Comprehensive Energy Analysis

Guaranteed Energy and Water Savings Program
City of Milpitas

October 6, 2020

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City of Milpitas Guaranteed Energy and Water Savings Program

Revision 3
October 06, 2020

Submitted to:

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1. Executive Summary

ENGIE Services U.S. (ENGIE) is pleased to present this Comprehensive Energy Analysis (CEA) report to the City of Milpitas (City). The comprehensive energy and water program outlined within this report includes both efficiency and renewable measures and represents the best ways to decrease water and energy consumption and reduce reliance on energy from the grid.

1.1. Program Strategy: City of Milpitas

ENGIE appreciates the valuable input the City has provided through meetings, site walks, data requests, and supplemental information as we designed this comprehensive energy and water savings program to align with key goals across the City. These key goals included reducing energy and water consumption, peak energy demands, and maintenance and operations costs to the City; expanding the City's use of renewable energy and storage; working via a turn-key design-build approach to improve City infrastructure; and garnering positive public recognition. Throughout the audit process, these goals were front and center, as we worked to design an innovative, paid-from-savings partnership that will help the City of Milpitas become more efficient, sustainable, responsive, and resilient.

Table 1. Energy Conservation Measure (ECM) Summary Matrix

Description	Solar PV	EV Chargers	Battery Storage/ Resiliency	High Efficiency Transformers	LED Lighting (Interior/Exterior, Parks, Sports, Streetlights)	HVAC Upgrades	EMS Upgrades	Facilities Water Retrofits	Water Meters Upgrades	SCADA, Pumping, and Automated Disinfection
City Hall	x	x	x	x	x	x		x		
Public Works Corp Yard and Vehicle Shop Police Department	x	x	x	x	x	x	x	x		
Community Center	x		x		x	x [×]		x		
Senior Center	x	x	x		x			x		
Sports Center Complex	x	x		x	x	x		x		
Library Parking Garage					x					
Fire Station No.1 Main Fire Admin Fire Training Center			x		x	x		x		
Fire Station No. 3					x	x		x		
Fire Station No. 4					x	x		x		
Pumping Stations					x					x

Description	Solar PV	EV Chargers	Battery Storage/ Resiliency	High Efficiency Transformers	LED Lighting (Interior/Exterior, Parks, Sports, Streetlights)	HVAC Upgrades	EMS Upgrades	Facilities Water Retrofits	Water Meters Upgrades	SCADA, Pumping, and Automated Disinfection
PRVs										o
City-wide					x *			x	x	x

Legend:

x = Included in proposal

o = Not included in proposal, could be handled within an allowance

* = Sports Lighting included for Cardoza (baseball and softball), Hall Memorial (soccer), and Dixon Landing parks

ˣ = Includes ductwork replacements for AC-2 and AC-7

The checked boxes in the above table are measures we have included in our CEA report. Our study revealed opportunities to use energy and water more efficiently and expand the use of renewable energy across multiple City facilities, strengthening the City's long-term fiscal position and sustainability while simultaneously engaging the community and showcasing an innovative approach to improving City infrastructure.

We used three main criteria to help guide whether a measure should be included for recommendation:

1) Technical feasibility: we evaluated whether a proposed measure could be safely and effectively installed without incurring significant costs or requiring infrastructure upgrades beyond what would be typically expected. In addition, we evaluated whether the proposed measure would be able to operate as intended for the duration of its expected lifetime. For example, ECMs at Fire Station No. 2 were removed from the scope of work due to the station's planned demolition.

2) Critical needs: we incorporated City staff feedback on what they identified as critical infrastructure, technology, and operational needs to help evaluate ECMs. Some ECMs are recommended for inclusion because they will help the City of Milpitas become more resilient, safe, comfortable, and efficient, aligning with Council and Staff priorities. ECMs that were included for recommendation as a critical need include SCADA and battery storage for backup power.

3) Financial payback: we evaluated measures based on their costs and projected energy, water, and operational savings. While we did not use a hard and fast metric for payback, we were able to eliminate measures for recommendation where costs far exceeded savings and were not deemed a critical need. One example of this is the rooftop solar at the library parking garage. This ECM was removed from the scope due to the ECM requiring significant PG&E upgrades that would far exceed any projected savings.

During our detailed evaluation, some of the sites and measures initially proposed in the preliminary CEA were not included in our final analysis. We have included some of these details in Appendix A. Further, we have grouped recommended measures into various bundles that we refer to as Bundles A, B, C, and

D. Bundle C has been split into C1 and C2 due to availability of funds and City priorities. Each of these bundles contain related measures as follows:

Bundle A: facility water retrofits, water meter AMI retrofits, and SCADA

Bundle B: LED lighting retrofits (for facilities, parks, streets and sports)

Bundle C: solar PV, battery storage/microgrids, and EV chargers. C1 puts these measures at the Senior Center and Community Center. C2 puts them at Public Works, Sports Center, and City Hall.

Bundle D: HVAC, EMS, and transformer upgrades

1.2. Program Savings Impact, Scope & Financials

1.2.1. Savings Impact

ENGIE congratulates the City for its continued commitment to fiscal and environmental sustainability. This comprehensive program will showcase the City as a responsible and innovative steward of the community's assets. By installing the proposed lighting, mechanical, water, and solar photovoltaics (PV) systems highlighted in this report, the City will conserve over 5,800,000 kWh of electricity per year, providing savings to the general fund while hedging against future energy and utility price increases. According to PG&E's Emission Factors and the EPA's Greenhouse Gas (GHG) Equivalencies Calculator, the annual energy savings of this project can be equated to the reduction of either of the following:

- GHG emissions of nearly 900 passenger vehicles
- Carbon sequestered by over 5,400 acres of U.S. forests in one year

Additionally, the City stands to save more than $1,800,000 in energy and water costs per year and over $690,000 in maintenance costs. Net of a typical financing approach, the City will realize substantial annual savings without any upfront costs.

1.2.2. Scope

ENGIE focused the program development effort, refined recommendations, and established project priorities according to our discussions with City staff. The CEA report includes five solar PV systems, up to six battery storage systems, high efficiency transformers, LED lighting retrofits, HVAC and energy management system (EMS) upgrades, water meter replacements, water conservation measures, and SCADA implementation. Table 2 summarizes these projects and the associated savings.

Table 2. City of Milpitas CEA Savings Summary

ECM #	Description	Annual Energy/Water Cost Savings	Annual Maintenance Cost Savings	Projected Incentives
1	Solar Net Energy Metering (NEM)	$289,156	N/A	
2	Battery Storage	$37,532	N/A	$1,915,350
3	Transformer Upgrades	$23,110	N/A	
4	EV Chargers	N/A	N/A	
5	Interior + Exterior Lighting	$239,940	$80,396	
6	Streetlights	$324,318	$52,125	
7	Sports Lighting	$11,627	$2,625	
8	Park Lighting	$38,201	$7,729	
9	HVAC Upgrades	$5,754	$81,930	
10	EMS Upgrades	N/A	$8,320	
11	Irrigation Controls	N/A	N/A	
12	Water Fixture Upgrades	$31,282	$1,090	
13	Water Meter Upgrades	$681,871	$416,000	$1,091,790
14	SCADA, Pumping, and Automated Dosing	$146,612	$41,600	
15	Continuous Monitoring	N/A	N/A	
TOTAL		**$1,829,403**	**$691,815**	**$3,007,140**

Later in this document, in Section 5.3, we include example pro-formas for an optimized package of measures that strikes a balance between City priorities and maximizing first-year savings.

As presented, the entire comprehensive package and the optimized bundle of measures has enough energy, water, and maintenance savings to outweigh any capital or financing costs in year one and over the life of the measures. Later in this document, we outline options to fund the program. ENGIE does not act as a municipal advisor but can facilitate financial option review and has assisted with the solicitation process. In partnership with City staff, ENGIE is prepared to present the findings to the City Council in accordance with City business objectives and standards.

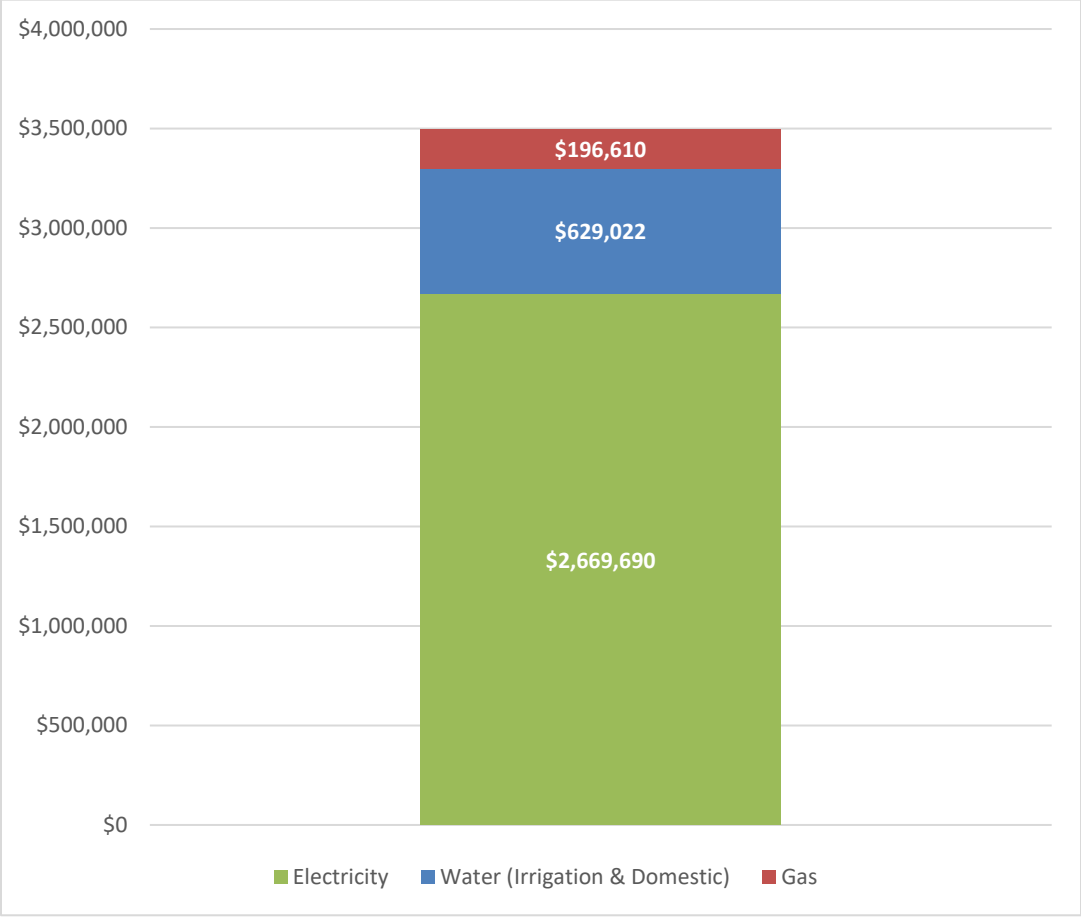
2. Utility Analysis

This section of the CEA documents and discusses the City of Milpitas's electricity, natural gas, and water use. Our analysis of existing utility usage forms the basis for conservation recommendations. The following data is included in this section:

1. Historical electricity usage and cost information
2. Historical natural gas usage and cost information
3. Historical water usage and cost information

The City of Milpitas provided ENGIE access to all available historical utility usage and cost data. This data was reviewed for completeness, reorganized into a format that is easy to use and understand, and analyzed for historical trends. The data was used to develop utility usage profiles per account, total energy usage for the City of Milpitas, and unit costs for each utility. The baselines that follow were developed by evaluating the annual usage for each type of utility.

Figure 1. Annual City Utility Expenses



2.1. Electricity

ENGIE received utility data history from Pacific Gas & Electric (PG&E) and Silicon Valley Clean Energy (SVCE) from 2018 and 2019. Table 4 shows the main electric meters and accounts that were included in the analysis.

Table 3. Electric Meters and Accounts Included in Utility Analysis

Address	Description	Account SAID#	Meter #	Rate	Electrical Consumption (kWh)	Dollars Per Year
455 East Calaveras Blvd	City Hall	2637174597	1010252574	A-10-B	1,564,487	$311,796
1265 North Milpitas Blvd	Public Works, Corp Yard, Vehicle Shop, Police Department	2637174111	1010024817	E-19-S	1,842,143	$305,853
457 East Calaveras Blvd	Community Center	2636559012	1010249154	A-10-A	156,475	$38,675
40 North Milpitas Blvd	Senior Center	3076453385	1010124977	A-1-A	265,799	$62,751
1325 East Calaveras Blvd	Sports Center Complex	2637174186 9699211830 2637174770 263717449	1010238909 1010085700 1009889477 1010002058	NEM E-19-S NEM A-6 NEM A-6 A-ST-S	336,718 131,115 85,404 0	$124,141 $29,212 $18,985 $703
160 N Main Street	Library Parking Garage	9945958031 9949177615	1010124979 1009568669	A-10-A A-1-B	192,201 8,949	$38,984 $2,268
777 South Main Street	Fire Station No.1 Main Fire Admin	2636180897 2637174118	1010249156 1006709151	A-10-A A-1-B	173,376 28,700	$37,304 $6,958
1263 Yosemite Dr.	Fire Station No. 2	2639561577	1010245866	A-6	51,340	$13,495
45 Midwick Dr.	Fire Station No. 3	2637174356	1008832236	A-6	40,081	$11,019
775 Barber Lane	Fire Station No. 4	2637174886	5000111523	A-6	41,364	$10,872
Kennedy Dr.	Cardoza Park	2637174964	1010091118	A-6	39,739	$9,317
TOTAL					**4,957,891**	**$1,022,333**

Figures 2 and 3 show the monthly electric consumption for 2018-2019.

Figure 2. Monthly Electricity Consumption – Large Meters

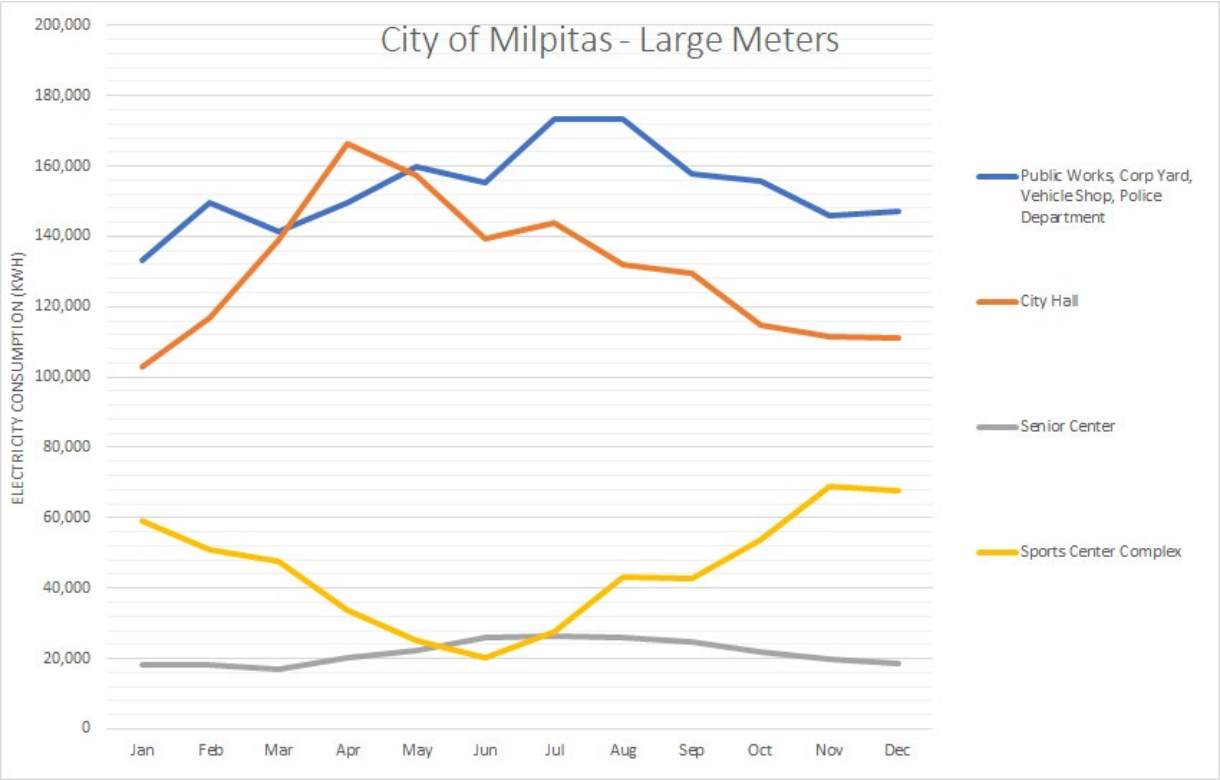
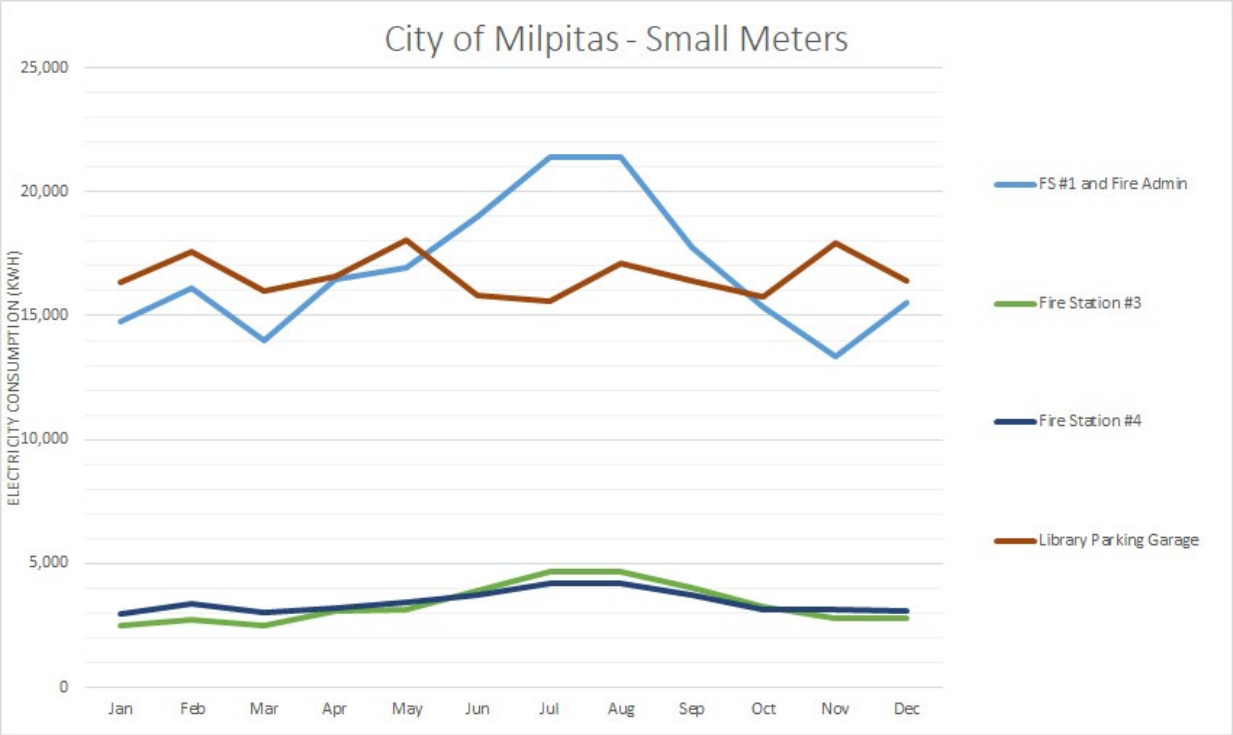


Figure 3. Monthly Electricity Consumption – Small Meters



2.2. Natural Gas

ENGIE received natural gas utility data history from PG&E and The Association of Bay Area Governments (ABAG) from 2018 and 2019. Table 5 shows the main gas meters and accounts that were included in the analysis.

