity # DOT-SS4A-FY22-01) from the federal Department of Transportation, implementing the city's SS4A Safety Action Plan.

The City's Engineering division's capital improvement program successfully managed and implemented the East Downtown Concord PDA Access & Safe Routes to Transit Project and Monument Boulevard Class I Path Project. Fund and project details are listed below.

CC-210003 is City Project No. 2457 – Federal Aid Project No. STPL-5135(063) East Downtown Concord PDA Access & Safe Routes to Transit Project. Funding is STP OBAG 2 Quickstrike Funds (\$2,164,000 Total for Construction). Funding is provided by the Federal Highway Administration ("FHWA") grants through the San Francisco Metropolitan Transportation Commission ("MTC"). MTC point of contact is Thomas Arndt at 415-820-7983, or [tarndt@bayareametro.gov](mailto:tarndt@bayareametro.gov).

CC-170039 is City Project No. 2455 – Federal Aid Project No. CML-5135(059) Monument Blvd Class I Path. Funding is CMAQ OBAG 2 Funds (\$4,368,000 Total for Preliminary Engineering and Construction). Funding is provided by the Federal Highway Administration ("FHWA") grants through the San Francisco Metropolitan Transportation Commission ("MTC"). MTC point of contact is Mallory Atkinson, Associate Funding Analyst, at 415-778-6793.

The City of Concord's successful grant program/project management is a result of working closely with all stakeholders including the grantors (federal and state agencies), the city's elected officials, the communities, other city departments (Finance and Public Works), the contractors, and others. Our staff's expertise, dedication, and professionalism also contribute to their success.

## **b. Reporting Requirements**

The City of Concord's project team shall follow the EPA grand agreement guidelines on all reporting requirements such as programmatic progress reports, financial reports, community engagement reports, semi-annual reports (including reports on quantified benefits to low-income and disadvantaged communities), and the final project report.

## **c. Staff Expertise**

The city's Community Development Department's engineering capital improvement program has a team of California State Board certified professional engineers with experience implementing federal and state grant programs/projects, to support this project.

*Ken Yee, Facilities Maintenance Manager with the City of Concord, certified LEED AP O+M, MBA, with extensive experience administrating and managing various federal, state and local grant programs and project deliveries with the City and County of San Francisco's Municipal Transportation Agency, the Human Services Agency, and the Department of Environment, will be the project manager. City staff have direct and in-depth knowledge and experience in administrating, managing, and executing federal and state grant-funded programs and projects.*

*Past grant and project management experience included direct participation and management of the Federal Transit Administration New Starts (Section 5309) and Federal Highway Administration Congestion Mitigation and Air Quality ("CMAQ") programs' funding for the San Francisco Municipal Transportation Agency's ("the SFMTA") Central Subway Phase 2 project real estate acquisition and relocation. Other experience included supervising and coordinating the work of subordinated staff, consultants, and contractors on various city projects, including the land acquisition for the SFMTA Islais Creek Motor Coach facility, funded through the Federal Transit Administration, Section 5309, Bus and Bus Facilities under the State of Good Repair Initiative. Additional experience included supervising and coordinating the work of subordinated staff, consultants, and contractors on the SFMTA's Central Control and Communications (C3) Program's planning and construction, funded by the Federal Transit Administration's public transit grant programs.*

**7. BUDGET (OPTIONAL BUDGET SPREADSHEET AND UP TO 10 ADDITIONAL PAGES MAY BE ADDED IF NEEDED AS AN APPENDIX TO THE WORKPLAN)**

**a. Budget Detail**

Budget Categories – Budget spreadsheet is attached in the application.

i.	<u>Personnel</u>	\$1,976,252.00
ii.	<u>Fringe Benefits</u>	\$953,146.00
iii.	<u>Travel</u>	\$1,675.00
iv.	<u>Equipment</u>	\$250.00
v.	<u>Supplies</u>	\$0.00
vi.	<u>Contractual</u>	\$23,848,208.00
vii.	<u>Other</u>	\$15,000.00
viii.	<u>Indirect Charges</u>	\$1,171,759.00
ix.	<u>Grant Total:</u>	\$27,966,290.00

See attached proposed budget for details.