Table 4. Gas Meters and Accounts Included in Utility Analysis

Address	Description	Account SAID#	Meter #	Rate	Gas Consumption (Therms/yr)	Dollars Per Year
1265 North Milpitas Blvd	Public Works, Corp Yard, Vehicle Shop, Police Department	6866163053, 6907829717	45005345, 44813054	GNR1	58,757	$63,886
455 East Calaveras Blvd	City Hall	5823673248	54049721	GNR1	33,946*	$34,160*
457 East Calaveras Blvd	Community Center	5740339920	002838A	GNR1	2,967	$4,004
40 North Milpitas Blvd	Senior Center	7318172437	60836494	GNR1	2,437	$3,073
777 South Main Street	Fire Station No.1 Main Fire Admin	6584551011	46300804	GNR1	6,700	$8,875
1263 Yosemite Drive	Fire Station No. 2	7282444687	61448793	GNR1	1,347	$1,886
45 Midwick Drive	Fire Station No. 3	9490697568	50138352	GNR1	1,574*	$2,002*
775 Barber Lane	Fire Station No. 4	6122456562	29647607	GNR1	2,533	$3,488
1325 E Calaveras	Sports Center	9900277988	Not Available	GNR1	76,776	$75,236
TOTAL					**187,037**	**$196,610**

*Based on 2017-2018 usage due to incomplete 2018-2019 data

2.3. Water

ENGIE received water data history from the City of Milpitas from 2017 and 2018. Table 6 shows the City's annual irrigation and domestic water usage. The City provided 94 irrigation and 42 domestic water accounts. Some accounts did not include 365 days of usage but are still included in the table below.

Table 5. Water Accounts Included in Utility Analysis

Description	Rate	Water Consumption (CCF)	Dollars Per Year
Irrigation	ICP	119,479	$612,927
Domestic	WCITY	82,567	$16,095
TOTAL		**202,046**	**$629,022**

3. Energy Conservation Measures

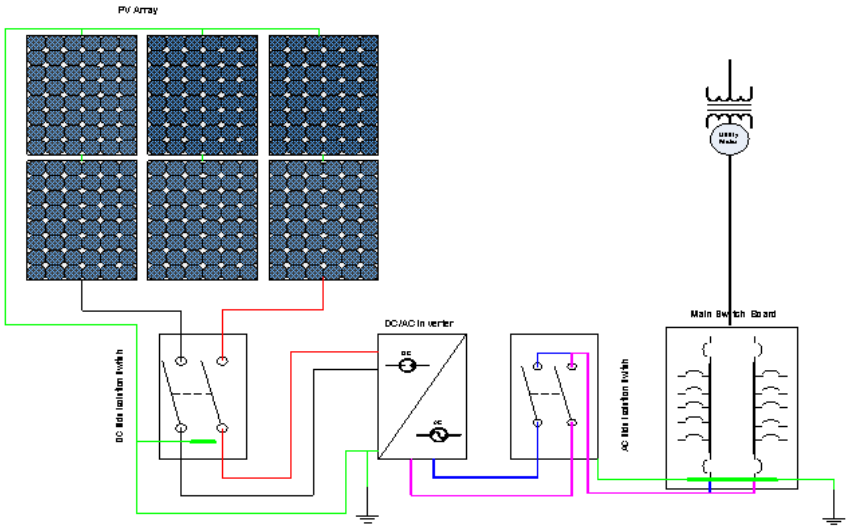
This comprehensive program has been developed to meet the technical, operational, and financial goals of the City. Various system configurations and technologies have been evaluated for cost-effectiveness and technical consistency with the City's objectives.

The proposed scope of energy and water efficiency measures and renewable energy locations were identified by ENGIE after analyzing multiple system arrangements, system sizing alternatives, and additional savings streams. ENGIE greatly appreciates the City's contributions to date to help refine the program scope: time spent on site walks and meetings, answers to questions, and overall dedication to the project development process.

3.1. ECM 1: Solar Photovoltaic Power Generation

A PV system converts sunlight directly to electricity. A typical system consists of arrays of PV modules (panels), electrical conversion equipment (inverters), electrical distribution equipment, and monitoring equipment.

Figure 4. General Photovoltaic System Schematic



3.1.1. PV Module

A PV array is best mounted in an area of good solar exposure. Shading of the modules impacts production and must be avoided. The PV modules in the array are typically mounted on rack structures which support them at a low angle of tilt, oriented to optimize production and revenue based on utility rate structures. Modules are connected in a series – a "string" – to produce near 1,000 volts (at their maximum power point). Several strings are tied together in parallel and connected to an inverter.

3.1.2. Inverter

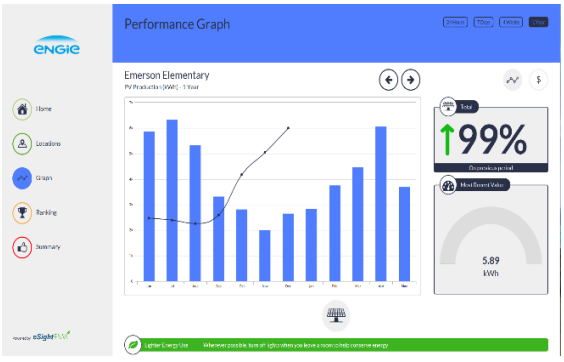
The inverter converts the variable direct current (DC) electricity produced by the PV modules to common alternating current (AC), which is the standard form of utility-provided electricity. It contains sophisticated control logic to maximize the solar output and to synchronize the AC output with the grid to which it is connected. In the event the utility power fails, the PV inverter will immediately disconnect the PV system – this is a key safety requirement by the utility company. Upon restoration of utility power, the inverter will be delayed for a preset period, and then automatically reconnect.

3.1.3. Monitoring Equipment

ENGIE provides a program that collects data into a format that is easily accessible to the City of Milpitas. ENGIE provides a user-friendly, web-based dashboard whereby City staff can view details about the PV system, track the instantaneous system performance, and pull tailored reports as required. This information can also be provided to community members and stakeholders to demonstrate the facility's sustainability features.

Figure 5. Overview Screen

Figure 6. Technical User Dashboard



3.1.4. Solar Benefits

- Local electricity production – Reduce the amount of energy purchased from local utility by adding more on-site solar PV production
- Equity across City sites – Expand the use of solar energy across facilities
- Environmental stewardship
- Positive public recognition
- Shade for parked cars with canopy structures
- Hedge against increasing electric rates

3.1.5. Net Energy Metering (NEM) Solar PV

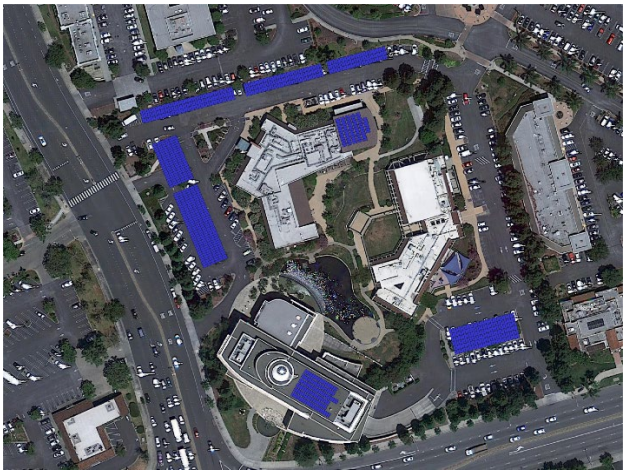
As part of the comprehensive energy analysis, ENGIE surveyed the City of Milpitas for renewable energy opportunities. The City has existing solar PV at the Milpitas Sports Center, but it does not currently offset the entire load of the facility. After site walks and review of site energy usage, ENGIE determined four sites for additional solar PV. Each solar PV system is designed to offset as much of the facility's electric usage with clean, renewable, on-site generation as we can reasonably fit at each site, under the utility's Net Energy Metering (NEM) rates.

A summary of the sites, proposed systems, and associated benefits are shown below in Table 7. The Bundle C ECMs of Solar PV, Battery Storage/ Resiliency, EV Chargers, were divided into C1 and C2 per City staff request, with C1 included in Group 1 (higher priority sites) and C2 in a future Group 2. C1 includes the Senior Center and the Community Center, and C2 includes the City Hall, Public Works/ Police Dept, and the Sports Complex. Total costs are estimated at $6.11MM with a simple payback of 21 years. The solar systems listed below have been designed using the monthly data that was provided by PG&E and SVCE. ENGIE has analyzed the 15-minute interval data and the detailed load profiles to ensure the solar is adequately sized for each meter's consumption.

Table 6. ECM 1 Solar Photovoltaic NEM Summary

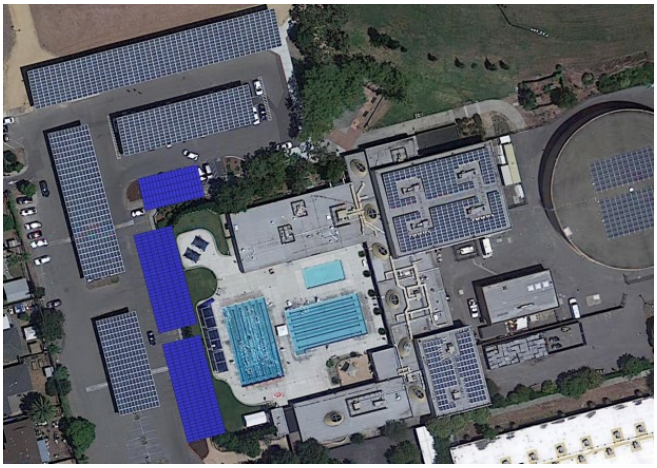
Site	Proposed System Type	System Size (kW DC)	Projected First Year kWh Generated	Projected First Year Cost Savings
City Hall (C2)	Canopy & Roof Mount	212	312,386	$43,471
Public Works, Corp Yard, Vehicle Shop, Police Department (C2)	Canopy	538	831,654	$100,852
Sports Center (C2)	Canopy	189	305,870	$65,521
Senior Center (C1)	Canopy & Roof Mount	137	213,126	$49,295
Community Center (C1)	Canopy	76	122,413	$30,017
TOTAL		**1,151**	**1,785,449**	**$289,156**

City Hall/ Senior Center/ Community Center



Public Works/Police Department/Corp Yard

City of Milpitas Sports Center



3.1.6. Design Considerations

Solar PV system design requires a multi-disciplinary review of each project site. Design considerations include the size and openness of the available area, existing structure or land use, potential shading of the panels, fire lanes, building code requirements, and ease of electrical interconnection. For rooftop and parking structure systems, an evaluation of the existing structure is performed to ensure the existing infrastructure can support a solar PV system. For all systems, existing electrical equipment is evaluated to determine the most cost-effective point of interconnection. ENGIE also considers impact on building usage, maintenance, accessibility, serviceability, and security. In addition to the general design considerations, each recommended solar PV system was optimized for existing site conditions, usage requirements, and where arrays would benefit City staff and residents the most. Site-specific considerations are described below.

City Hall, Community Center & Senior Center

The City Hall, Community Center, and Senior Center roofs were preliminarily evaluated (based on available drawings and roof reports) to ensure that they can adequately support the new systems without reinforcements. The City Hall and Senior Center roofs were recommended to include solar PV, and the Community Center roof was not recommended for solar PV. Additionally, existing roof equipment and its shading, as well as permitting setback requirements, were all taken into consideration to determine whether a cost-effective quantity of solar panels could fit into each proposed roof. ENGIE has coordinated with City staff regarding tree removal considerations to minimize shading on the proposed arrays while maintaining the site's aesthetics, minimizing removal of essential trees which define the site's character, and instituting an on-site tree replanting policy at a 2:1 rate. A thorough shading analysis has been performed to evaluate potential shading impacts on solar PV production. Additionally, extra tall carports (13'6" minimum clearance) are recommended at these sites to minimize shading from the tall perimeter trees and the tall City Hall building. ENGIE also had detailed conversations with City staff about the look of the solar arrays at this site, proposing additional decorative features to better align with the site's aesthetic design.

Public Works/Corp Yard

Extra tall carports are recommended at this site to accommodate truck or bus parking and access, as well as minimize shading. These carports have a 13'6" minimum clearance to provide adequate access to taller vehicles. A thorough shading analysis has also been performed to evaluate potential shading impacts from the two-story Public Works building on the adjacent parking canopies, and from tall surrounding trees. Any trees that need to be removed due to physical conflicts with the new arrays or shading concerns will also be replanted on-site at a 2:1 rate. Atrium solar was also considered, but ultimately not recommended due to prohibitive costs from required structural upgrades.

City of Milpitas Sports Center

The new solar PV system at the Sports Center is designed to offset the remaining energy consumption of the Sports Center that is not already offset from the existing solar PV system. The canopy option expands on the current site design, shading additional parking spots. Any trees that need to be removed due to physical conflicts with the new arrays or shading concerns will also be replanted on-site at a 2:1 rate.

3.1.7. Other Solar PV

During the CEA, ENGIE also identified three other sites with potential for more creative solar strategies, utilizing PG&E's Renewable Energy Self-Generation Bill Credit Transfer (RES-BCT) program. This included parking garage solar canopies at the Library and floating solar at two City parks. Ultimately, based on field findings and conversations with City staff, ENGIE is not recommending that the City move forward with these designs. More details on the initial designs that were proposed are outlined in Appendix A.

3.2. ECM 2: Battery Energy Storage System

ENGIE is the country's leading developer of turnkey distributed energy storage solutions with more than 88 MWh of Battery Energy Storage System (BESS) at over 170 sites deployed and in development. Our team consists of top energy storage industry experts who provide performance-based solutions to optimize the value of energy for our customers. ENGIE evaluates battery manufacturers based on their quality, performance, and pricing to provide the best BESS solutions to our customers.

3.2.1. BESS Benefits

- Reduced maximum demand each billing period – reduce electrical bills by substantially reducing the maximum non-coincidental and peak demands logged each month
- Environmental stewardship – reduce overall GHG emissions by reducing energy consumption during peak times of day when utilities typically bring the least efficient "peaker plants" online to meet high demand on the grid
- Positive public recognition
- Diversify the City's energy portfolio and hedge against increasing electric rates
- Provide electricity during utility power outages, allowing critical City services to continue operating with only minor disruptions.

The City of Milpitas has expressed strong interest in creating microgrids for their community. Due to increased utility unreliability, such as Public Safety Power Shutoff (PSPS) events, the availability of a microgrid is more valuable than ever. ENGIE has evaluated the City's facilities for microgrid opportunities. The BESS size and savings are dependent on analyzing the 15-minute demand load profile. Resiliency needs are critically beneficial for the city and community and yet difficult to represent financially due to the unpredictable nature of the resiliency backup timing and needs. Facilities on rates such as E-19 and A-10, with high demand charges, are the best candidates for financially recommended BESS systems, which include Public Works, City Hall and the Sports Center. These sites also have existing diesel generators that can work in conjunction with the BESS and solar PV during an outage to keep the facilities operating for an extended period of time.

Figure 7. BESS at another ENGIE Project

The Senior Center and Community Center have also been sized with BESS that can handle the site's demand profile to provide community resource centers during an outage. ENGIE also proposes the installation of a 100kW natural gas generator at each of these sites to provide an additional level of protection from outages. The BESS microgrid systems will provide resilient backup to benefit the city throughout any upcoming power outages.

The Sports Center poses a challenge with its existing Power Purchase Agreement (PPA) solar system. Without the load profile of the existing solar, ENGIE estimated the battery size using only the residual utility load, but this is not a complete picture of how the site utilizes electricity. Additionally, for a reliable and fully functioning microgrid, the resiliency controls must be able to curtail solar production to ensure continuous operation. Without these controls, if at any time during an outage the existing solar production exceeds the load that can be used by the site and battery combined, the battery would automatically trip, subsequently causing the PPA solar to trip as well and the site to lose power. To prevent this, the microgrid must be able to "tune down" solar production as needed, which cannot be accomplished with the older inverters installed as part of the PPA. Starting in 2021, the City would have the option to buyout

their solar PPA (more information on that in section 5 of the CEA), but before this happens, any modifications are not an option since the City does not own the system. If the City decides to buy it out, ENGIE could investigate the most cost-effective way to integrate controls to the existing system. Currently, ENGIE is unable to fully engineer and price this system due to all these unknowns, but preliminary sizing and savings are provided for the City's consideration.

Lastly, Fire Station No. 1 was evaluated for a BESS that can handle the site's demand profile and work in conjunction with its existing diesel generator to extend the site's critical operations during an outage, but without on site solar (due to sizing and shading constraints), this would not be as sustainable as the other microgrid options proposed.

The BESS controller monitors for facility load at the utility revenue meter through CT measurements on a second-by-second basis and communicates with the BESS to charge and discharge in response to offset peak demands and capitalize on Time-of-Use (TOU) energy cost differences. The BESS is used to reduce the highest demand peaks and peaks occurring during the highest cost periods encountered during a given billing cycle.

Table 8 below summarizes the BESS systems proposed for the City of Milpitas. These provide increased safety, security, and peace of mind with increased resiliency for the community and the City of Milpitas.

Table 7. ECM 2 BESS Summary

Site	System Size (kW)	Approximate System Duration (hours)	Projected Annual Cost Savings
Police Department/ Public Works	375	2	$14,049
City Hall	375	2	$8.028
Community Center	125	2	$250
Senior Center	125	2	$375
Sports Center	250	2	$8,697
Fire Station 1	125	2	$6,133
TOTAL	**1,375**		**$37,532**

Based on conversations with City staff, ENGIE recommends BESS for the Senior Center and Community Center as part of Bundle C1. The BESS for Public Works is recommended as part of Bundle C2. These systems meet a critical need of resiliency for the City, and total costs for these three systems are estimated at $4.69MM.

3.3. ECM 3: Transformer Upgrades

The scope of this ECM is to replace old, inefficient transformers with new, ultra-high efficiency transformers. While all facilities are unique, the electrical infrastructure is most likely based on industry standard transformers, typical of most facilities across the United States. Replacing the old, inefficient

transformers with state-of-the-art transformers yields substantial energy savings and renews a key component of the infrastructure that powers all connected equipment.

Low-voltage (<600 volts) electrical distribution transformers, which are located throughout the City of Milpitas facilities, play a key role in delivering electrical power to the building systems. Transformers are continuously powered in order to ensure that the equipment served by them has power available (whether they are turned on or not), consuming energy 24 hours per day, 7 days per week.

High efficiency transformers set new benchmarks for environmental protection, energy efficiency and reliability. Designed to provide the lowest life cycle cost, the high efficiency transformers go beyond the efficiency of standard off-the-shelf transformers, ensuring lower operating losses, providing superior performance, and reducing environmental impact. High efficiency transformer technology has proven to reduce electric losses and associated operating costs by approximately 60-80% compared to existing older inefficient transformers. This consequently reduces power drawn from generating stations resulting in less pollution and lower greenhouse gas emissions.

High efficiency transformers are designed and manufactured to fit within the existing footprint or constraints and are provided with custom lug termination configurations. They also have an environmental advantage in that they are produced with less manufacturing waste and also reduce hazardous materials. Custom design and manufacturing allow for faster installation, lowering labor costs. Additionally, high efficiency transformers' long life and dependable performance is backed up with an up to 32-year warranty from the manufacturer.

Working or learning environments can be degraded or disrupted when noisy transformers are located close to people. High efficiency transformers have embedded structural and acoustic treatments that combine to reduce ambient noise generated by the transformer.

A majority of today's building connected load is electronic in nature, indicating a need for transformers that are K-rated and UL-Listed per code. Replacing older inefficient distribution transformers with energy efficient transformers can also help bring existing code deficient distribution transformers up to code.

Total costs are estimated at $0.33MM with a simple payback of 14 years.

3.3.1. Transformer Replacement Benefits

- Expected loss reduction is 75% on average
- Decades of embedded energy savings without the need for upgrades, control systems, or building occupant behavior change
- Additional reduction in local air-conditioning load due to reduction in excessive heat from transformer energy losses
- Environmental benefits including greenhouse gas reduction
- Improved environment with noise reduction
- Removal of the end-of-life risk associated with the current old existing transformers
- An updated electrical foundation optimized for modern electronic equipment and loading conditions delivering both lower losses and higher power quality

Table 8. Transformer Replacement Summary

Site	Transformer Quantity	Projected kW Reduction	Projected Annual kWh Savings	Projected Annual Cost Savings
City Hall	5	5.42	47,403	$9,447
Public Works, Police Department	5	5.92	51,839	$8,607
Milpitas Sports Center	1	1.57	13,714	$5,056
TOTAL	**11**	**12.90**	**112,956**	**$23,110**

3.4. ECM 4: Electric Vehicle Charging

The City of Milpitas already has several electric vehicle (EV) charging stations installed at sites like City Hall and the Library Garage. As the costs of electric vehicles have decreased and the number of electric vehicles on the road has increased, the demand for EV charging stations accessible to City staff and the public has increased. To meet this demand and encourage the use of electric vehicles throughout the Bay Area, we recommended the installation of additional EV charging stations throughout the City.

Our scope proposes adding a total of eight dual port Level 2 charging stations plus 1 DC Fast Charger throughout the City, at the locations shown in Table 10 below. Bundle C1 includes the EV chargers at the Senior Center, and C2 includes the EV Chargers at City Hall, Public Works, and the Sports Center.

Table 9. EV Charging Summary

Site	Dual Port Level 2 Charging Stations	Single DC Fast Charging Station
City Hall	2	0
Senior Center	2	0
Public Works	2	0
Milpitas Sports Center	2	1
TOTAL	**8**	**1**

The eight dual-port, level-2 (high) charging stations are capable of an electrical output of 7.2 kW that can charge any type of electric vehicle. This provides the capacity for up to 16 concurrent charges across the four locations. Typical charging time is 3-4 hours per vehicle. The quantity per site was selected based on feedback from City staff.

The one DC Fast Charger was recommended by City staff to be added to the Milpitas Sports Center. The DC Fast Charger has a 62.5kW output that enables a typical electric car to be fully charged in 30 minutes rather than the 3-4 hours that is required for Level 2 charging.

This measure takes advantage of the new solar carports being proposed at City parking lots, coordinating the electrical conduit work required by both scopes to reduce costs when interconnecting the new charging stations into the existing electrical service at each site. Installation of the EV charging stations would also include commissioning, a 5-year software agreement with the provider, and a warranty program.

While EV charging stations increase the site's electricity consumption and demand, rather than reducing it, they encourage the use of electric vehicles and a reduction in GHG emissions and pollution throughout the City. The CEA analysis does not include any revenue streams from EV chargers.

Total implementation costs are estimated at $0.47 MM, and no payback is calculated due to there being no direct associated savings.

3.4.1. EV Charging Benefits

- Environmental stewardship

- Positive public recognition
- Encouraging City staff and residents to use electric vehicles

3.5. ECM 5: Facilities Lighting Upgrades

ENGIE has investigated the use of LED lighting technology for a variety of lighting applications. With the advancement of this technology, there is an opportunity to utilize LED lighting for office spaces, conference rooms, warehouses, multi-purpose rooms, exercise areas, pumping stations, parking lots, and other locations within City facilities for a comprehensive lighting upgrade. LED replacements will make an immediate difference and will be noticed with improved light coverage, light quality, efficiency, longevity, color rendering, nighttime safety, energy savings, and maintenance savings.

In addition to the main sites listed in the ECM Matrix (Table 1 of this report), facility lighting upgrades are also included for the pump stations shown below. Sunnyhills Turnout, Calaveras Turnout, and Main Street Turnout pumping stations do not have any lighting.

Table 10. Pumping Stations Included in Lighting Retrofits

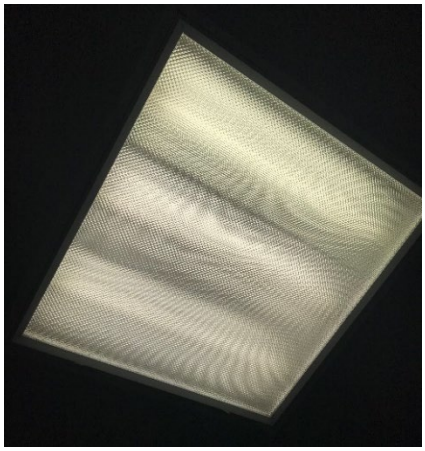
Site	Address
Jurgens Storm Pump Station	345 Jurgens Drive
Spence Creek Storm Pump Station	11 Butler Street
Penitencia Storm Pump Station	944 La Honda Drive
Milpitas Materials Storm Pump Station	1125 N. Milpitas Blvd
Abbott Storm Pump Station	1225 N. Abbott
California Circle Storm Pump Station	1735 California Circle
Berryessa Storm Pump Station	731 Folsom Circle
Murphy Ranch Storm Pump Station	801 Murphy Ranch Road
Bellew Storm Pump Station	481 Murphy Ranch Road
Oak Creek Storm Pump Station	1521 McCarthy Blvd
PD Sump Storm Pump Station	1275 N. Milpitas Blvd
Wrigley Ford Storm Pump Station	75 Marylinn Drive
Manor Storm Pump Station	349 Marylinn Drive
McCarthy Storm Pump Station	1001 N. McCarthy Blvd
Main Sewer Pump Station	1425 N. McCarthy Blvd
Venus Way Sewer Pump Station	1085 Venus Way
Gibraltar Turnout (2 adjacent) + G Reservoir	641 Gibraltar Court
Ayer Reservoirs	1429 E. Calaveras Blvd
Tularcitos Pump Station	1200 Tularcitos Drive
Country Club Station	1437 Country Club Drive
Minnis Tank	Launch Site Road

3.5.1. Interior LED Lighting Description

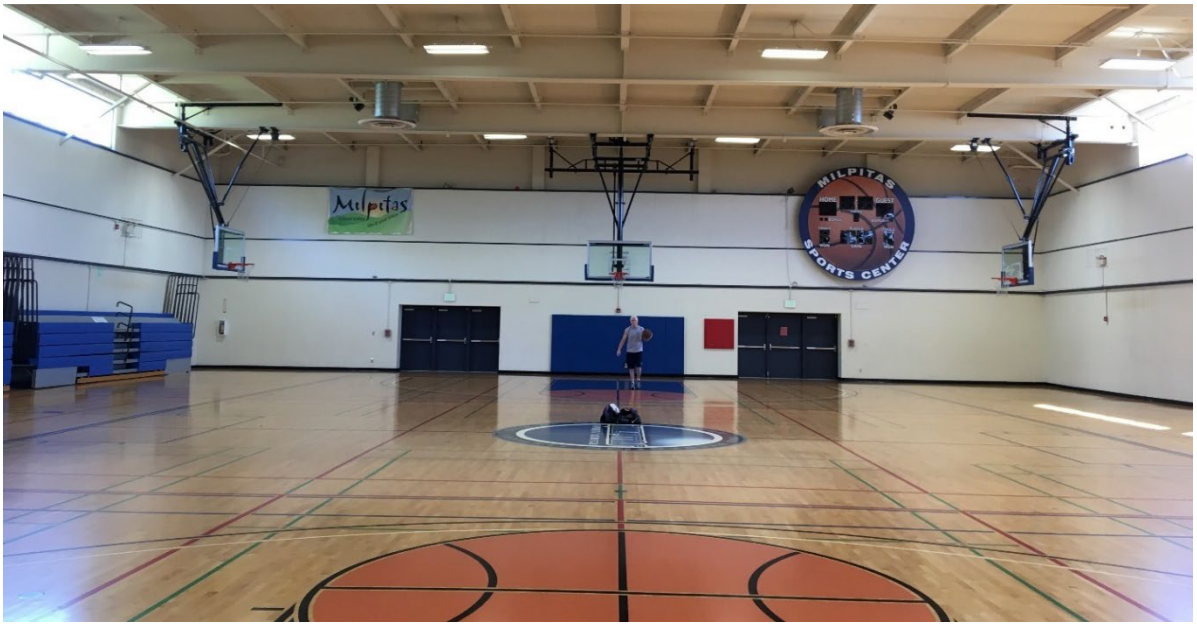
A detailed audit of City facilities revealed that the majority of the interior lighting consists of older generation 32-Watt T8 linear fluorescent lamps (with some older 34-Watt T12 linear fluorescents also present), recessed-can fixtures with screw-in and plug-in compact fluorescent and incandescent lamps of various wattages. Several T5 linear fluorescent fixtures were also present in the Milpitas City Hall, Community Center, Senior Center, Public Works, and Sports Center. Lighting technologies across facilities have been slowly upgraded over time, but there is still great potential to minimize consumption and maximize savings.

City Hall

Public Works/Police Department



Sports Center



The current interior T8 and T12 lighting applications have an estimated life of 20,000 to 24,000 hours. They are outdated and not very cost effective, with continuous intensive lamp maintenance, whereas LEDs will provide a life expectancy of 50,000 to 100,000 hours and up to a 10-year warranty depending on manufacturers. LED fixtures also have an environmental advantage in that they contain no mercury, produce less waste, and are made from fully recyclable materials.

The full site audit determined exact quantity and type of light fixtures across City facilities, as well as the appropriate retrofit for each scenario. Options ranged from simple tube replacements, to retrofit kits, and all the way to entirely new fixtures. ENGIE evaluated the application and cost effectiveness of each option, deciding along with City staff the best solution for specific areas. In general, ENGIE proposes converting all existing lighting to LEDs on a one-for-one basis, reusing existing structural attachments as appropriate. A few exceptions are not getting retrofits, in instances where there may not be viable LED solutions (for example, certain decorative sconces) or where LEDs are not the appropriate technology for the specific application (for example, stove top hoods which give out a lot of heat). ENGIE can also provide photometric analyses of select representative areas on an as-needed basis.

Replacing older lamp technology with LED technology will yield an average of approximately 50% energy savings, while significantly increasing the average lamp life and reducing maintenance costs associated with lamp replacement.

Additionally, LEDs have the advantage of minimal lumen depreciation, better optical efficiency, and high lumens per watt. LEDs are instant on and instant off so there is essentially no re-strike period.

3.5.2. Interior Lighting Efficiency Benefits

- Increased energy savings
- Environmental stewardship
- Improved light quality for interior spaces
- Improved lighting system reliability
- Reduced cooling needs due to lower thermal impact of LED lamps
- Reduced maintenance costs
- Reduced lamp and ballast stock requirements
- Reduced manufacturer component redundancy
- Reduced GHG emissions

3.5.3. Lighting Controls Description

ENGIE will also install control systems necessary to meet CA Title 24 energy codes and further energy savings, while also maintaining or increasing lighting functionality. Interior fixtures are currently primarily controlled by manual switches, with limited use of occupancy sensors for automatic shut-off of selected areas.

In most cases, the control strategy will include automatic operation of the lighting, considering the needs of the space's occupants as well as what is necessary to comply with mandatory energy codes. Control technologies usually refer to the type of device that will be used to carry out a specific strategy and what method the device will use to operate (passive infrared, ultrasonic or dual technology sensors, timers, daylighting controllers or lighting control panels).

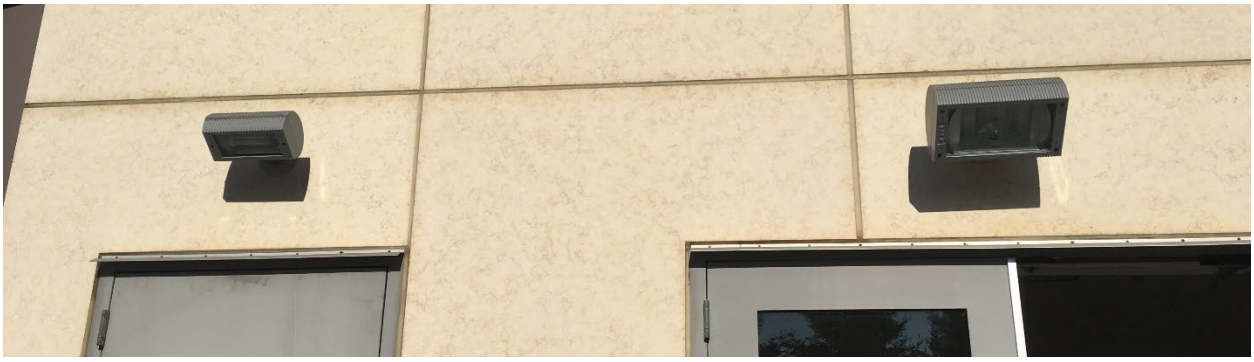
Some City locations already use interior occupancy controls, but many high use spaces currently lack lighting controls. To meet Title 24 requirements and reduce energy usage, as well as ensure that existing lighting functionality is maintained post-retrofit, the following will be installed as required in each office space, conference room, restroom, multipurpose room, exercise room, and other areas as applicable:

- **Occupancy Controls:** Switching lighting off and on in response to the occupancy of a space
- **Dimming Controls:** Continuously adjusting lighting levels to achieve desired lighting effects or appropriate light levels for different occupant activities

3.5.4. Exterior LED Lighting Description

A detailed audit of selected City facilities revealed that the majority of the City’s exterior fixtures consist of floods, wall packs, and canopy fixtures with metal halide, high pressure sodium, and CFL lamps around building perimeters, pathways, and general area lighting. The City also has several high intensity discharge pole-mounted fixtures in parking lots and driveways. Upgrading exterior lights with LED lighting will save energy, significantly increase lamp life, and reduce maintenance.

City Hall



Public Works/Police Department

The current exterior HID lighting applications have an estimated life of 20,000 hours. They are outdated and not very cost effective, with continuous intensive lamp maintenance, whereas LEDs will provide a life expectancy of 50,000 to 100,000 hours and up to a 10-year warranty depending on manufacturers. LED fixtures also have an environmental advantage in that they contain no mercury, produce less waste, and are made from fully recyclable materials. Additionally, LEDs have the advantage of minimal lumen depreciation, better optical efficiency, and high lumens per watt. LEDs are instant on and instant off so there is essentially no re-strike period.

A full site audit determined exact quantity and type of exterior light fixtures across City facilities, as well as the appropriate retrofit for each scenario. ENGIE evaluated the application and cost effectiveness of each option, deciding along with City staff the best options for specific areas. In general, ENGIE proposes converting all existing lighting to LEDs on a one-for-one basis, reusing existing structural attachments as appropriate. The only exceptions are lamps for which there are no viable LED solutions, and therefore no retrofit is proposed.

Exterior fixtures are mainly controlled by a photo sensor or digital timer. Further reduction in demand and operating hours can be achieved with integrated adaptive lighting controls that allow for lower light output after an area is unoccupied – when full brightness is no longer necessary. This “bi-level” strategy will also aid evening security with better light quality and alert personnel to areas that are turned on to full brightness in response to movement. Bi-level will also be installed as required to meet CA Title 24 energy codes.

3.5.5. Exterior Lighting Efficiency Benefits

- Increased energy savings
- Improved light quality for exterior spaces
- Improved safety of exterior areas
- Improved lighting system reliability
- Reduced maintenance cost
- Reduced lamp and ballast stock requirements
- Reduced manufacturer component redundancy
- Reduced GHG emissions

Table 12 summarizes the estimated savings and costs for the interior lighting efficiency upgrades proposed. These estimates were created using ENGIE’s experience, based on the buildings’ square footage and annual electricity usage, as well as data from similar, recent projects. Total costs for interior and exterior facilities lighting are estimated at $1.88MM with a simple payback period of 6 years.

Table 11. Interior and Exterior Facility Lighting Summary

Site	Projected Annual kWh Savings	Projected Annual Cost Savings	Projected Annual O&M Savings
Main Buildings	1,061,318	$224,335	$77,025
Pumping Stations	76,031	$15,605	$3,371
Total	**1,137,349**	**$239,940**	**$80,396**

3.6. ECM 6: Streetlighting Upgrades

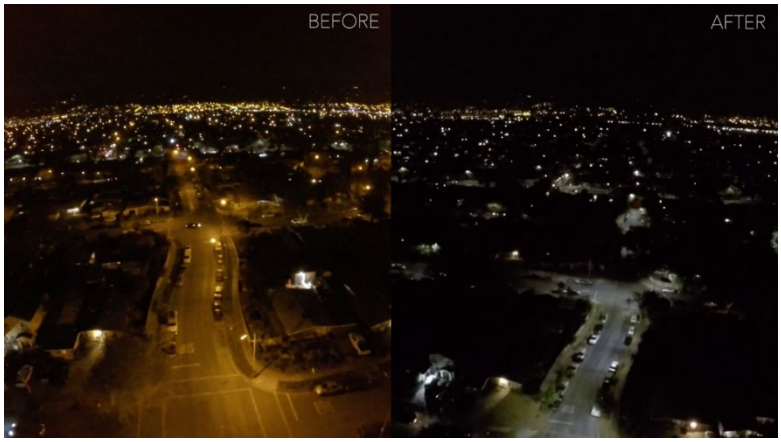
Streetlights are typically broken into two groups: City owned streetlights and PG&E owned streetlights. The City owned streetlights are billed under the LS-2 (unmetered) or LS-3 (metered) PG&E rate tariffs. The City is responsible for operation and maintenance of these streetlights. The PG&E owned streetlights are billed under the LS-1 PG&E rate tariff, and PG&E is responsible for their operation and maintenance. The City of Milpitas has 93 PG&E owned streetlights and 4,362 City-owned streetlights (all unmetered and billed under LS-2).

The City can upgrade the LS-2 streetlights from HID fixtures to LED fixtures at their discretion. For the LS-1 streetlights, the City can request that PG&E perform a savings study on the upgrade of LS-1 streetlights from HID fixtures to LED fixtures.

3.6.1. Streetlighting Efficiency Benefits

- Increased energy savings
- Improved light quality and safety for streets, roadways, and neighborhoods
- Improved lighting system reliability
- Reduced maintenance cost
- Reduced lamp and ballast stock requirements
- Reduced manufacturer component redundancy
- Reduced GHG emissions

Figure 8. ENGIE Streetlight Retrofit for City of San Jose



The City of Milpitas has already replaced a significant portion of their streetlights to LEDs. ENGIE analyzed the City's BRIO report and based on information from the City staff, performed a detailed audit of the remaining 1,700 streetlights not yet in the process of being upgraded by the City. The remaining City streetlights were found to be primarily a mix of 100, 150, 200, 250, and 400-watt fixtures, and include 257 decorative acorn lights.

ENGIE proposes to upgrade all remaining 1,700 HID streetlights to LED fixtures, and can also provide the labor to install 485 LED fixtures already owned by the City but not yet installed. This will achieve energy savings, improve light coverage, and help standardize on streetlight technology throughout the City, as these are brought up to match the over 2,200 fixtures already converted to LEDs.

ENGIE performed a study of current streetlighting vendors on the market (looking at their performance, reliability, warranty terms, pricing, and past project experience), and worked with the City of Milpitas on any preferred manufacturers. Based on City staff input, since the City already has a wide variety of LED brands and models installed, the scope includes the most cost-effective LED options available, but uses the same color temperature as the existing City LEDs for consistency (4,000K).

Additionally, ENGIE worked with City staff to evaluate specific needs and priorities for streetlighting controls, leveraging our worldwide expertise to determine the best solutions for City of Milpitas. Many smart lighting options exist, and after discussions with City staff, ENGIE is proposing cellular controls that will enable the City to view all their streetlights in an online dashboard, increasing awareness of any outages and their ability to quickly replace those for the community.

LS-1 (PG&E-owned streetlights) Scope of Work

- ENGIE has requested PG&E to provide a savings analysis on the conversion of the existing HID fixtures to LED fixtures
- PG&E confirmed that out of their 93 LS-1 fixtures, most have already been replaced with LEDs
- Fewer than 18 fixtures are not yet converted. Those are located in hard to access places, and will be retrofitted to LED as the existing fixtures fail over the next few years
- No additional work is required from the City of ENGIE regarding these fixtures

LS-2 (City-owned streetlights) Scope of Work

- ENGIE has completed an audit of the remaining fixtures, specifying retrofits for each situation as appropriate
- ENGIE will complete final engineering and prepare submittals and specifications
- ENGIE will remove and replace existing HID fixtures to LED fixtures
- ENGIE will dispose of old lamps and ballasts per EPA, or other state and local regulations; the City can be provided documentation (manifest etc.) of proper disposal as needed

Streetlighting Controls Scope of Work

- ENGIE will install streetlighting controls at all 4,455 City of Milpitas streetlights
- While visiting all poles, ENGIE will compile an updated detailed audit for all City streetlights

Table 13 below summarizes the projected savings associated with this measure. Total costs are estimated at $2.95 MM, with a simple payback period of 8 years.