**b. Expenditure of Awarded Funds**

*Once the EPA grant and financial agreements are finalized and executed, the city project staff shall seek the City Council's acceptance and approval.*

*The EPA grant funds will be deposited into a special account for the project's exclusive uses. Project manager, grant administrator, project support and accounting staff shall review and check for accuracies and completeness of invoices, documentations, and signoff by appropriate parties. Project manager and finance manager shall then authorize the payments to the contractors per*

*the contract terms and conditions. Grant administrator and the project manager shall compile and approve all required reports and financial audits prior to submission to the EPA grant program staff.*

*The post award phase comprises a significant amount of work over the duration of the award dates, which includes implementing the grant, reporting progress, and completing the closeout requirements. The city's project team shall work with the EPA grant program staff on full compliance with the grant terms and conditions. We shall faithfully and diligently carry out the grant program.*

### **c. Reasonableness of Costs**

*The City of Concord's application and proposed budget used the following in its itemized personnel cost calculations:*

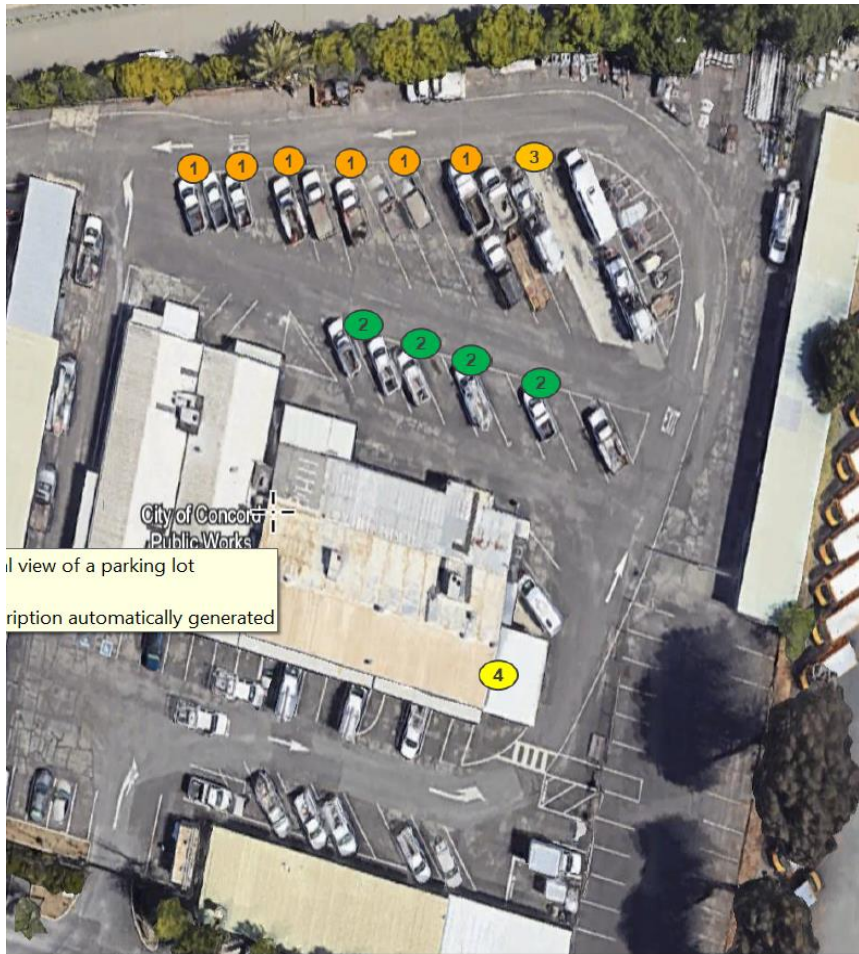
- 1. City of Concord's latest salary schedule of selected classifications.*
- 2. City of Concord's latest fringe benefit rates for selected classifications.*

*The City of Concord's application and total proposed budget included 95.81% in direct cost and 4.19% in indirect cost.*

*Construction/installation contractor is to be procured through a design-bid-build delivery in a low-bid selection approach. The city's Finance Purchasing division shall administrate and monitor the procurement standards and practices. In determining the "lowest responsive, responsible bidder," the city will apply the best value concept. Criteria for determining low bids shall include, but not limited to, the following:*