Table 12. Streetlighting Retrofit and Controls Summary

Description	Projected Annual kWh Savings	Projected Annual Cost Savings	Projected Annual O&M Savings
City-wide Streetlighting Retrofits and Controls	1,771,359	$324,318	$52,125

3.7. ECM 7: Sports Lighting Upgrades

The City of Milpitas has multiple locations with sports lighting which might be good candidates for LED upgrades. LED lighting has several functionality advantages for sports lighting:

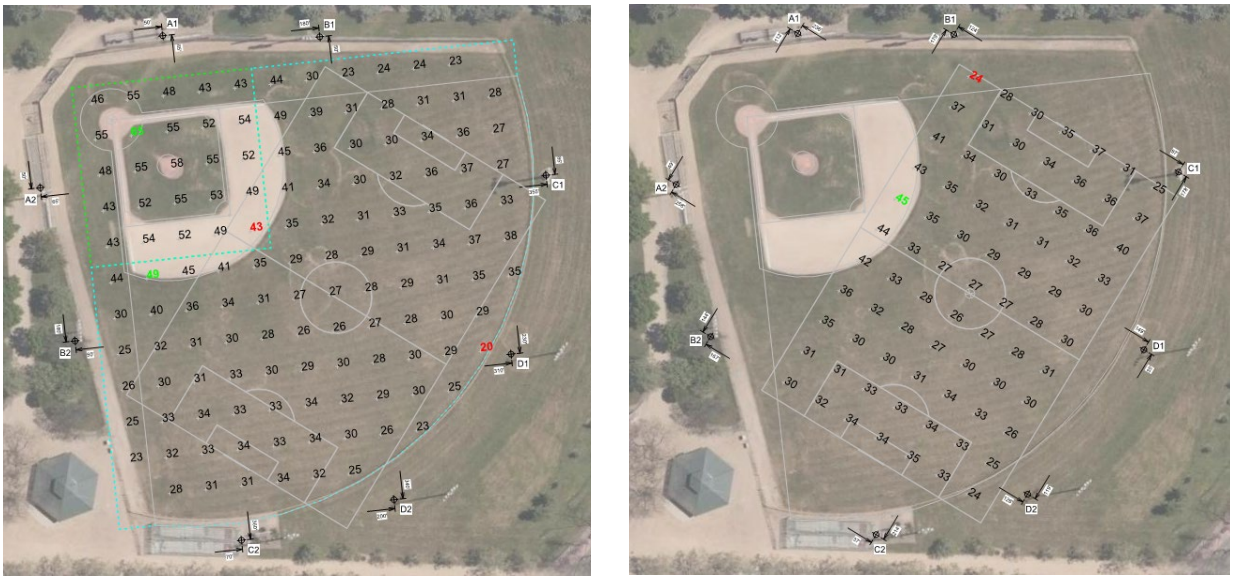
3.7.1. Sports Lighting Upgrade Benefits

- Significant energy savings
- Significant maintenance savings, since the fixtures last much longer, reducing the need for expensive repairs/replacements at heights of up to 80'
- Fixtures reach full illumination almost immediately after being powered on
- LED sports lighting can be brightened or dimmed
- LED sports lighting can create near-perfect lighting uniformity across a playing surface, thus eliminating shadows or dark spots
- LED sports lighting can be remotely controlled for scheduled practices/games or automatic shut-off at preset times

Based on conversations with City staff, ENGIE evaluated sports lighting upgrades to LED fixtures (optimizing pole distribution and height as needed) at the Cardoza Park baseball field and softball field as well as the soccer field at Hall Memorial Park. In addition, ENGIE evaluated adding new LED sports lighting to Dixon Landing Park to encourage future expanded use of its sports fields. These fields and parks were selected in conjunction with City staff, prioritizing high-usage spaces, bypassing fields with already recent retrofits, and prioritizing new lighting where most beneficial for residents and City sports programs.

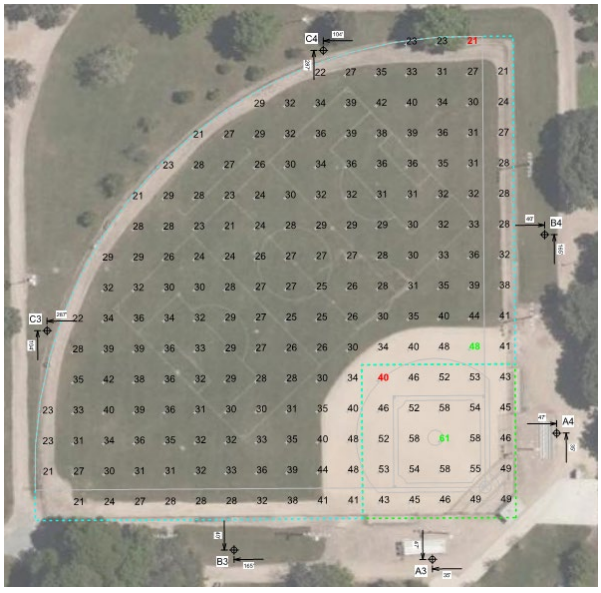
Our analysis shows that the baseball field at Cardoza Park is a great candidate for LED retrofits. There are significant energy savings to be achieved from retrofitting these lights to LEDs due to the extended hours of use, and the existing poles are all in good condition. This baseball field also has an overlaying soccer field which gets heavily used. Since the City is currently using Musco sports lighting equipment, ENGIE worked with Musco to obtain a recommended design (with the photometrics shown below).

Figure 9. Photometrics of Cardoza Park Baseball and Overlaying Soccer Fields



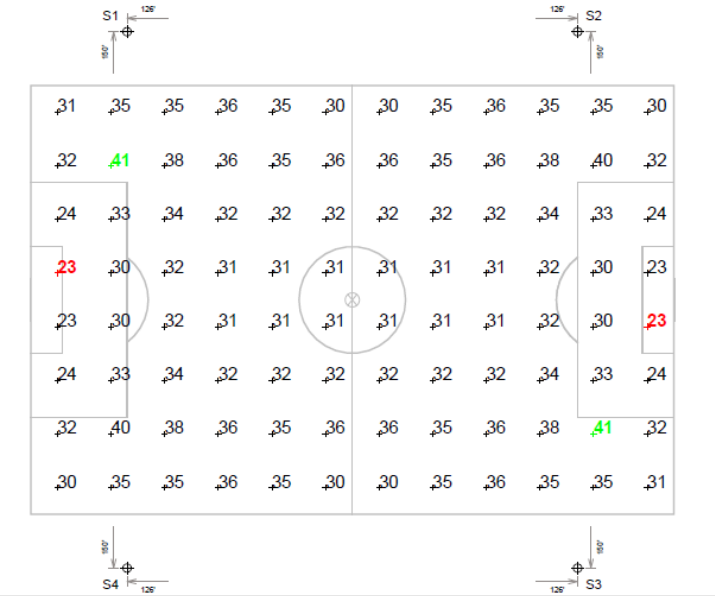
ENGIE also evaluated the Cardoza Park softball field for upgrades. Since the existing poles are quite short, in order to provide a good LED retrofit ENGIE is recommending that those be replaced with taller poles to properly distribute the light across the field. This field still has good energy savings associated with the retrofit.

Figure 10. Photometrics of Cardoza Park Softball Field



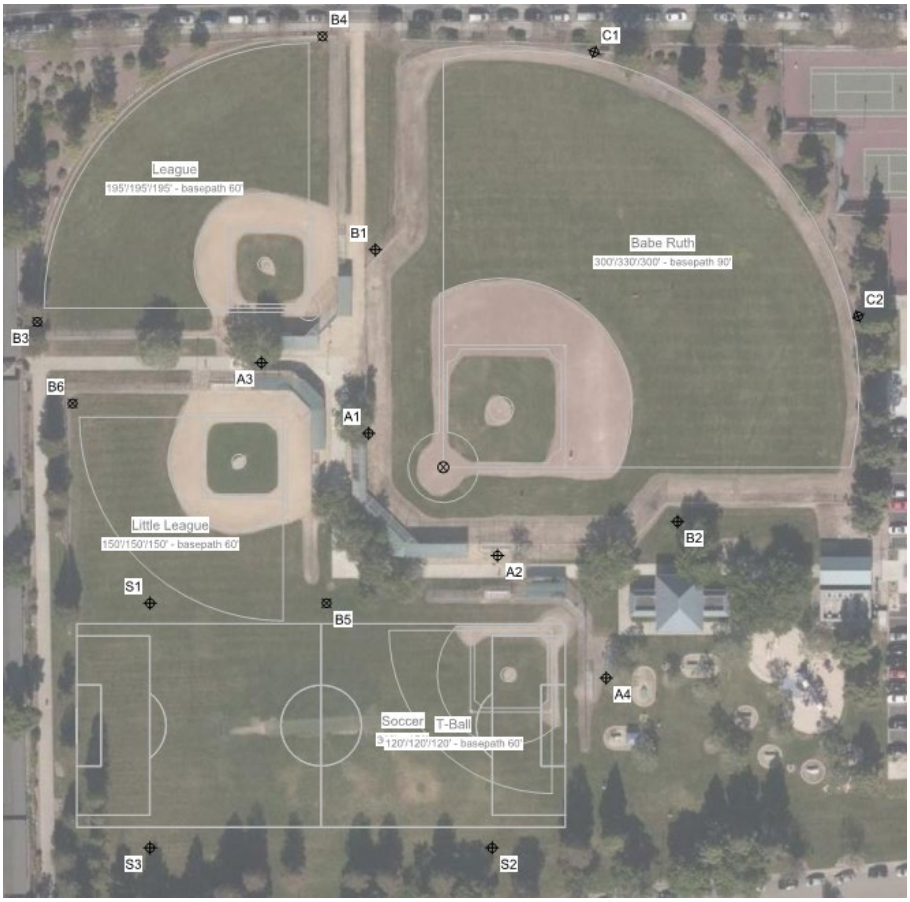
The soccer field at Hall Memorial Park was also evaluated for an LED lighting replacement. Since the park has such few existing fixtures, a proper LED retrofit would actually consume a little more energy than the existing baseline, but would still provide significantly better lighting for the field and its users. Hours of operation are not currently very high, but the City expects an increase in the near future due to potential shifts in sports programs and used spaces. Additionally, the existing 8 poles are quite short, so for better light distribution, ENGIE is recommending that they be removed and replaced with 4 taller poles.

Figure 11. Photometrics of Hall Memorial Park



The City also requested that an evaluation be completed to add new sports lighting to all Dixon Landing Park fields. Since this would be an addition, there are no associated energy savings, but the installation of LED sports lighting would dramatically improve visibility and offer opportunity for increased sports usage of the park in the years ahead, benefitting the citizens of Milpitas. Due to the nature of adding new lights where none exists, this is by far the most comprehensive sports lighting scope, including electrical upgrades to the site to account for the new consumption. Additionally, a full Environmental Impact Report would need to be completed, to identify and examine the likely environmental effects of this proposed project, outlining measures to avoid, mitigate, or offset them. This process is expected to take multiple months in design and discussion, and installation would be consequently delayed. Because of this, we are not currently including LED sports lighting at Dixon Landing as part of our recommended Bundle B. Figure 12 below shows the layout of proposed pole locations to illuminate all Dixon Landing Park sports fields.

Figure 12. Layout of Proposed Pole Locations for Dixon Landing Park



Total costs for the requested bundle (which excludes Dixon Landing Park) is estimated at $1.55MM.

Table 14 below summarizes the sporting lighting scopes identified, with projected energy and maintenance savings.

Table 13. Sports Lighting Summary

Site	Projected Annual kWh Savings	Projected Annual Cost Savings	Projected Annual O&M Savings
Cardoza Park Baseball Field	43,021	$10,025	$1,500
Cardoza Park Softball Field	6,550	$1,602	$725
Hall Memorial Park Soccer Field	0	$0	$400
Dixon Landing Park (new)	0	$0	$0
Total	**49,571**	**$11,627**	**$2,625**

3.8. ECM 8: Park Lighting Upgrades

ENGIE audited all 35 City of Milpitas parks for potential lighting upgrades, and fully evaluated this scope for the 28 parks that have existing lighting. This is detailed in the table below.

Table 14. Park Lighting Summary

Park Name	Address	Lighting (Yes/ No)
Augustine Memorial Park	Cortex and Coelho off Escuela	Yes
Ben Rogers Park	Grand Teton at Sequoia	Yes
Calle Oriente Mini-Park	Calle Oriente off North Park Victoria	Yes
Cardoza Park	Kennedy Drive at North Park Victoria	Yes
Cerano Park	SanDisk and Murphy Ranch	Yes
Creighton Park	Olympic west of South park Victoria	No
Dixon Landing Park	Dixon Landing and Milmont	Yes
Foothill Park	Roswell Drive at Roswell Court	Yes
Gill Memorial Park	Paseo Refugio and Santa Rita	Yes
Hall Memorial Park	LaHonda and Coyote	Yes
Hidden Lake Park	N. Milpitas Blvd between Escuela Pkwy and Jacklin Rd	Yes
Higuera Adobe Park	Wessex off N Park Victoria	Yes
Hillcrest Park	Fieldcrest off Crescent	Yes
Murphy Park	Yellowstone east of S. Park Victoria	Yes
Pinewood Park	Lonetree and Starlite Drive	Yes
Sandalwood Park	Escuela Pkwy and Russell	Yes
Selwyn Park	Selwyn Drive off Dempsey Rd	Yes
Sinnott Park	Clear Lake and Tahoe	Yes
Starlite Park	Rudyard and Abbott Ave.	Yes
Strickroth Park	Martil and Gemma off east Tramway	Yes
Jones Memorial Park	Jacklin at Hillview	Yes
Robert E. Browne Park	Yellowstone east of S. Park Victoria	Yes
Dog Park at Ed Levin	3100 Calaveras Rd, Milpitas	No

Park Name	Address	Lighting (Yes/ No)
Pecot Park	Dixon Landing, west of Conway	No
Parc Metro East Park	Parc Metro, Curtis, east of main St	Yes
Parc Metro Central Park	Parc Metro, Curtis, east of main St	Yes
Parc Metro West Park	Parc Metro, Curtis, east of main St	Yes
Alviso Adobe	Calaveras, east of Piedmont	Yes
Tom Evatt Park	Abel St and Machado St	Yes
John McDermott Park	Alvarez Court, off Abel St	Yes
O'Toole Elms Park	Abel St, north of Curtis St	Yes
Calaveras Ridge Park	Calaveras Ridge Drive	No
Bob McGuire Park	Garden St, between S. Milpitas Blvd and Piper Drive	No
Augustus Rathbone	Expedition Lane and Jubilee Drive	No
McCandless Park	1700 block McCandless Drive	No

Given the improvements in efficiency of LED light fixtures and the decrease in costs over the last few years, LEDs have become a very cost-effective replacement for conventional lighting that will save the City over 50% in energy savings. Added bi-level controls both help meet Title 24 requirements and increase savings for fixtures when no one is present. In addition, the brighter, more uniform light enhances park security. Furthermore, LED service life of 15 to 20 years means drastically reduced maintenance requirements.

Dixon Landing Park

Pinewood Park

3.8.1. Park Lighting Efficiency Benefits

- Increased energy savings
- Improved light quality for park areas
- Improved safety of park areas
- Improved lighting system reliability
- Reduced maintenance cost
- Reduced lamp and ballast stock requirements
- Reduced manufacturer component redundancy
- Reduced GHG emissions

Total savings from LED fixture conversions at all 28 City parks would yield in a reduction of 61% of the baseline lighting consumption. Full savings are summarized in the table below. Costs for this measure are estimated at $0.49MM, with a simple payback of 10 years.

Table 15. Park Lighting Summary

Description	Projected Annual kWh Savings	Projected Annual Cost Savings	Projected Annual O&M Savings
City-wide Park Lighting Retrofits	151,312	$38,201	$7,729

3.9. ECM 9: HVAC Upgrades

ENGIE found that the City of Milpitas has a significant amount of air conditioning equipment that is being operated past its useful life. This results in less than optimal working environments for staff and residents, high maintenance costs, high running costs, and an overwhelmed facilities department. By leveraging savings from other ECMs, ENGIE proposes to upgrade equipment identified by City staff as most in need of replacement and most likely to fail in the short-term.

City Hall

Police Department/Public Works

ENGIE has reviewed the HVAC inventory list that was provided by the City and conducted a full audit of all units, wherein we verified and documented all equipment, nameplate information, scheduling, zoning, set point, and control sequences. We then prioritized replacements based on unit age and conditions, as well as feedback from City staff. Replacement of old and outdated HVAC equipment provides energy savings due to improved efficiency and technology and reduces maintenance costs due to increased reliability and functionality. The following scope has been identified for replacements:

Table 16. HVAC Upgrades

Site	Condensing Unit & Heat Pump	Rooftop Packaged Unit	Condensing Unit & Coil	Furnace	Ductless Split System	Make-up Air Unit	Gas Heater	General HVAC Maintenance	Exhaust Fan	Cooling Tower	Water Heater	Water Pump	Unit Heater	Air Compressor	Variable Frequency Drive	TOTAL
Corp Yard		3							1					1		**5**
Police Department/ Public Works			1					10		2		1		1	3	**18**
Community Center		2							3		1					**6**
Sports Center		12				1	1									**14**
City Hall	6							2				3				**11**
Senior Center											2					**2**
Fire Station No. 1			5	5	1				6							**17**
Fire Station No. 3			1	2									1			**4**
Fire Station No. 4			1	1									2			**4**
Dixon Landing Park											1					**1**
TOTAL	**6**	**17**	**8**	**9**	**1**	**1**	**1**	**12**	**10**	**2**	**4**	**4**	**3**	**2**	**3**	**82**

The new replacement units will be primarily selected based on capacity of the existing units and ability to match the existing installed location including physical size and ductwork configuration. Due to some configurations, the efficiency selections may be limited. Rooftop packaged HVAC units will include economizers as required. The scope of work will include reuse of existing equipment mountings, vibrations isolation, electrical connections, and other equipment where feasible.

Custom air handlers and other custom HVAC equipment are not recommended for upgrade, since a newer version would have a larger footprint and weigh more, creating issues within the physical space available and structural capacities of the existing buildings. They are instead recommended for retro-commissioning, with inspection and upgrade of any key components to ensure they are operating at top efficiency.

The cooling tower at Public Works is also past its useful life and currently has leaking problems. After researching current equipment available in the market, due to the limited footprint of the existing space, ENGIE is recommending that the two existing side-by-side cooling towers be replaced with a single, larger one.

ENGIE is vendor agnostic and will work with whatever manufacturers the City prefers. As needed, ENGIE will leverage our expertise to help select the best-fit solutions, recommending specific products based on cost and performance.

Additionally, for the Community Center, the City of Milpitas requested that ENGIE evaluate replacing and elevating the ductwork associated with the two packaged units up for replacement, since it is past its useful life. Due to the extensive costs and no associated savings, this ductwork replacement is not included in the proposed bundle.

3.9.1. HVAC Upgrade Benefits

- Improved working environment through improved comfort in occupant spaces via new equipment and better controls
- Energy savings through newer, more efficient units and better controls
- Reduced equipment down-time and maintenance needs
- Remote monitoring of equipment's operation set points

The table below summarizes projected savings associated with the proposed HVAC upgrades for the City of Milpitas. Everything but ductwork improvements for the Community Center are included in the proposed bundle, totaling an estimated $2.18MM in costs with a simple payback of 25 years.

Table 17. HVAC Savings Summary

Description	Projected kWh Savings	Projected Annual Cost Savings	Projected Annual O&M Savings
HVAC Upgrades	21,982	$5,754	$81,930

3.10. ECM 10: EMS Upgrades

The Energy Management System (EMS) at City Hall has previously been upgraded and works efficiently, while the EMS system at the Public Works Complex has not been very effective. This CEA evaluated installing the same effective EMS system at Public Works that has been successful at City Hall. The Public Works Building would receive the same Automated Logic brand DDC/BMS as currently exists in City Hall and it would have DDC controllers for mechanical equipment including air handler units, chiller units, the cooling tower, and air conditioners. This would effectively leverage the existing successes for the City Hall EMS and facilitate maintenance for City staff.

The existing EMS at the Public Works Complex is a Johnson Controls METESYS, with numerous control panels located throughout the facility. These control panels allow the units to communicate back to a central controller, with access to the facilities engineers. This system plays a critical role in maintaining proper equipment operation, troubleshooting, and overall maintenance of the existing equipment. However, this has not been a fully-functioning system. City staff reported several communication issues between the controllers and the equipment, resulting in the equipment operating in manual mode or with non-optimal settings.

At Public Works, ENGIE proposes to replace the current EMS with the above noted Automated Logic DDC/BMS to ensure proper operation of the mechanical equipment. Control panel upgrades are the first step in the proper control of the conditioned spaces. Once high-level communication and controls are set up, the existing equipment would be recommissioned and sensors and points upgraded and calibrated to ensure office and other occupied spaces are operating within predesigned set points.

When the Public Works Building receives the new Automated Logic DDC EMS system installed, both the City Hall Building and the Public Works/ Police Department Building will be integrated to the same control web platform. Those systems can then be controlled from a central point and key control variables will be visible and remotely adjustable for the responsible facilities engineers. This provides increased control ability and understanding, but also allows settings to be quickly and accurately adjusted in case any alarms are triggered and the necessary troubleshooting can be fulfilled remotely. This allows for faster response times, reduced maintenance times and costs, and overall increased reliability. The actual energy savings are difficult to quantify, but the benefits are visible, and the new upgraded EMS system will provide increased reliability and resiliency for performing critical City functions at the Public Works Complex, including the Police Department.

Total costs are estimated at $0.44MM with a simple payback of 55 years.

3.10.1. EMS Upgrade Benefits

- Improved working environment
- Improved equipment control
- Remote monitoring of equipment's operation set points
- Ability to remotely troubleshoot, solve, and reset system alarms and problems
- Energy savings through better controls monitoring

Table 18. EMS Savings Summary

Description	Projected Annual kWh Savings	Projected Annual Cost Savings	Projected Annual O&M Savings
EMS Upgrades	0	$0	$8,320

3.11. ECM 11: Irrigation Controls Upgrades

The need for water conservation has become more essential for cities in California due to recent droughts. The City of Milpitas has over 30 parks with extensive irrigation needs, which ENGIE investigated to determine whether they could benefit from weather-based irrigation controller upgrades. Irrigation controls can significantly reduce excess watering for athletic fields as well as landscaping.

3.11.1. Weather-Based Irrigation Controller Upgrade Benefits

- Cellular connection and data service
- Central cloud-based management system
- Weather-based scheduling engines
- Evapotranspiration (ET) controls
- Leak detection and automatic shutoff, with associated maintenance savings
- Water savings from reducing unnecessary watering

ENGIE audited Milpitas' parks, inspecting existing local and centralized controls, while also performing a data analysis of their water usage per acreage watered, evaluating the City's baseline compared to industry standards. The City parks were found to use low amounts of water, showing that the City's scheduling is already quite efficient and there is very little water wasted. Several of the City's parks are on a central RainMaster irrigation controller (located at the Public Works building), an older model with some limited weather-based capabilities. If desired, the City could explore upgraded enhancements to the unit, but at this time ENGIE is not recommending any action, since there is very little potential for water savings given the City's already efficient operations.

City staff also requested that ENGIE recommend an alternate, more user-friendly product for future consideration. Our research has shown that customers have found a high level of success using the control system from HydroPoint Data Systems and their WeatherTrak devices. This is a North Bay Area company (based in Petaluma, CA), and their products have robust capabilities and user-friendly interfaces.

3.12. ECM 12: Water Fixture Upgrades

Water conservation is important given the statewide drought and the City's commitment to sustainability. ENGIE evaluated all City water fixtures including toilets, sinks, urinals, and showerheads, at all public buildings and park restroom facilities, to investigate savings opportunities associated with lower flow equivalents.

In recognition of the COVID-19 pandemic and the new awareness it has brought regarding safety and cleanliness, touchless sensor sink faucets for lavatories and kitchens are planned, as well as touchless toilets and urinals flushing mechanisms. This will help mitigate contact contamination possibilities.

3.12.1. Water Fixture Upgrades Benefits

- Environmental stewardship
- Positive public recognition
- Significant water savings
- Energy savings associated with decreased hot water demand
- Reduced maintenance cost
- Increased fixture reliability
- Decreased contact contamination by installing touchless sensors

Cardoza Park

ENGIE conducted a full audit of the domestic water fixtures in City buildings and parks, counting each fixture and noting their condition and functionality. With this data, retrofit options were determined for the existing toilet and sink valves, as well as all other sources of water usage. Lower flow fixtures reduce water usage and water costs and can also lead to reductions in electric usage due to the reduced hot water demands. These retrofits would also reduce operation and maintenance (O&M) requirements by reducing the needs for staff repairs throughout the year given the newer and more reliable fixtures.

Table 20 below summarizes projected water and energy savings. Measure costs are estimated at $0.70MM with a simple payback of 23 years.

Table 19. Water Fixture Retrofit Summary

Description	Projected Annual Water Cost Savings	Projected Annual Thermal Cost Savings	Projected Annual O&M Savings
City-Wide Water Fixture Retrofits	$30,532	$750	$1,090

3.13. ECM 13: Water Meter Upgrades

Advanced Metering Infrastructure (AMI) consists of digital hardware and software technology, from customer meters and communication networks all the way to the service provider, allowing for continuously available remote communication of detailed measurements. The City of Milpitas has started implementing an AMI system for their water meters, working with Badger Meters to install communication gateways throughout the city and already installing over 1,000 new Badger meters with ORION SE Fixed Network transmitters.

Unaccounted for water is an important component of overall water system capital improvement planning. New water meters are significantly more accurate, allowing to City to fully recognize the revenue from all water sold to its constituents. Line losses are not directly impacted by meter replacement, but the frequency of AMI data points once new meters are installed allows for very sophisticated leak targeting and planning for subsequent pipe replacements.

3.13.1. Water Meter Upgrades Benefits

- Significant improvement in accuracy of water reporting
- Increase in revenue from previously under-reported consumption
- Significant maintenance savings from automating the meter reading process

ENGIE worked closely with City and Badger Meters staff to evaluate the work completed to date, and determine the work still needed for a City-wide system. ENGIE analyzed the existing City BEACON AMA database, which indicates that 15,590 meters still need to be upgraded to AMI.

The City presently has 36 active gateways, which propagation studies show will cover 13,625 water meters. Based on this data and the City's total meter count, ENGIE estimates that approximately 3,100 water meters will reside outside the gateways' area of coverage and will therefore require cellular connections. These are also included in the proposed scope.

Due to the magnitude of this scope, field conditions have not yet been verified for every single meter. Therefore, ENGIE expects that during construction, unforeseen conditions will come to light, requiring some additional work. This could include meter reconfiguration for new lay-lengths or adding bypass valves, meter lid replacements to allow for transmitter signal to properly communicate to gateway, or any deteriorating existing conditions that need to be fixed for a fully functioning system. To minimize out-of-pocket expenses to the City, ENGIE proposes a $250,000 allowance to be included with this scope.

Table 21 summarizes projected scope water "savings" - really, increased revenue due to the improved water meter accuracy. Total costs for this measure are estimated at $12.50MM (plus the $250,000 allowance), with a simple payback of 11 years.

Table 20. Water Meter Retrofit Summary

Description	Projected Annual Additional Water CCF Billed	Projected Annual Additional Water Revenue	Projected Annual O&M Savings
City-wide Water Meter Retrofits	101,604	$681,871	$416,000

3.14. ECM 14: SCADA, Pumping, and Automated Disinfection

The City of Milpitas is like most cities in the San Francisco Bay Area that are struggling to keep up with the growing needs of their population and simultaneously maintain their infrastructure, all while often facing shrinking budgets. Through conversations with City staff we understand that the City has long desired upgrades to their water, wastewater, and stormwater infrastructure. During this CEA, we worked closely with City staff to identify opportunities for SCADA and pumping upgrades to save energy, optimize systems, and reduce maintenance and operations costs.

3.14.1. SCADA and Pumping Upgrades Benefits

- Improved monitoring of water quality to ensure the City remains in compliance with state and other applicable standards
- Reduced electricity usage by reducing pumping needs
- New tank health monitoring equipment, which allows the city to maintain tank water quality and fire capacity without having to constantly turn over the tank water for water quality reasons
- Reduced maintenance costs by automating sampling and facilitating troubleshooting, reducing the number of required site visits

3.14.2. Water Controls & Pumping

Currently the City has localized controls installed at each of the water pumping stations and tank systems, all planned on being upgraded. The control systems currently being considered for upgrades are at Gibraltar, Ayer, Country Club, Tularcitos and Minnis stations. Each site is discussed separately since their scopes are all slightly different, after a brief overview of measures that are universal to several of the sites. Table 22 below outlines the water pumping sites being considered for upgrades in this CEA.

Table 21. Pumping Stations Included in Scope

Site	Type	Address
Gibraltar Tank & Pump Station	Water	641 Gibraltar Court
Ayer Tank & Pump Station	Water	1429 E. Calaveras Blvd
Tularcitos Tank & Pump Station	Water	1200 Tularcitos Drive
Country Club Booster Station	Water	1437 Country Club Drive
Minnis Tank	Water	Launch Site Road

3.14.3. SCADA Upgrade

The existing iFix SCADA system at Gibraltar and the other SCADA packages at the other water pumping sites are fairly old and are not scalable to meet the current city-wide needs. ENGIE performed an analysis

of current industry-leading SCADA software to determine the best fit for the City's needs. The following matrix compares the options available for City staff consideration. Based on feedback from City staff, ENGIE is proposing what we believe to be the best solution for the purposes of this CEA, but if this scope is selected to move forward, additional discussion will take place in close collaboration with City staff in order to develop and engineer a design that truly meets the City's needs.

Table 22. SCADA Options for City Consideration

Platform	# of clients per License	Number of Tags	Scalable beyond Water	Remote Access	Data Storage	Historian Redundancy	Years in Business	Level of Support (Subjective)
Inductive Automation - Ignition	Unlimited	Unlimited	Yes, scales to several different operations platforms. Suitable for Municipal environments	Platform built with remote access native support for Android and iOS	SQL Database	May require third-party software	17+	Good, has been very responsive to inquiries, suggestions, and solving problems with integration into other existing systems
Aveva - Wonderware	Depends on License, Scales on number of users	Depends on Price, Tiered	Yes, but more focused on manufacturing environment	Yes, through InTouch Access Anywhere web-based client	Wonderware Historian, compatible with SQL Server and Windows Server	Available but not synchronized; Changes must be done to each historian settings	33+	Support has been mixed and much more difficult to get help with integration with other non-Wonderware systems
Schneider Electric - ClearScada	Tiered based on the number of users	Depends on Price, Tiered	Remote operations Targeted for Water/Wastewater/Oil/Gas	Yes, remote access available but will cost based on the number of remote users; Access level is tiered	Robust tree system, databased stored in ClearScada	Native between servers; Updates/Data Sync happens when server is brought online	25+	Good support, not quite as extensive since being acquired by Schneider Electric, still relatively responsive and willing to help with integration with other PLC systems

Platform	# of clients per License	Number of Tags	Scalable beyond Water	Remote Access	Data Storage	Historian Redundancy	Years in Business	Level of Support (Subjective)
GE Systems - iFix 6.1	Multiple tiers dependent on pricing; Base level includes 3 clients and price scales up from there	Depends on Price, Tiered	Scalable but designed more for manufacturing/ single site operations; Can be adapted to multi-site operations but not structured towards multi-site operations	Yes, through remote desktop but not native access, some user configurable options for mobile devices	Proficy Historian 8.0, GE proprietary database	Available through third-party software and configuration	25+	No recent experience found; Defer to City's experience with existing iFix system
National Instruments - Lookout	Limited	Depends on Price, Tiered	Not easily scalable for multiple platforms	No integrated remote access	Local storage only, requires third-party software for full backup	Not available natively, may be available for third-party	20+	Limited as it is an older platform that is mainly used on small systems; Has limited support for integrating larger scale systems

Based on the information outlined, ENGIE is proposing the Ignition! software by Inductive Automation as a starting point for this design. This decision is based on several factors:

General Features: Ignition! is a mature and scalable platform that is centrally managed and offers real-time data acquisition, monitoring and real-time development of the Human Machine Interface (HMI). The area where Ignition! really excels is the opportunity for integration of several different subsystems that the City currently manages, while only having to pay for a single license for all of them.

Scalability: In addition to being suitable for smaller server architectures, Ignition! can also scale readily to a city-wide distributed architecture and can scale between different servers allowing distributed loads between them. This would make it an ideal transition for the City, allowing them to pull data from several different City systems into a central SCADA system without requiring users to learn various control systems.

Security: Ignition! supports modern web-based authentication strategies such as federated identity, multi-factor identification and single sign on (SSO). With Ignition! you can use central identity management, using technologies such as SAML and OpenID connect. As with all systems, the level of security is largely driven by the level of need and protocols developed by the user. Ignition! does keep pace with security developments as the industry makes changes and allows for frequent security updates.

Operator Ease of Use: Like other SCADA packages, some of the ease of use is driven by how the SCADA is arranged and programmed. By working with City staff to develop useful HMI screens and tools, Ignition! can be customized to meet the needs of the City and its operators. The system can also be modified and changed as the operations and needs of the City evolve over time.

Remote Access: Ignition! supports multiple users, via mobile platforms and custom-designed applications that can be linked to the City's SCADA platform. This would allow operators to troubleshoot an issue while offsite and would reduce the number of site visits due to unknown alarms.

Adaptability: One of the most attractive things about Ignition! is the ease with which it can adapt to the different water, wastewater, and stormwater systems. This way, all these different systems can be simultaneously monitored at a single site, multiple sites, and/or remotely. This not only improves redundancy, but in lockdown situations (such as seen with COVID-19) it can help limit contact and provide a useful tool for maintaining critical infrastructure. There is also the possibility of being able to roll the City's other infrastructure into the same platform, allowing staff to know when there is a problem with any part of their infrastructure.

ENGIE plans on engaging with City staff to verify that Ignition! is indeed the right fit for them or study the integration feasibility of any other preferred SCADA software. Once a software has been approved by City staff, ENGIE can then help determine the best way to proceed with its rollout.

3.14.4. Remote Communication & Networking

The City of Milpitas has been considering networking their water, wastewater, and stormwater stations for many years to allow better data gathering and an upgrade to a central SCADA system that can monitor the status of these stations without requiring frequent site visits. In the past, because of shrinking budgets and other constraints, the City has been unable to find the time and resources to complete this upgrade. A previous radio survey was completed for the City more than 10 years ago but since the City landscape has changed so drastically since then, ENGIE decided as part of the CEA to perform an updated radio study. This study allowed us to determine if all the City's water, wastewater, stormwater, and pressure

reducing stations would be able to use Radio Frequency (RF) communication to integrate into a SCADA network. RF Communication allows the City to operate their network without ongoing costs related to cellular or hard line DSL/Fiber/Cable internet costs.

ENGIE proposed for most sites to communicate with either Gibraltar or the Public Works main office, using those two sites as the primary relay points for data due to their height and relatively central location. As an alternate site, ENGIE also proposed using either Ayer or Tularcitos as a backup relay site if the other two sites were unable to communicate with some of the locations. During the course of the Radio survey, ENGIE and the survey company were able to determine that both the Gibraltar and Public Works office would be suitable to communicate with all of the stations in the network.

Based on the results of the survey, ENGIE will work with the City to determine which site would be designated as the primary communication site for RF communications and determine if they would like to use one site as a centralized hub or divide up the communication between the Gibraltar and the Public Works office. Having two sites to network the system might also be useful as the City grows, allowing for more resources to be added into the RF communication network. In theory, if the City eventually wanted to network other parts of their infrastructure, the RF communication network would also allow for that expansion.

3.14.5. Water Treatment and Chemical Dosing Upgrades

As part of the overall water system upgrades at each of the water tank sites, ENGIE has taken a closer look at providing a more automated chemical dosing system. Based on Milpitas' needs, ENGIE investigated a solution that could automatically dose both the water going directly to city-wide distribution (bypassing tanks), as well as the water stored in the City tanks.

3.14.6. Automated Dosing and Mixing System Benefits

- Greater control of water quality in the tanks and for system distribution
- Prevention of stratification in the water tanks
- Near instant reaction of introduced chemicals, improving water quality and reducing chemical usage
- Real-time monitoring of tank water health, allowing longer term tank storage without having nitrification or other quality issues that could otherwise occur
- Reduced need for operator intervention
- Reduced maintenance costs due to reduced labor and chemicals required

The new chemical dosing system would use Liquid Ammonium Sulfate (LAS) and a Salt Power/Hypochlorite generation system to avoid handling liquid Sodium Hypochlorite, which can be a hazard and often has more stringent storage requirements. Given the City's issues with the tablet system at Gibraltar in the past and the general lack of reliability of such systems, the power-based generation system seems like a good option. Additionally, ENGIE has identified companies with local manufacturing and support facilities in Milpitas, so getting support for the system can be very straightforward.

3.14.7. Water Stations

Gibraltar Tank Site

Gibraltar is the largest water pumping and tank site the City of Milpitas operates, and it is fed by two main water sources (water mains coming from the City of San Francisco and from the Santa Clara Water District). Both systems deliver water at high pressures, with Santa Clara delivering water at approximately 170 psig and San Francisco at around 135 psig. Currently, the plant operates two 5 MGD tanks, which are typically divided between the two water systems – under normal operations, one tank is filled from the San Francisco water main while the other tank is filled from the Santa Clara water main. During the daytime, water is fed into the tanks from each system and then pumped back out of the tanks to their respective zones. About 1/3 of the tank volume is rolled over every day, to maintain the tank water quality since no automated chlorination or mixing system are available. This means that each day the water pumps must operate and consume power that is not necessarily required to do so if the tank water quality can be maintained.


There is some automated sampling that occurs at Gibraltar with HACH instrumentation that measures chlorine, chloramine, and turbidity. City operators have stated that the instrumentation has not been as reliable as they would like, likely in some part due to the age of the City instruments.

Gibraltar has a relatively modern Allen Bradley Control Logix Programmable Logic Controller (PLC) that operates a GE iFIX SCADA system. There is also a server for the control system and historian (database for historical data) located at the Gibraltar site. Currently the City has been experiencing some issues with the historian, and the current SCADA system is somewhat outdated since this technology evolves quite quickly.

Controls and SCADA Upgrade:

Based on the current condition of the site controls, ENGIE would recommend minor upgrades to the Allen Brandley PLC, which would include the addition of RF communication and additional Input/Output (I/O) cards as needed. The existing PLC is new enough to allow for easy expansion without having to make any drastic changes to hardware. The I/O cards would allow the addition of power monitoring equipment for the pumps on-site. There would also be new connections made for the new chlorine/ammonia injection system, to allow direct communication from the SCADA system to the new chemical injection and tank mixing controls.

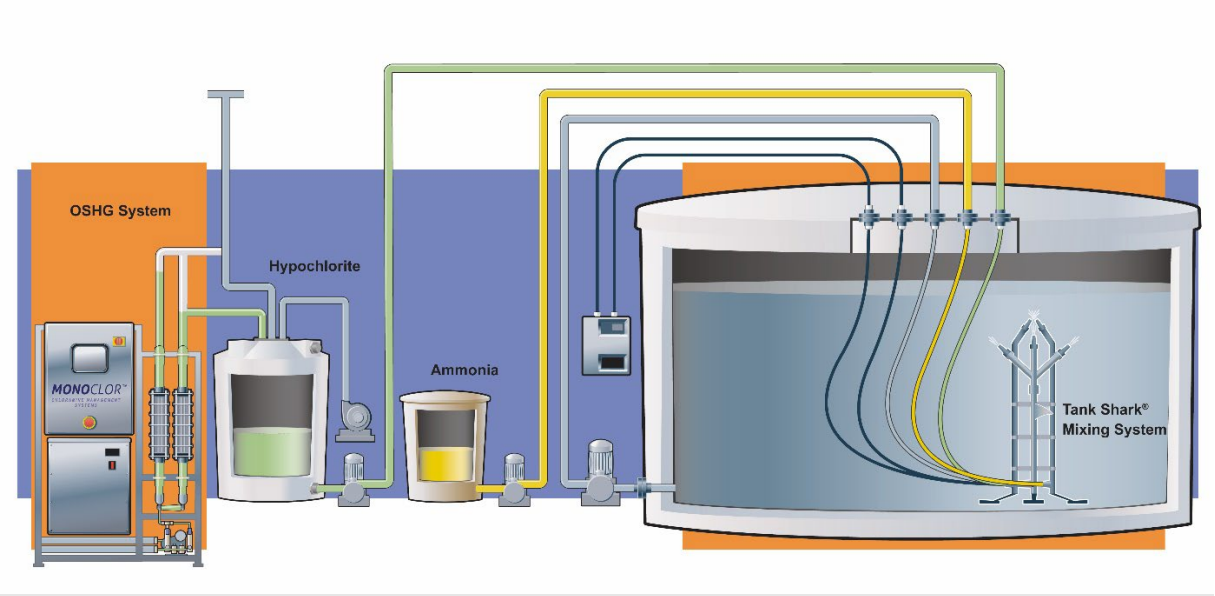
Additionally, since ENGIE is recommending moving to a new SCADA platform for the City as a whole, the Gibraltar site would be moved from the current GE iFix platform over to the new Ignition! platform, benefitting from the additional support it offers. This would also allow the system to be set up to monitor all of the water and stormwater sites from Gibraltar, since it is one of the primary water distribution sites for the entire Milpitas area.

City staff has mentioned that having one of the redundant servers at the Gibraltar site, in addition to some of the other City sites, is one of their goals; therefore, this was considered and included in the proposed scope.

Chemical Dosing and Tank Mixing:

In order to provide some of the proposed pumping savings and improve water quality at Gibraltar and throughout the City's distribution system, ENGIE has proposed a disinfectant boosting system designed to work with both tanks, add automated mixing, and allow the City to monitor and adjust dosing of the distribution water entering City zones from Gibraltar.

Figure 13. Disinfectant Boosting System Diagram



Since the Gibraltar tanks are large and flows will be intermittent, an active in-tank mixing system is being proposed to keep the tanks well mixed and the water quality stable. In the past, due to various factors in mixing and the inability to fully automate tank dosing and monitoring, the City has been unable to store water for long periods of time in the tanks without seeing degraded water quality. After this installation, the City should not be required to cycle the water in the tanks other than occasionally (ENGIE estimates once or twice a month at most). This will allow the distribution pumps to run far less frequently, and the majority of the distribution water to be supplied to the systems directly from Santa Clara and San Francisco, yielding significant energy savings for the City. The new disinfectant boosting system will also be able to adjust chemical dosing incoming from Santa Clara and San Francisco to stabilize disinfection chemistry towards optimal for the City's distribution system.