- The ability, capacity, and skill of the bidder to perform the contract or provide the supplies, services, or equipment required.*
- The ability of the bidder to provide the supplies, services, or equipment promptly or within the time specified without delay or interference.*
- The character, integrity, reputation, judgment, experience, and efficiency of the bidder*
- The quality of the bidder's performance on previous purchases or contracts with the City*
- The ability of the bidder to provide future maintenance, repair, parts, and services for the use of the supplies purchased.*

*Direct cost is calculated based on one of the local vendor's<sup>\*18</sup> rough-order-of-magnitude ("ROM") proposals of 390kW solar carport without the battery component of the micro-grid. See the below attached +InCharge Energy proposal for reference and details. The project's proposals are of higher capacity units of 1MW with battery capacity. Three of the four facilities also provide public access to electric vehicle ("EV") charging stations in addition to the city's electric fleet.*



- 1 Dual 19.2 AC Charger
- 2 30KW DC Charger
- 3 120KW+ DC Charger
- 4 Electrical Panel

Solar canopies will be covering vehicles in parking area.



#### In-Charge Energy, Inc.

1433 Fifth Street  
Santa Monica, CA 90401  
818-697-4638  
833-772-GOEV toll free  
[sales@inchargeus.com](mailto:sales@inchargeus.com)

Date: 2/13/2024  
Proposal #: BWE011823-1  
Created by: Brent Elliott  
Phone: 714-404-8192  
email: [Brent.elliott@inchargeus.com](mailto:Brent.elliott@inchargeus.com)

#### CUSTOMER INFO

Company Name: City of Concord  
Street Address: 1455 Gasoline Alley  
City, State, Zip: Concord, CA, 94520  
Contact: Craig Blythe  
Customer Phone: 925-671-3141  
Email: [craig.blythe@cityofconcord.com](mailto:craig.blythe@cityofconcord.com)

#### SITE (SHIP TO) INFO

Site Name: City of Concord  
Site Street Address: 1455 Gasoline Alley  
City, State, Zip: Concord, CA, 94520  
Contact: Craig Blythe  
Customer Phone: 925-671-3141  
Email: [craig.blythe@cityofconcord.com](mailto:craig.blythe@cityofconcord.com)

#### SCOPE OF SERVICE AND BILL OF MATERIAL:

##### Scope:

- 390kw solar carport/canopy
- 800A 277/480 switchgear
- 150kva stepdown transformer.
- 400A 120/208v panelboard.
- (1) 120kw DCFC
- (4) 30kw DCFC
- (6) 80A L2 chargers

##### Exclusions/ Site Specific Conditions:

- Unforeseen conditions
- Striping asphalt
- Load study

\*ROM budget. For discussionary purposes only

\*This proposal excludes any/all material/labor for the service entrance which includes but is not limited to feeder conduits/wire, exterior equipment for the service, drawings/Engineering, permitting and civil work.

##### Exclusions:

- Utility fees
- Primary/Secondary service feed
- Utility poles
- Utility transformer
- Unforeseen conditions

\*Proposal assumes new service location is accepted by utility. Additional cost will be determined once utility company provides their SOW.

\*The current market for commodities is very volatile. All copper, aluminum, PVC, and steel pricing is based on current market pricing for commodity materials as of the date of this proposal, and no contingency is carried for commodities market pricing escalation. Additional costs will apply in the event of market-based commodity materials pricing escalation. Pricing is valid for 30 days from the date listed on the proposal.

PART NUMBER	QTY	DESCRIPTION	PRICE EACH	EXT. PRICE
SVS-ENG-PM	1	Design Engineering, Drawings, Permit Fees, Project Management, Mobilization	\$ 100,237.50	\$ 100,237.50
EQ-GRD-PNL-TRD	1	Electrical Distribution Upgrades, (Utility Fees, Switchgear, Panels, Transformers)	\$ 3,037,024.43	\$ 3,037,024.43
INST-CIVIL-SW	1	Civil site work, trenching, concrete bases, pavement, core drilling, backfill, restore	\$ 154,223.44	\$ 154,223.44
INST-CIR-CW	1	Electrical construction work, installation of conduit/wiring for chargers and equip	\$ 138,715.16	\$ 138,715.16
INST-CUSTOM	1	EV Charger installation, assembly, startup and commissioning	\$ 20,270.25	\$ 20,270.25
INST-SAF-INS	1	Site Safety item installation, protective bollards, signage, striping	\$ 22,687.50	\$ 22,687.50
INST-CUSTOM	11	Final Commissioning	\$ 1,500.00	\$ 16,500.00
SUBTOTAL OF ALL SERVICES				\$ 3,489,658.27
Budget TOTAL:				\$ 3,489,658.27