Ayer Tank Site

Ayer is the second largest water tank and pumping site at Milpitas, utilizing a single 5.6 MG tank and a 3-pump arrangement. The pumps include high efficiency motors and newer VFDs that are in good condition. The system is controlled by an older Allen Bradley PLC system that is well over 15 years old, and system hardware is also reaching end of life. Ayer currently has an older SCADA platform called Lookout, which was functional back in the day, but is very limited compared to modern SCADA platforms. There is ample room at the site for upgrades and operational improvements.

Controls and SCADA Upgrade:

Based on the current condition of the site controls, ENGIE recommends a complete upgrade. The existing panel and control wiring would be re-used, and the terminations for the existing equipment would just be moved to a new PLC rack. A local touch screen could be added to the cabinet as well as a local workstation to monitor the site. There would also be new connections made for the new chlorine/ammonia injection system, allowing direct communication from the SCADA system to the new chemical injection and tank mixing controls.

Additionally, since ENGIE is recommending moving to a new SCADA platform for the City as a whole, the Ayer site would be moved from the old outdated Lookout platform over to the new one, benefitting from the additional support it offers. This would also allow the system to be set up to monitor all of the City's water and stormwater sites from the local workstation if needed.

As with the other sites, the SCADA system would be tied into the network using RF communication between the sites and the Public Works building and/or the Gibraltar site. Data from Ayer would be available on the network and access to the entire system view could be made available at Ayer, if needed.

Chemical Dosing and Tank Mixing:

In order to improve water quality at the Ayer Tank site and throughout the distribution system, ENGIE has proposed a disinfectant boosting system designed to work with the single tank, add automated mixing, and allow the City to monitor and adjust dosing of the distribution water entering the city zones from the Ayer Tank. Since Ayer needs the pumps to distribute water, the ability to generate savings by shutting down pumps and delivering water to the distribution directly from the source isn't feasible.

Figure 14. Disinfectant Boosting System

The new disinfectant boosting system would maintain the water quality at the Ayer tank with minimal energy usage and would allow for tighter water quality control, especially during times of the year when nitrification is an issue. Like the Gibraltar site, the Ayer system would utilize a small on-site hypochlorite generation system as well as LAS to create monochloramines for system disinfection.

County Club Booster Station

The Country Club booster station takes water from the City distribution 2SF zone when the rest of the system cannot deliver the needed pressure to boost the water up to the Tularcitos tank. This station operates a minimal wet well for the water pumps and pumps water up the hill for 1,600 to 1,700 hours a year. The station's existing pumps, of a submersible style, are quite old, and it is unknown how their current condition compares to the original pump curves. City staff has stated that the pumps are reaching end of life and are becoming difficult to find parts for, with one pump even removed and offline for some time now due to the lack of repair parts.

Controls and SCADA Upgrade:

Based on the current condition of the site controls, ENGIE recommends a minor upgrade to the current SCADAPACK controls setup. The touch screen is quite old, but the PLC is more modern and can be easily upgraded with RF communication, tying into a new SCADA system should the City agree with that approach. ENGIE also recommends an upgrade on the controls programming, to add a new local touch screen with more in-dept data logging capabilities that could provide more data for operators and be integrated into a more modern software platform.

Pump Replacement:

With the age of the station's pumps and the fact that they are becoming difficult to find parts for, ENGIE recommends replacing the one pump that has not yet been repaired with a new vertical turbine pump (instead of matching the existing submersible pump style). This approach would replace aging equipment with a more efficient style of pump that is easier to maintain over time, reducing operation and maintenance costs. Vertical turbines have the motor set on top of the well head, allowing for easy access to the motor and reducing cable requirements to the motor which would otherwise sit submerged. Because the connections for a vertical turbine would be very similar, installation would be simple, likely only requiring an adapter flange, pipe, and new pump sole plate.

Vertical turbine pumps and motors are also generally more efficient due to the gain in motor efficiency, which would lead to energy savings. Given that this is also a deferred maintenance and redundancy issue, ENGIE believes this would be a good opportunity to upgrade to a more modern pump technology that will be easier to service while capturing some energy savings at the same time.

Tularcitos Tank Site

Tularcitos is the first hillside water tank that distributes water to the houses below the intersection of Tularcitos and Country Club Drives. The site utilizes a single 310,000-gallon tank and a 2-pump arrangement.

Controls and SCADA Upgrade:

Based on the current condition of the site controls, ENGIE recommends a minor upgrade to the current SCADAPACK controls setup. The touch screen is quite old, but the PLC is more modern and can be easily upgraded with RF communication, tying into a new SCADA system should the City agree with that approach. The system would be upgraded to pull in data from the automated tank dosing and mixing system and could provide that data to the new SCADA system.

Chemical Dosing and Tank Mixing:

In order to improve water quality at the site and throughout the distribution system, ENGIE proposes a disinfectant boosting system designed to work with the single tank, add automated mixing, and allow the City to monitor and adjust dosing of the distribution water feeding the houses below the tank, as well as water being pumped up to the Minnis Tank. Since Tularcitos needs the pumps to pump water to the Minnis tank, the ability to generate savings by shutting down pumps is not possible here.

The new disinfectant boost system will maintain the water quality at the tank with minimal energy usage and improved water quality control especially during times of the year when nitrification is an issue. Like the other tank sites, the Tularcitos system would utilize a small on-site hypochlorite generation system as well as LAS for creation of monochloramines for system disinfection.

The tank monitoring system will take into account that there isn’t a drain present at the tank site and no water can be discharged.

Pump Replacement:

Much like Country Club, the Tularcitos submersible pumps are quite old (have been in service since 2003) and are becoming difficult to find parts for. Therefore, ENGIE recommends replacing the one pump that has not yet been repaired with a new vertical turbine pump (instead of matching the existing submersible pump style). This approach would replace aging equipment with a more efficient style of pump that is easier to maintain over time, reducing operation and maintenance costs. Vertical turbines have the motor set on top of the well head, allowing for easy access to the motor and reducing cable requirements to the motor which would otherwise sit submerged. Because the connections for a vertical turbine would be very similar, installation would be simple, likely only requiring an adapter flange, pipe, and new pump sole plate.

Vertical turbine pumps and motors are also generally more efficient due to the gain in motor efficiency, which would lead to energy savings. Given that this is also a deferred maintenance and redundancy issue, ENGIE believes this would be a good opportunity to upgrade to a more modern pump technology that will be easier to service while capturing some energy savings at the same time.

Minnis Tank Site

Minnis is the second and final hillside water tank that distributes water to the houses above the intersection of Tularcitos and Country Club Drives. It utilizes a single 350,000-gallon tank and is gravity fed to the housing below. Currently, this tank has had the most issues with nitrification during parts of the year, so being able to maintain its water quality is critical both for water supply and fire protection reasons.

Controls and SCADA Upgrade:

Based on the current condition of the site controls, ENGIE would recommend a minor upgrade to the current SCADAPACK controls setup. The touch screen is quite old, but the PLC is more modern and can be easily upgraded with RF communication, tying into a new SCADA system should the City agree with that approach. ENGIE also recommends an upgrade on the controls programming, to add a new local touch screen with more in-depth data logging capabilities that could provide more data for operators and be integrated into a more modern software platform. The system would be upgraded to pull in data from the automated tank dosing and mixing system and provide that data to the new SCADA system.

Chemical Dosing and Tank Mixing:

In order to improve water quality at the site and throughout the distribution system, ENGIE proposes a disinfectant boosting system designed to work with the single tank, add automated mixing, and allow the City to monitor and adjust dosing of the distribution water feeding the houses below the Minnis tank.

The new disinfectant boosting system will maintain the water quality at the tank with minimal energy usage and improve water quality control especially during times of the year when nitrification is an issue. Like the other tank sites, the Tularcitos system would utilize a small on-site hypochlorite generation system as well as LAS to create monochloramines for system disinfection.

This tank monitoring system will take into account the fact that there isn't a drain present at the site, and that no water can be discharged.

3.14.8. Stormwater and Wastewater Stations

The City of Milpitas currently operates 13 stormwater stations and 2 wastewater lift stations. All of these stations have limited remote communication and often require frequent visits from operators to monitor conditions and inspect equipment. When there is an issue, it can often take up to half a day to inspect the station and acknowledge alarms which may or may not be critical. Additionally, in most of the stations the infrastructure is starting to show its age even though the equipment is well maintained. The wastewater main lift station on McCarthy Blvd has been upgraded, but the majority of the stormwater stations have had minimal upgrades other than the addition of small electric pumps for low flow conditions. Like with most cities, budgets are squeezed, and staff struggles to keep up with deferred maintenance.

The goal of this ECM is to upgrade each of the stations with new controls and add the ability to remotely communicate with the stations so staff can monitor status from afar. The controls upgrade would also allow staff to acknowledge non-critical alarms without visiting the sites, saving manpower hours which can be used for other deferred maintenance. By adding new controls and remote communication, the staff will be able to more effectively manage City resources, especially during critical weather events.

Stormwater and Wastewater Station Controls and Remote Communication

Currently, stormwater and wastewater stations have very basic relay or loop controllers. Because of the age and style of the controllers, it isn't feasible to integrate them to remote communication. Additionally, the age of the existing hardware is to the point that if there were a major failure of the critical panel components, the City would be hard pressed to find replacement parts and may be forced into an upgrade during peak operating times.

Based on these factors, ENGIE recommends the addition of new local PLC panels at each of the stormwater stations and the Main Lift wastewater station. These new PLC's would replace the old relay-based control panels and would have local touch screens added to the system to locally control the basic station functions. Additionally, entry detection and other alarming for each stormwater site would be added to each station as part of the upgrade. New RF communication equipment is planned for each station so that the data could be transmitted to the new SCADA software platform chosen by the City. Data would be distributed between the Gibraltar and Public Works offices and could be viewed on any workstation on the system as well as remotely. This would allow for remote access to check on local alarms and acknowledge non-critical ones.

ENGIE proposed to monitor the following items at each of the stations:

1. Entry Detection
2. Electric/Jockey Pump Run/Stop
3. Power Monitor for Electric Pumps
4. Water Level
5. Fuel Level (If available)
6. Fuel Leak Detection Alarm
7. Engine Driven Pump Telemetry (Discussed below)
8. Engine Heaters On/Off
9. VFD On/Off

Engine Controls for Pumps

Because the diesel-driven pump engines at the stormwater sites are quite old, part of the controls retrofit at each of the stations is new controls for each of the engine-driven pumps. This would include up to 17 total engine-driven pumps across all of the stations.

Each engine would get upgraded telemetry and a local control panel so that it can be individually operated for testing. The new controls would include upgrades to engine instruments to allow recording of the following engine data:

1. Run/Stop
2. Total Run Hours
3. Engine RPM
4. Engine Temp

Additional telemetry can be added if needed for reporting or for City staff monitoring.

The updated controls would extend the usable life of the engines for at least another 10 to 20 years, giving the City time to plan for replacement of the engine-driven pumps at some point in the future.

Stormwater and Sewer Lift Stations

Table 23. Stormwater and Sewer Lift Station Summary

Site	Type	Address
Jurgens Storm Pump Station	Storm	345 Jurgens Drive
Spence Creek Storm Pump Station	Storm	11 Butler Street
Penitencia Storm Pump Station	Storm	944 LaHonda Drive
Milpitas Materials Storm Pump Station	Storm	1125 N. Milpitas Blvd
Abbott Storm Pump Station	Storm	1225 N. Abbott
California Circle Storm Pump Station	Storm	1735 California Circle
Berryessa Storm Pump Station	Storm	731 Folsom Circle
Murphy Ranch Storm Pump Station	Storm	801 Murphy Ranch Road
Bellew Storm Pump Station	Storm	481 Murphy Ranch Road
Oak Creek Storm Pump Station	Storm	1521 McCarthy Blvd
PD Sump Storm Pump Station	Storm	1275 N. Milpitas Blvd
Wrigley Ford Storm Pump Station	Storm	75 Marylinn Drive
Manor Storm Pump Station	Storm	349 Marylinn Drive
Main Sewer Lift Station	Sewer	1425 N. McCarthy Blvd
Venus Lift Station	Sewer	1085 Venus Way

Jurgens Stormwater Station

This site is typical of the stormwater stations in Milpitas. It has four CAT engine-driven pumps that are connected to a relay-driven control system. The existing panel would be removed, upgrading the engine controls to modern digital controls. Additionally, a new touch screen PLC would be added to the site to pull all the telemetry from the new engine controls. A new RF communication system would also be added to the site to communicate with either Gibraltar or Public Works.

Spence Stormwater Station

This site just consists of outdoor panels that contain the relay controls for the electric pumps. The outdoor enclosure would be upgraded for a new PLC and a new RF communication system would be added to allow for communication with either Gibraltar or Public Works. It is understood that this site doesn't operate very frequently but would be upgraded as part of the overall project.

Penitencia Stormwater Station

This site is different than many of the stormwater station sites in Milpitas in that it only has two FIAT engine-driven pumps (instead of CAT-driven ones) and one electric jockey pump. This station, like the others, has an older relay-based control panel that would be replaced with a new modern PLC panel. The engines would be updated with new controls, and the jockey pump would be added to the new controls and PLC panel. This would give the operators more control to adjust the set points for the operation of the engines and jockey pump. Other control points, such as entry detection and fuel system status, could also be integrated into the new controls for this site if control points are present in the existing fuel system monitoring.

Milpitas Materials Stormwater Station

This site, adjacent to Public Works, includes two electric pumps and a relay panel that is entirely located outdoors. One of the existing panels may be reused and a new PLC based controls and communication can be added. There is limited other telemetry from this site outside of the electric pump and level detection.

Abbott Stormwater Station

This site includes two 30HP electric pumps and a relay panel located in a small building. The pumps are quite new and driven off a loop controller. A new PLC panel with a local touch screen would be added to the interior of the building, along with remote RF communication. This site would include just basic pumping controls and would also have intrusion detection. No other telemetry is expected.

California Circle Stormwater Station

This site includes three CAT 3208 diesel-driven pumps with relay-driven controls in one panel for all three pumps. There is also a single loop controller that controls engine operation based on the level in the adjacent surge pond. An outdoor diesel tank and leak detection would also need to be tied into the new controls.

The engines would receive new controls and their own local panel, and the site would also receive a new Master PLC and touch screen for control and monitoring of the station. As with the other stations, telemetry would be sent to Gibraltar or Public Works to be captured by the main SCADA system. Operators would be able to see general operation telemetry from the site and could expand monitored points if needed.

Berryessa Stormwater Station

This site is adjacent to a creek and a community pond that is also used for surge capacity. The station includes three CAT diesel-driven pumps with somewhat modernized Ryeso digital engine controls in three separate panels. Additionally, there is an electric jockey pump at the site being run by a loop controller. There is also an outdoor in-ground diesel tank along with leak detection that would need to be tied into the new controls.

The engine controls at this site are more modern, and therefore have the potential to be re-used but that would have to be determined during a more detailed engineering audit. For now, it has been assumed that the engine controls are suitable for re-use and can be tied into a new PLC that will control the engine-driven pumps as well as the electric jockey pump. The PLC would pull other alarm systems at the site, including entry notification and an RF communication system would be added to allow the PLC to communicate with the new SCADA system.

Murphy Ranch Stormwater Station

This site includes three CAT diesel-driven pumps with older relay-based engine controls in a single panel. Additionally, there is an electric jockey pump at the site being run by a loop controller. There is an outdoor in-ground diesel tank along with leak detection that would need to be tied into the new controls, and likely new control wiring and conduit would need to be run into the building. The PLC would pull other alarm systems at the site, including entry notification, and an RF communication system would be added to allow the PLC to communicate with the new SCADA system.

Bellew Stormwater Station

This site includes one CAT diesel-driven pump with older relay-based engine controls in a single panel. Additionally, there are two electric pumps at the site being run by loop controllers. There is an outdoor in-ground diesel tank along with leak detection that would need to be tied into the new controls. The PLC would pull other alarm systems at the site, including entry notification, and an RF communication system would be added to allow the PLC to communicate with the new SCADA system.

Oak Creek Stormwater Station

This station is adjacent to a creek and a community pond that is also used for surge capacity. The site includes three CAT diesel-driven pumps with older relay-based engine controls in a single panel. There is one electric jockey pump at the site being run by a loop controller. There is an outdoor above-ground diesel tank along with leak detection that would need to be tied into the new controls. The PLC would pull other alarm systems at the site, including entry notification, and an RF communication system would be added to allow the PLC to communicate with the new SCADA system.

PD Sump Stormwater Station

The PD Sump Stormwater site is located at the Milpitas Police Department. The site includes two electric pumps and a relay panel located in a small building. The pumps are quite new and driven off a loop controller. A new PLC panel with local touch screen would be added to the interior of the building, along with remote RF communication or perhaps tied directly through Wi-Fi or wired connections. The site would include just basic pumping controls and would also have intrusion detection, but no other telemetry is expected.

Wrigley Ford Stormwater Station

This site includes two electric pumps and a relay panel with loop controllers that control pumps based on level detection. There is a backup generator that could be tied into the new PLC as well but is currently not planned, since a lot more information will be required for that integration. A new PLC panel with local touch screen would be added to the interior of the building along with remote RF communication. The site would receive just basic pumping control and would also have intrusion detection. Because of past vandalism, this site might be a good candidate for additional security measures such as cameras.

Manor Stormwater Station

This site includes three electric pumps and a relay panel with loop controllers that control pumps based on level detection. The panels in this location are located outdoors, but there should still be enough space for a new PLC with local touch screen in the interior of the cabinets, along with remote RF communication. The site would include just basic pumping controls and would also have intrusion detection at the panel level. Because of past vandalism, this site might also be a good candidate for additional security measures such as cameras or additional intrusion detection.

Main Sewer Lift Station

This site has several site lift pumps, grinders, and other equipment that would be added to a new PLC, and it is also a candidate for a local server for redundancy. A new PLC panel with local touch screen would be added to the interior of the building along with remote RF communication. The site would receive pumping controls, intrusion detection, and level detection for the wet wells, and would tie in any existing flow controls. This site might be a good candidate for additional security measures such as cameras that could be networked into the system, depending on the speed of the internet connection that is available on-site.

Venus Sewer Lift Station

This is a simple lift station with pumps that are located underground for the most part. A small antenna and mast may need to be mounted here to get a good signal, but it would be small and inobtrusive. Telemetry from this site would just bet the wet well depth and the pump run data for on/off and run hours. For security, intrusion detection could be added to let the system know when the hatch is accessed, or the control panel is opened. Additionally, if desired, a small touch panel inside of a sealed electrical box may be added for ease of maintenance or local control.

3.14.9. Pressure Reducing Valves (PRVs)

The City of Milpitas has indicated that they would like to see their Pressure Reducing Valves (PRVs) added to the SCADA and automation scope. This is something ENGIE proposes to continue investigating alongside City staff, since the sites are numerous and require higher levels of engineering and additional investigation.

ENGIE did a thorough investigation of the PRV stations as part of the RF study and found that all of them are reachable with RF communication equipment. However, because some of the locations are fairly challenging to get power to and may require erecting an antenna for communication, a much more in-depth audit will be required. Many of the sites may need to pull power from nearby power poles or building lighting of which ownership still needs to be verified. A detailed review of each site and how power can be added to the vaults is needed to ensure that they can all operate properly within the system.

Additionally, the PRV valves and flow meters may need to be replaced to be compatible with new SCADA telemetry. There is also limited space at many of the locations, and therefore the type of PRV that can be used will need investigation as well as what style of flow meter might be compatible with the installation locations. The City has also indicated they would like to consider shutoffs at some of the PRV locations for maintenance purposes, which can also be evaluated during a more detailed audit.

Table 24. PRV Locations

Site	Address
Calera Creek Heights PRV	Near 163 Calera Creek Heights Drive
Capitol PRV	N. Capitol Ave between Montague Expwy and City limits
Curtis PRV East	W. Curtis Ave between Main/Abel
Curtis PRV West	W. Curtis Ave between Main/Abel
Gibraltar PRV21A	641 Gibraltar Court
Gibraltar PRV21	641 Gibraltar Court
Gibraltar PRV22	641 Gibraltar Court
Main PRV	Hammond Way
Milpitas PRV	N. Milpitas/Calaveras, north of City Hall
North Vault PRV	Near 1475 Pinehurst Court
South Vault PRV	Near 1486 Tularcitos Drive
Sunnyhills PRV	Washington/Escuela
Abel PRV	Junipero/Abel
Live Oak PRV	Live Oak Ct/Highway 680
McCarthy PRV1	South of Cadillac Court

Site	Address
McCarthy PRV2	South of Dixon Landing Lagoon
Montague PRV	Montague Expwy/Highway 680
Sinclair PRV	Sinclair Frontage Rd/Yosemite Drive

3.14.10. Savings Summary

Preliminary costs for the measures outlined in this section are estimated at $7.36MM. Additionally, ENGIE proposes an allowance of $1.8MM to be added to this scope, to fully utilize available funds and give the City the flexibility to finalize SCADA software selection and include additional PRV work as needed.

Table 26 below summarizes savings for this proposed measure.

Table 25. SCADA, Pumping, and Automated Disinfection Summary

Description	Projected Annual kWh Savings	Projected Annual Cost Savings	Projected Annual O&M Savings
Water System Controls, Pumping, and Automated Disinfection	840,672	$146,612	$41,600

4. Savings Calculations and Methodology

To calculate if a proposed energy efficiency measure or renewable energy project is financially viable, a rigorous analysis is performed. First, at each location where a measure or project is being considered, a baseline electrical, gas, or water usage profile is calculated. Then the expected production or savings is calculated and matched to the baseline load. Finally, the dollar savings are calculated matching the resulting net load profile to current utility rates. The modeling is different for electrical, gas, and water meters and is examined in more detail below.

4.1. Baseline Establishment Methodology

ENGIE thoroughly investigated and documented baseline energy and water usage profiles of City of Milpitas facilities included in this CEA. Our approach to baseline development involved the following steps:

- Performing a utility analysis to determine the usage of various City of Milpitas facilities and the cost of energy and water. This includes demand and real-time pricing, seasonal price changes, and historical cost escalation.
- Surveying City of Milpitas buildings to document existing conditions and operating requirements.
- Interviewing facility managers regarding operating hours, upcoming renovations, problem equipment, occupant complaints, and many other human factors. Well-documented information from the interviews and site walks are used in savings calculations to determine whether a proposed energy or water conservation measure will benefit the facility and its occupants. Using the results of the utility analysis and expected future use of the facilities, a baseline usage for electricity, gas, and/or water is generated for each facility where a proposed measure or project is located. For electrical baseline calculations, hourly incremental usage is calculated when needed. For both gas and water usage, monthly summary data is sufficient for baseline modeling.

4.2. Solar Production and Savings Modeling

The production of each proposed solar PV system was modeled using industry standard software, PVSyst. This software allows the user to accurately analyze the PV production with custom inputs such as site location, equipment manufacturer, system azimuth, panel tilt, and system losses. The weather and irradiance data, a critical input, is TMY3 (Typical Meteorological Year) data collected at the San Jose International Airport from 1991-2005. TMY3 data sets are provided by the National Renewal Energy Laboratory. Using these inputs, PVSyst outputs one year of expected PV system electricity output (kWh) on hourly intervals.

Once hourly kWh production values are determined, the dollar value of each kWh produced is determined using a third-party energy modeling tool. Current baseline electricity usage and modeled PVSyst hourly production data were entered into the modeling tool. Using current utility rates, the monetary value of the energy produced by each solar PV system is calculated. For each solar PV system, a comprehensive analysis was done to determine optimal utility rate and interconnection tariff to maximize the value of each kWh produced.

4.2.1. Community Choice Aggregation (CCA)

ENGIE is aware that the City of Milpitas recently migrated to Silicon Valley Clean Energy (SVCE) as a power provider. We have modeled this project using current PG&E rates. SVCE aims to be more solar-

friendly, which may offer benefits on PV value compared to the PG&E base case. ENGIE used PG&E rates in the analysis as this will offer a conservative base case for PV savings.

4.3. Battery Storage Savings Modeling

The production of the BESS was modeled using the battery supplier's proprietary modeling tools. The values were then checked using a third-party energy modeling tool, to ensure that the kW savings and dollar savings were reasonable. Depending on how the BESS systems are used for backup purposes, they Demand savings may be limited, especially during times when power outages are more likely (e.g. high fire-risk times and leading up to PSPS events).

The estimated bill savings were calculated for each meter by using the new implementation baseline (with the final selected ECM savings taken into consideration), through a third-party energy modeling tool, using current rate schedules to create a baseline billing. The battery kW demand savings were then subtracted from the baseline data. This reduced 15-minute interval data was then again run through the third-party energy modeling tool. The difference between the baseline output and the reduced output was used as the expected dollar savings from the battery systems.

4.4. Transformer Savings Modeling

ENGIE inspected each low voltage transformer that the City owns to determine its kVA or energy rating, its base efficiency, and if there would be any issues related to the installation of a new, higher efficiency transformer in the same location. ENGIE also performed measurements of the actual transformer loading and losses. This data, in addition to historical and industry standard data, were used to determine existing transformer usage and potential energy savings. Energy (kWh) expected reductions were then multiplied by each site's average electricity rate.

4.5. Lighting Savings Modeling

ENGIE performed a detailed audit of City facilities, including individual fixture details, fixture counts, and existing controls. If a fixture retrofit or replacement provided energy savings, maintenance savings, and improved lighting quality, the fixture was considered for replacement. In some cases, where the existing lighting system already represents the most effective solution or LED replacements are not available for the existing fixture, the systems will not be modified. The lighting savings per year are based on a reduction of wattage, or kW per fixture, and reduced hours of use.

A reduction in kW is accomplished simply by using higher efficiency LED fixtures, which provide a similar light output. Savings per year were estimated based on the reduction of kW and the hours of usage. Hours of usage were estimated based on room and building type, as well as feedback from City staff. Existing consumption was then vetted against current utility bills, to verify if assumptions proved accurate, and adjusted as needed.

When installing new controls (such as occupancy sensors or dimming capabilities for interior spaces, or bi-level dimming for exterior applications), a savings percentage was used to calculate the new reduced hours of operation for the impacted fixtures.

Energy (kWh) savings are finally multiplied by the average electricity rate for each and every facility, determining the total dollars saved per year.

- kW= Fixture kW
- H= Operating Hours per Year
- ES= kW Hr Savings
- ER= Energy Rate ($E/kWh)
- $S= $ Savings

$$(kW \times H)_{existing} - (kW \times H)_{new} = ES$$

$$ES * ER = \$S$$

4.6. HVAC Savings Modeling

The annual energy savings resulting from installation of replacement units was determined using eQuest 3.65, a graphical user that interfaces with the Department of Energy's 2.2 whole building analysis software tool. Using inputs including averaged 30-year TMY2 weather data, occupancy schedules, building loads, building parameters, zone, and equipment performance specifications, ENGIE created a baseline energy model. After this baseline model was calibrated to match the profile of the current electrical and gas consumption, the new equipment and controls measures were added into the model to determine the new energy profile for each measure. The difference between the baseline and new energy profile is the energy savings resulting from the ECM. Electrical bill savings were then calculated multiplying the kWh energy savings per site by each site's corresponding blended $/kWh utility rate.

4.7. EMS Savings

Upgrading the City's EMS controls will enable the facilities engineers to monitor the operation set points of the equipment and collect trending data on operation set points. Consequently, the facilities engineer will be able to use this data to determine and set up a sequence of operation for the equipment that will optimize its energy consumption. Savings will be completely dependent on any action taken by the City and subsequent modifications to the system's usage, and therefore were not estimated for this analysis.

4.8. Water Fixture Savings Modeling

ENGIE performed a detailed audit of all City water fixtures, recording their actual and nameplate consumption rates, as well as noting conditions. Existing water consumption was determined using the measured gallon per flush and gallon per minute rates for each fixture, the number of fixtures counted during the on-site audits, and standard assumptions about fixture uses per day (based on building types and occupancy hours). A new water usage profile was created using the proposed lower gallon per flush and gallon per minute rates. These savings were kept in an annual savings format, as water utility rates do not vary based on time of day.

The estimated bill savings were calculated by subtracting the new water usage profile from the baseline profile to determine water savings in CCF. Current City of Milpitas $/CCF rates were then used to calculate bill savings for each facility.

4.9. Water Meter Savings Modeling

Estimating the full value of retail water being delivered starts with a billing system analysis. This analysis details the water meter quantities and distribution, breaking it down by size and type, and also looks into the system-wide difference between total water purchased and total water billed to City customers.

ENGIE gathered and analyzed three years of City of Milpitas' billed consumption and AWWA reports, a database of City water meter quantity by size, the distribution of City water consumption by meter size, as well as current water rates.

ENGIE worked closely with City staff to determine percent losses to be applied to City meters in this evaluation. The City of Milpitas has bench-tested their larger meters throughout the years, with the most recent AWWA reports showing 5%, 3%, and 2% losses for 2016, 2017, and 2018, respectively. Therefore, ENGIE used a conservative 1% loss percentage. Regarding the smaller water meters, industry standards indicate that those losses can easily range from 10-15%, with studies showing that 16% of all domestic water usage occurs at flows smaller than 1 GPM (which older meters cannot register and are therefore never recorded). Older meters like the ones seen at Milpitas (some almost 30 years old) are especially bad at accurately measuring low flows, but ENGIE used a conservative 4% loss for smaller meters. Newer meters are tested and certified at 100% accuracy, so the full losses can be reclaimed.

Minimizing under-reporting ensures that the City can bill customers to the full extent of the service provided. Dollar values of the savings were calculated based on market prices for the water being sold to customers.

4.10. Pumping Savings Modeling

Pump savings are determined based on the calculated reduced kWh, multiplied by the average electricity rate for each pumping station in question.

4.10.1. Gibraltar

To calculate pump energy savings associated with the new automated tank dosing systems, ENGIE studied the current versus proposed operating schedule for the pumps in question, in addition to pump curves and any data available from the sites' historians.

Currently, the Gibraltar tanks are required to be cycled on a frequent basis to maintain the quality of their water. The tanks are also required to maintain a minimum capacity as a fire reserve for the system. This frequent cycling means that water must be delivered into the tanks, its quality checked, and then pumped back out of the tanks. The Gibraltar tanks are filled from the Santa Clara and San Francisco water systems from roughly 7:30 AM to 5:30 PM every day, meaning that the pumps must run on approximately the same schedule to provide water to the distribution system during those times.

With the new automated tank dosing system, the water in the tanks will not need to be cycled and the pumps will be able to be mostly shut off, with water being distributed directly to the distribution system from the incoming water mains. The City should not be required to cycle the water in the tanks other than occasionally (ENGIE estimates once or twice a month at most, but conservatively used 5 days/month for this analysis). Additionally, ENGIE also included a 70% certainty factor to this estimate, to take into account variations in actual daily operation. This would still allow a bi-weekly tank turnover for each tank at Gibraltar, and account for the pumps running on a semi-frequent basis to maintain good operational functionality.

Savings were then calculated based on the provided pump curves and data from the Gibraltar historian, using the current operating pumping schedule for both pump #4 and pump #6 as a base, and assuming that they will be allowed to be turned off for 25 out of 30 days every month.

4.10.2. Country Club and Tularcitos

To calculate energy savings associated with the high-efficiency motor pump upgrades, ENGIE studied the current submerged pump performance and the proposed vertical turbine pump efficiency. Assuming the same operating schedules, savings were obtained from the reduced energy required to operate the new, more efficient, pump in the same capacity as the existing one.

For Country Club and Tularcitos, since a recent pump test for either site is not available, the current energy savings calculated would likely be the minimum savings from the addition of a new pump. If the existing pump is worn at all, the motor has lost efficiency, or there are any other issues repaired during the pump replacement, savings would likely increase (typically between 5-10%).

4.11. Operation and Maintenance Savings

Several measures carry operational savings related to avoided materials or repair costs based on the longevity or age of the asset. After implementing the retrofits recommended by ENGIE, the City of Milpitas will reduce material dollars spent maintaining equipment replaced by this program. Additionally, implementing these measures will allow the City of Milpitas staff to redirect their efforts to preventative maintenance or other critical tasks instead of repairing aging equipment.

4.11.1. Lighting

The rated life for LEDs is significantly longer than that of fluorescent or HID fixtures. LEDs are typically rated to 50,000 hours whereas comparable non-LEDs are typically rated to 20,000 hours. Maintenance savings are based on the reduction in labor (estimated based on City staff hourly wages) and material costs due to the increased life of LEDs.

Using each specific City of Milpitas facilities burn rate, the average fixture life is calculated for all existing and new fixtures. Over the lifetime of the project, each LED lamp will need to be replaced significantly fewer times. Existing HID streetlights and sports lights are estimated to have a 10-year lifespan, and therefore an average 10% of them need to be replaced every year, while LED lamps will last considerably longer. This reduction in lamp replacements offers significant operational and maintenance savings for the City of Milpitas, as they save money on materials and free up personnel to deal with other tasks.

Furthermore, “average life” is defined differently for LEDs compared to fluorescent or HID lights. For LEDs, average life is defined as the number of run hours when the lumen output has decreased to 70% of initial output. LEDs do not burn out in the traditional sense and have an extremely low spontaneous failure rate. For fluorescent and HID fixtures, average life is defined as the number of run hours when 50% of the lamps will have failed. Where fluorescent lamps burn out completely, LEDs continue to operate well past their rated life. Finally, unlike some non-LED lighting technologies, LED life is not adversely affected by 24/7 usage, excessive switching, or compatibility with existing controls.

4.11.2. HVAC

HVAC maintenance savings stem from a combination of reduced staff time in responding to complaints and reduced spending on any maintenance contracts with third parties to repair aging equipment. ENGIE reviewed the City's last three years of contracts with their HVAC maintenance providers, obtaining annual costs. These encompass all City HVAC units, not just the ones ENGIE is proposing to replace, but most of the high-issue units are included in the proposed replacement scope.

Another approach is to take into account the capital cost avoidance of replacing this equipment down the line. As a rule of thumb, HVAC units have a lifetime of 20 years, so it is safe to assume that given different ages of existing equipment, these will be failing at a rate of 5% a year for the lifetime of the project.

ENGIE compared the estimated savings based on both approaches, and ultimately used the capital cost avoidance method, which yielded more conservative savings (annual City contracts amounted to more than twice as much).

4.11.3. EMS

EMS savings are calculated by estimating the reduction in maintenance staff time to respond to alarms in order to troubleshoot on site and make setting adjustments. The new EMS at the Public Works and Police Department building will allow remote troubleshooting and setting adjustments at a greatly reduced time demand on facilities engineers. Benefits will be faster fixes of problems and a more comfortable and reliable working environment for City staff.

4.11.4. Water Fixtures

Water fixture maintenance savings are calculated based on quantities in scope and the failure rate of each type of equipment over its lifetime. These are primarily from the material costs saved by avoiding these fixes.

Additional savings could be estimated from reduced staff time in responding to complaints, fixing aging equipment, and repairing leaks, but those are difficult to estimate and are expected to be quite small. Therefore, no labor savings are included in the CEA.

4.11.5. Water Meters

Water Meters are currently read manually by City staff, and maintenance savings will stem from having this task automated, freeing up staff to work on other tasks. The City currently has two full time employees and one part-time employee reading water meters, and savings were estimated based on their hourly wages.

4.11.6. SCADA and Automated Dosing

SCADA savings are calculated by estimating the reduction in maintenance staff time to respond to alarms in order to troubleshoot on site and to make setting adjustments, as well as removing the need for a secondary weekly physical sampling, which will be able to be completed remotely and continuously. This will free up personnel to work on other tasks throughout the City.

Based on conversations with City staff, we estimated the frequency and duration of these events, and calculated the reduction in labor costs associated with these changes using the technician's hourly wages.

4.11.7. Summary

Total O&M savings per measure are summarized in Table 27 below.

Table 26. O&M Savings Summary

Measure	Annual O&M Cost Savings
Lighting	$142,875
HVAC	$81,930
EMS	$8,320
Water Fixtures	$1,090
Water Meters	$416,000
SCADA and Automated Dosing	$41,600

5. Project Costs and Financing

To allow the City of Milpitas to take advantage of the energy and water savings described above, ENGIE provided information and support on project financing. This began during the design process by including products and solutions eligible for energy and water conservation rebates, as well as gathering information on financing options. Our Project Finance staff is available and ready to assist in identifying financing options as needed.

5.1. Rebates, Incentives, and Grants

Financial incentives for renewable energy projects, energy efficiency measures, and water conservation measures are sometimes offered through local utilities and the State of California. We investigated the availability of programs applicable for this project. It is very important to note that although these programs were in effect at the time this report was issued, incentive programs can and do change quickly. It is possible that any incentive programs will either change or close before the City can take advantage of them.

5.1.1. Utility, Regional, and Tax Incentives

The City of Milpitas is located in the PG&E utility service territory. ENGIE tracks and manages the application process for all PG&E rebates and incentives relevant to the program scope, as well as offerings from any other currently available programs.

At this time, the proposed project may eligible for the following rebates:

- **Deemed LED Lighting** – Can be eligible for incentives up to $105/fixture for qualifying interior, exterior, and streetlighting fixtures. Would need to be installed by October 2020. Timing may not work for the City, but we will continue to keep our eye on whether the City and proposed fixtures qualify.
- **Customized LED Lighting** – Can be eligible for incentives up to $0.08 per kWh saved with qualifying interior, exterior, and streetlighting fixtures. Would need to be installed by October 2020. Timing may not work for the City, but we will continue to keep our eye on whether the City and proposed fixtures qualify.
- **Electric Vehicle Charging** – Can be eligible for incentives up to $5,750 per site with five double-port charging stations installed, but currently proposed scope does not include enough fixtures per site to qualify. Unfortunately, City sites are also not eligible for the higher, PG&E-owned EV charging rebate structure, since they are not located in the eligible areas. There may be additional funding for EV charging available from Silicon Valley Clean Energy (SVCE) and the California Electric Vehicle Infrastructure Project (CALeVIP), for both level 2 and DC fast chargers. Program details are expected to be released in Fall 2020 (likely to be a first come, first serve incentive), so conservatively nothing is yet accounted in this CEA. ENGIE will continue to work with the City to coordinate with SVCE and CALeVIP to take advantage of any available incentives. Additionally, ENGIE is monitoring the Bay Area Air Quality Management District (AQMD) incentive programs in the event they re-open eligibility for EV charging incentives.
- **Self-Generation Incentive Program (SGIP)** – This rebate is available for all BESS systems, and requires completion of at least 104 equivalent round-trip cycles per year. To obtain SGIP, the system does not need to be paired with solar PV. As of September 2020, SGIP has 4 different incentive levels. The City of Milpitas qualified for the standard $0.40/Wh at

Community Center and Senior Center, as well as the Equity incentive of $0.85/Wh at Public Works. We expect the City Hall, Sports Center, and Fire Station #1 will qualify for the next Tier of SGIP standard Large-Scale Storage incentives, at $0.35/Wh. ENGIE submitted applications for the 3 systems in the recommended bundle (Community Center and Senior Center to the standard program in Bundle C1, and Public Works to the Equity program in Bundle C2). The two standard applications are currently under review, while the Public Works Equity application was placed on a waitlist on 5/15/2020 since the program has limited funds and was significantly oversubscribed. ENGIE is gathering information on the likelihood of additional Equity funds being available for the City of Milpitas, or whether they might want to apply for the standard incentive for Public Works instead.

Table 27. BESS and SGIP Summary

Site	System Size (kW)	System Size (kWh)	SGIP Incentive Level	SGIP Incentive
Police Department/ Public Works	375	750	Equity	$568,650
City Hall	375	750	Standard	$234,150
Senior Center	125	250	Standard	$89,200
Community Center	125	250	Standard	$89,200
Sports Center	250	500	Equity	$156,100
Fire Station #1	125	250	Standard	$78,050

- **Customer Relief and Community Resilience –** As part of their COVID-19 response, SVCE is investing in the planning and infrastructure development of community resilience efforts. Funds have been earmarked for the City of Milpitas, estimated at over $700,000. ENGIE has assisted the City in completing an application for these funds to be split among the Senior Center and Community Center microgrids. Current project pro-formas assume these incentives will be paid in the first year after project operation.
- **Advanced Metering Infrastructure (AMI) water meter conversion incentives** – The Santa Clara Valley Water District (Valley Water) offers rebates for AMI water meter conversion when combined with water use reports to customers. ENGIE will work closely with the City and Valley Water to ensure the City can take advantage of the $10 per AMI meter conversion annually over 7 years to help supplement its Capital contribution. We estimate that the City is eligible for a total of $1,091,790 in incentives from Valley Water.
- **Water Fixture Retrofits** – ENGIE is also working closely with Valley Water to understand and leverage any incentives available for water fixture retrofits. There are programs currently under development for toilet and urinal replacements, and potentially material availability for water-efficient aerators and pre-rinse sprayers that the City may be able to take advantage of.
- **Investment Tax Credit (ITC)** – This Federal tax rebate of 30%* is available for solar PV as well as BESS systems that are charged from solar. ITC is only available to the City if the project has been financed through a Power Purchase Agreement (PPA), and the battery is owned by a private entity – an approach our finance team could work with the City to analyze.

The SGIP incentive decreases to $0.29/Wh when going after ITC, and there are rigid construction schedule deadlines that must be met to qualify.

*The Federal ITC stepped down to 26% from 30% in 2020, however ENGIE has procured enough solar equipment to safe harbor the 30% incentive for its customers if they are in construction in calendar year 2020.