## **Reference:**

- <sup>\*1</sup> California Public Utilities Commission Agenda ID#21141; 12/15/2022  
<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M499/K921/499921246.PDF>
- <sup>\*2</sup> Clean Energy, Volume 6, Issue 3, June 20022, Pages 476-483  
<https://academic.oup.com/ce/article/6/3/476/6606003>
- <sup>\*3</sup> The Intergovernmental Panel on Climate Change – Climate Change 2023 Synthesis Report  
[https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC\\_AR6\\_SYR\\_LongerReport.pdf](https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_LongerReport.pdf)
- <sup>\*4</sup> EPA Greenhouse Gas Equivalencies Calculator  
<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results>
- <sup>\*5</sup> Columbia Climate School – Climate, Earth, and Society – State of the Planet  
<https://news.climate.columbia.edu/2022/10/26/solar-panels-reduce-co2-emissions-more-per-acre-than-trees-and-much-more-than-corn-ethanol/>
- <sup>\*6</sup> RystadEnergy – Coal Usage and Emissions in the Global Power Sector to Peak in 2023  
<https://www.rystadenergy.com/news/coal-power-peak-solar-wind-emissions>
- <sup>\*7</sup> U.S. Energy Information Administration – Solar Energy and the Environment  
<https://www.eia.gov/energyexplained/solar/solar-energy-and-the-environment.php>
- <sup>\*8</sup> Sky Stream Energy – How much electricity does 1 MW solar plant produce?  
<https://www.skystreamenergy.com/how-much-money-can-a-1-megawatt-solar-farm-make/>
- <sup>\*9</sup> Deloitte Insights; Climate equity -  
<https://www2.deloitte.com/us/en/insights/topics/strategy/climate-change-equity.html>
- <sup>\*10</sup> Justice40 at EPA  
<https://www.epa.gov/environmentaljustice/justice40-epa#Engagement>
- <sup>\*11</sup> Community Outreach and Solar Equity  
CleanEnergy States Alliance; February, 2021  
<https://www.cesa.org/wp-content/uploads/Community-Outreach-and-Solar-Equity.pdf>
- <sup>\*12</sup> U.S. Energy – Community Solar Best Practices Guide  
<https://www.energy.gov/communitysolar/community-solar-best-practices-guide-developing-projects-meaningful-benefits>
- <sup>\*13</sup> U.S. Energy and Employment Jobs Report (USEER)  
<https://www.energy.gov/policy/us-energy-employment-jobs-report-useer>  
<https://www.energy.gov/sites/default/files/2023-06/2023%20USEER%20EXEC%20SUMM-v2.pdf>
- <sup>\*14</sup> National Renewable Energy Laboratory PVWatts Calculator  
<https://pvwatts.nrel.gov/pvwatts.php>



*\*<sup>15</sup> U.S. Energy Information Administration – Electricity and the Environment*  
<https://www.eia.gov/energyexplained/electricity/electricity-and-the-environment.php>

*\*<sup>16</sup> World Nuclear Association – WNA Report – Comparison of Lifecycle Greenhouse Gas Emissions of Various Electricity Generation Sources*  
[https://www.world-nuclear.org/uploadedFiles/org/WNA/Publications/Working\\_Group\\_Reports/comparison\\_of\\_life\\_cycle.pdf](https://www.world-nuclear.org/uploadedFiles/org/WNA/Publications/Working_Group_Reports/comparison_of_life_cycle.pdf)

*\*<sup>17</sup> OYA Renewables – Solar Panel Life Cycle Analysis Proves Sustainability*  
<https://oyarenewables.com/resources/solar-panel-life-cycle-analysis-proves-sustainability/>

*\*<sup>18</sup> +InCharge Energy*  
<https://inchargeus.com/>