5.2. Other Financing Options

In addition to rebates for individual measures, ENGIE has provided information on other financing options to support a comprehensive energy and water savings program. These include Power Purchase Agreements (PPAs), Tax Exempt Lease Purchases, On-Bill Financing (OBF), and low-interest State loans.

- **Tax Exempt Lease Purchases** – ENGIE issued a request for proposals (RFP) on behalf of the City for competitive financing proposals. Two banks responded with rates and terms summarized below. These proposals expired in early April, and ENGIE requested a refresh in early May. These updated rates have since expired but if the City desires to re-engage third-party lenders before the end of 2020, it is possible that the rates will not deviate significantly from the assumptions used in this analysis. ENGIE is happy to help the City engage third-party lenders as needed. As the table below indicates, we asked the banks to provide financing in two tranches: one for Bundle A measures assuming a 7-year term and one for Bundle B+C+D measures assuming a 15-20 year term.

Table 28. TELP Financing RFP Results

	Bundle A		Bundle B + C + D	
Financial Partner	**Bank #1**	**Bank #2**	**Bank #1**	**Bank #2**
Financed Amount	$8,310,000	$8,310,000	$19,896,000	$19,896,000
Construction Period (months)	15	15	15	15
Term (years) and Rate				
7	1.998%	2.250%		
15			2.280%	2.430%
17			2.374%	2.540%
20 minus construction			2.489%	
20 plus construction				2.930%
Payments	fixed payments or step payments			

- **Power Purchase Agreement (PPA)** – A PPA is an energy purchase contract for electricity produced by on-site distributed generation (PV and/or BESS). The generating equipment would be owned and maintained by ENGIE or a third-party, and the City agrees to purchase electricity at a set rate that would cost less than purchasing from the Utility. A PPA generally utilizes tax benefits to enhance the cost structure, and contract terms are generally available on 20-year or longer with possible early buyout provisions, paid on a monthly basis.
  - The City currently has a 20-year Power Purchase Agreement through which it has been receiving solar power at several sites for almost 10 years. The PPA contains a base rate of between $0.185 and $0.20 per kWh (varying by site) and an annual price escalation of 3% - 4%. The PPA contains buyout provisions that would allow the City to purchase the generating equipment (10 years after the PPA effective date), potentially resulting in significant cost savings for the City. Additionally, owning these systems would give the City the flexibility to make component modifications, such as upgrading inverters to more modern models that are compatible with microgrid controls, or upgrading under-canopy lighting to LEDs. While ENGIE cannot provide advice on such a transaction, we can assist in identifying financing options, provide technical assistance, and provide ongoing monitoring, operations, and maintenance to optimize the systems' output and financial benefits.

- **On-Bill Financing (OBF)** – Like other Investor Owned Utilities (IOUs) in CA, PG&E offers zero-interest 10-year loans for efficiency measures through its on-bill finance program. At this point, the efficiency measures specified by ENGIE for Milpitas would not qualify, but we will continue to monitor the program qualifications.
- **California Energy Commission ECAA Loan** – A rolling loan program from the CEC that provides low-interest 1% loans for cities to complete energy efficiency projects. Maximum loan amount is $3,000,000 or available funding, whichever is less, and applications are accepted on a rolling basis.
- It is ENGIE's understanding that the City may use some of its allocated capital funding to pay for certain pieces of the program, including the SCADA upgrades, AMI water meters, and potentially streetlighting retrofits.

5.3. Optimized Comprehensive Package

The CEA identified approximately $50MM of efficiency, water, and renewable energy measures across the City that would yield projected gross-savings of over $109 million over 30 years and net-savings of over $50 MM after deducting all financing costs and capital contributions. We understand that the City may want to take a phased approach in implementation. Please note that measures interact with one another, and once the City selects their preferred measures to move forward with, ENGIE should study how the final mix impacts the original, all-inclusive, designs, making adjustments as necessary to maximize City benefits. For example, removing efficiency measures would increase a building's consumption, which could impact solar and battery sizing and savings; similarly, if batteries are not selected, the solar systems could be re-designed with more efficient and cost-effective inverters that do not meet the microgrid control requirements.

Below in Table 30 we provide an optimized package of measures that maximizes net savings in Year 1 of the program and fit the aforementioned feasibility criteria: technically viable, critical need, or good financial payback. We have also grouped the measures by bundle and provided proformas for each.

Some highlights of this optimized group of measures:

- Leverages high-savings, quick-payback measures like interior and exterior lighting, solar, and water meters.
- Excludes addition of new lighting at Dixon Landing, as it will require an extensive environmental review and does not provide any savings. We recommend including this in a future Phase.
- Includes the best-payback and most critical battery systems, at Public Works, which gets the highest SGIP incentive and provides resiliency for the Police Department, as well as at the Community Center and Senior Center, which receive lower SGIP incentives but provide critical City services.
- Excludes replacement of duct work at the Community Center due to high costs and no associated savings.
- Includes SCADA, Pumping, and Automated Dosing measures due to non-quantifiable benefits, City demand, and already-allocated budget.
- ENGIE continues auditing and engineering Pressure Reducing Valves (PRVs) and pumping stations to include these upgrades through the allowance indicated under the SCADA ECM.

ENGIE is happy to work to with the City to determine a phased approach for implementation of the measures. For example, **Group I** could include Bundles A, B, and part of C (C1), which includes measures that have already been allocated capital (i.e. water meters and SCADA upgrades) or which

have critical City needs, and after that work has been underway for a few months, implement **Group 2** which would include Bundle C2, and D. Please note the cost estimates include current labor and material rates, as well as economies of scale under the assumption that several scopes will be simultaneously installed by ENGIE, while a phased approach might incur some additional remobilization costs. This approach can be implemented with one Energy Services Contract using two Notices to Proceed (NTPs), one to initiate each Group of measures. We look forward to working with the City to determine the best overall approach.

Table 29. Optimized Energy Program by Bundle

	Group 1								Group 2				
Bundle	A			B				C1	C2		D		
Description	Facilities Water Retrofits	Water Meters Upgrades	SCADA	LED Lighting Retrofits (interior / exterior at facilities)	LED Park Lighting	LED Streetlights	LED Sports Lighting	Solar PV, Battery Storage/ Resiliency	Solar PV + EV Chargers	Battery Storage/ Resiliency	High Efficiency Transformers	HVAC Upgrades	EMS Upgrades
City Hall				x					x		x	x	
Public Works, Vehicle Shop / Corp yard, Police Department				x					x*	x*	x	x	x
Community Center				x				x				x	
Senior Center				x				x×				x	
Sports Center Complex				x					x		x	x	
Library Parking Garage				x									
Fire Station No.1, Main Fire Admin, Fire training Center				x								x	
Fire Station No. 3				x								x	
Fire Station No. 4				x								x	
Pumping Stations			x	x									
PRVs			o										
City-wide	x	x	x		x	x	x+						
Costs (MM)	$0.70	$12.50	$7.36	$1.88	$0.49	$2.95	$1.55	$4.46	$5.12	$1.68	$0.33	$2.18	$0.44
Allowance (MM)		$0.25	$1.80										
CIP Funding (MM)		$8.99	$9.10										
Energy/Water Savings (MM)	$0.03	$0.68	$0.15	$0.24	$0.04	$0.32	$0.01	$0.08	$0.22	$0.01	$0.02	$0.01	
O&M Savings (MM)	$0.00	$0.42	$0.04	$0.08	$0.01	$0.05	$0.00					$0.08	$0.01
Incentives (MM)		$1.09						$0.88		$0.57			
Simple Payback	23	11	N/A	6	10	8	N/A	45	23	79	14	25	55

Legend:
Costs include capitalized guarantee and O&M
x = Included in price
o = Not included in price, to be handled within contract allowance
* = To be moved to Group 1 if Equity SGIP incentive gets funded from the waitlist
× = EV chargers included at Senior Center only
+ = Sports lighting retrofits included for Cardoza Park (Baseball and Softball) and Hall Memorial Park (Soccer)

Tables 31-36, below, include a series of proformas for the above optimized package of measures shown several different ways:

- Bundles A+B+C+D with all O&M savings
- Bundle A with all O&M savings
- Bundle B Lighting without labor savings
- Bundle C1 Resiliency
- Bundle C2 Resiliency
- Bundle D Infrastructure

Table 30. Proforma for Bundles A+B+C+D

Including water meter O&M savings

Year	Solar Electricity Produced (kWh)	Solar Avoided Electric Rate ($/kWh)	Solar Electricity Savings	Solar O&M Costs	Solar M&V Costs	Solar O&M and M&V Costs	Net Solar Project Savings	Energy Conservation Savings	Energy Storage Savings	SGIP and SVCE Funds	Water Meter Incentive	Water O&M Costs	Streetlighting Controls O&M Costs	EV Charging Network Costs	Capital Infusion	O&M Savings	Total Program Savings	Estimated Lease Payment	Project Net Benefit	Cumulative Program Savings
	A	B	C = A * B	D	E	F = D + E	G = C - F	H	I	J	K	L	M	N	O	P	Q=G+H+I+J+K-L-M-N+O+P	R	S = Q - R	T
1	1,910,911	$0.157	$299,937			$0	$299,937	$1,503,214	$13,691	$813,052	$155,970	$49,674	$0		$2,880,000	$596,517	$6,212,707	$4,746,444	$1,466,262	$1,466,262
2	1,901,356	$0.164	$311,867			$0	$311,867	$1,570,859	$13,537	$75,000	$155,970	$49,674	$0		$2,030,000	$613,165	$4,720,724	$3,254,461	$1,466,262	$2,932,525
3	1,891,850	$0.171	$324,271			$0	$324,271	$1,641,547	$13,504	$75,000	$155,970	$49,674	$0			$630,312	$2,790,930	$1,324,668	$1,466,262	$4,398,787
4	1,882,390	$0.179	$337,169			$0	$337,169	$1,715,417	$13,607	$75,000	$155,970	$51,164	$0			$647,973	$2,893,972	$1,427,710	$1,466,262	$5,865,049
5	1,872,978	$0.187	$350,580			$0	$350,580	$1,792,611	$14,044	$75,000	$155,970	$52,699	$0			$666,164	$3,001,670	$1,535,408	$1,466,262	$7,331,311
6	1,863,614	$0.196	$364,524	$51,740	$10,385	$62,125	$302,399	$1,873,278	$14,493		$155,970	$54,280	$0	$30,100		$684,901	$2,946,661	$1,510,499	$1,436,162	$8,767,474
7	1,854,296	$0.204	$379,023	$53,292	$10,697	$63,989	$315,034	$1,957,576	$14,953		$155,970	$55,909	$0			$704,200	$3,091,825	$1,625,563	$1,466,262	$10,233,736
8	1,845,024	$0.214	$394,099	$54,891	$11,017	$65,908	$328,190	$2,045,667	$15,426			$57,586	$0			$724,078	$3,055,775	$1,589,513	$1,466,262	$11,699,998
9	1,835,799	$0.223	$409,774	$56,538	$11,348	$67,886	$341,888	$2,137,722	$15,910			$59,313	$0			$744,553	$3,180,760	$1,714,497	$1,466,262	$13,166,260
10	1,826,620	$0.233	$426,073	$58,234	$11,688	$69,922	$356,151	$2,233,919	$16,408			$61,093	$0			$765,641	$3,311,026	$1,844,764	$1,466,262	$14,632,523
11	1,817,487	$0.244	$443,020	$59,981	$12,039	$72,020	$371,000	$2,334,445	$16,003			$62,926	$44,530			$787,363	$3,401,355	$1,979,623	$1,421,732	$16,054,255
12	1,808,399	$0.255	$460,641	$61,780	$12,400	$74,180	$386,460	$2,439,495	$16,723			$64,813	$44,530			$809,735	$3,543,071	$2,121,339	$1,421,732	$17,475,987
13	1,799,357	$0.266	$478,963	$63,634	$12,772	$76,406	$402,557	$2,549,273	$17,476			$66,758	$44,530			$832,779	$3,690,797	$2,269,065	$1,421,732	$18,897,719
14	1,790,361	$0.278	$498,014	$65,543	$13,155	$78,698	$419,316	$2,663,990	$18,262			$68,760	$44,530			$856,515	$3,844,792	$2,423,060	$1,421,732	$20,319,452
15	1,781,409	$0.291	$517,822	$67,509	$13,550	$81,059	$436,763	$2,783,870	$19,084			$70,823	$44,530			$880,962	$4,005,326	$2,583,593	$1,421,732	$21,741,184
16	1,772,502	$0.304	$538,419	$69,534	$13,957	$83,491	$454,928	$2,909,144	$19,943			$72,948	$44,530			$906,143	$4,172,679	$2,750,947	$1,421,732	$23,162,916
17	1,763,639	$0.317	$559,834	$71,620	$14,375	$85,996	$473,839	$3,040,055	$20,840			$75,136	$44,530			$932,079	$4,347,147	$2,925,415	$1,421,732	$24,584,648
18	1,754,821	$0.332	$582,102	$73,769	$14,807	$88,575	$493,526	$3,176,858	$21,778			$77,390	$44,530			$958,794	$4,529,035		$4,529,035	$29,113,683
19	1,746,047	$0.347	$605,255	$75,982	$15,251	$91,233	$514,022	$3,319,816	$22,758			$79,712	$44,530			$986,310	$4,718,663		$4,718,663	$33,832,347
20	1,737,317	$0.362	$629,329	$78,261	$15,708	$93,970	$535,359	$3,469,208	$23,782			$82,104	$44,530			$1,014,651	$4,916,366		$4,916,366	$38,748,713
21	1,728,630	$0.379	$654,360	$80,609	$16,179	$96,789	$557,571	$3,536,002				$84,567	$44,530			$878,872	$4,843,349		$4,843,349	$43,592,062
22	1,719,987	$0.396	$680,387	$83,028	$16,665	$99,692	$580,695	$3,695,122				$87,104	$44,530			$903,990	$5,048,174		$5,048,174	$48,640,236
23	1,711,387	$0.413	$707,450	$85,518	$17,165	$102,683	$604,767	$3,861,403				$89,717	$44,530			$929,862	$5,261,785		$5,261,785	$53,902,021
24	1,702,830	$0.432	$735,589	$88,084	$17,680	$105,764	$629,825	$4,035,166				$92,408	$44,530			$956,510	$5,484,562		$5,484,562	$59,386,583
25	1,694,316	$0.451	$764,847	$90,726	$18,210	$108,937	$655,910	$3,383,371				$95,181	$44,530			$887,242	$4,786,813		$4,786,813	$64,173,397
26	1,685,844	$0.472	$795,268	$93,448	$18,756	$112,205	$683,064	$511,588								$41,600	$1,236,252		$1,236,252	$65,409,648
27	1,677,415	$0.493	$826,900	$96,252	$19,319	$115,571	$711,329	$534,610								$41,600	$1,287,539		$1,287,539	$66,697,187
28	1,669,028	$0.515	$859,790	$99,139	$19,899	$119,038	$740,752	$558,667								$41,600	$1,341,019		$1,341,019	$68,038,207
29	1,660,683	$0.538	$893,988	$102,113	$20,496	$122,609	$771,379	$583,807								$41,600	$1,396,786		$1,396,786	$69,434,993
30	1,652,380	$0.563	$929,547	$105,177	$21,111	$126,287	$803,259	$610,078								$41,600	$1,454,938		$1,454,938	$70,889,930
Total	**53,358,677**		**$16,758,839**			**$2,265,032**	**$14,493,808**	**$68,467,776**	**$342,220**	**$1,113,052**	**$1,091,790**	**$1,711,413**	**$667,950**	**$30,100**	**$4,910,000**	**$20,507,315**	**$108,516,498**	**$37,626,567**	**$70,889,930**	
																		Outlay	$18,825,124	
																		Net Benefit	$52,064,806	
																		NPV	$27,150,362	

Table 31. Proforma for Bundle A – Water meters and SCADA, Including water meter O&M savings

Year	Solar Electricity Produced (kWh)	Solar Avoided Electric Rate ($/kWh)	Solar Electricity Savings	Energy Conservation Savings	Water Meter Incentive	Water O&M Costs	Capital Infusion	Water Meters O&M Savings	SCADA O&M Savings	Total Program Savings	Estimated Lease Payment	Project Net Benefit	Cumulative Program Savings
	A	B	C = A * B	D	E	F	G	H	I	J = D+E+G+H+I-F	K	L = J - K	M
1	-	$0.000	$0	$859,765	$155,970	$49,674	$2,880,000	$417,090	$41,600	$4,304,751	$3,372,083	$932,668	$932,668
2	-	$0.000	$0	$898,454	$155,970	$49,674	$2,030,000	$429,603	$41,600	$3,505,953	$2,573,285	$932,668	$1,865,336
3	-	$0.000	$0	$938,885	$155,970	$49,674		$442,491	$41,600	$1,529,272	$596,604	$932,668	$2,798,004
4	-	$0.000	$0	$981,135	$155,970	$51,164		$455,766	$41,600	$1,583,306	$650,638	$932,668	$3,730,672
5	-	$0.000	$0	$1,025,286	$155,970	$52,699		$469,438	$41,600	$1,639,595	$706,927	$932,668	$4,663,340
6	-	$0.000	$0	$1,071,424	$155,970	$54,280		$483,522	$41,600	$1,698,235	$765,567	$932,668	$5,596,007
7	-	$0.000	$0	$1,119,638	$155,970	$55,909		$498,027	$41,600	$1,759,326	$826,659	$932,668	$6,528,675
8	-	$0.000	$0	$1,170,021		$57,586		$512,968	$41,600	$1,667,004		$1,667,004	$8,195,679
9	-	$0.000	$0	$1,222,672		$59,313		$528,357	$41,600	$1,733,316		$1,733,316	$9,928,995
10	-	$0.000	$0	$1,277,693		$61,093		$544,208	$41,600	$1,802,408		$1,802,408	$11,731,403
11	-	$0.000	$0	$1,335,189		$62,926		$560,534	$41,600	$1,874,397		$1,874,397	$13,605,800
12	-	$0.000	$0	$1,395,272		$64,813		$577,350	$41,600	$1,949,409		$1,949,409	$15,555,209
13	-	$0.000	$0	$1,458,060		$66,758		$594,671	$41,600	$2,027,572		$2,027,572	$17,582,782
14	-	$0.000	$0	$1,523,672		$68,760		$612,511	$41,600	$2,109,022		$2,109,022	$19,691,804
15	-	$0.000	$0	$1,592,237		$70,823		$630,886	$41,600	$2,193,900		$2,193,900	$21,885,704
16	-	$0.000	$0	$1,663,888		$72,948		$649,813	$41,600	$2,282,353		$2,282,353	$24,168,057
17	-	$0.000	$0	$1,738,763		$75,136		$669,307	$41,600	$2,374,534		$2,374,534	$26,542,591
18	-	$0.000	$0	$1,817,007		$77,390		$689,386	$41,600	$2,470,603		$2,470,603	$29,013,194
19	-	$0.000	$0	$1,898,773		$79,712		$710,068	$41,600	$2,570,728		$2,570,728	$31,583,922
20	-	$0.000	$0	$1,984,218		$82,104		$731,370	$41,600	$2,675,084		$2,675,084	$34,259,006
21	-	$0.000	$0	$1,998,064		$84,567		$751,342	$41,600	$2,706,440		$2,706,440	$36,965,446
22	-	$0.000	$0	$2,087,977		$87,104		$773,883	$41,600	$2,816,356		$2,816,356	$39,781,802
23	-	$0.000	$0	$2,181,936		$89,717		$797,099	$41,600	$2,930,918		$2,930,918	$42,712,720
24	-	$0.000	$0	$2,280,123		$92,408		$821,012	$41,600	$3,050,327		$3,050,327	$45,763,047
25	-	$0.000	$0	$2,382,729		$95,181		$845,642	$41,600	$3,174,790		$3,174,790	$48,937,837
26	-	$0.000	$0	$440,633					$41,600	$482,233		$482,233	$49,420,070
27	-	$0.000	$0	$460,461					$41,600	$502,061		$502,061	$49,922,131
28	-	$0.000	$0	$481,182					$41,600	$522,782		$522,782	$50,444,913
29	-	$0.000	$0	$502,835					$41,600	$544,435		$544,435	$50,989,348
30	-	$0.000	$0	$525,463					$41,600	$567,063		$567,063	$51,556,411
Total	-		**$0**	**$40,313,454**	**$1,091,790**		**$4,910,000**	**$15,196,343**	**$1,248,000**	**$61,048,174**	**$9,491,763**	**$51,556,411**	
											Outlay	$18,825,124	
											Net Benefit	$32,731,287	
											NPV	$15,926,652	

Table 32. Bundle B – Lighting
Excludes any labor savings

Year	Solar Electricity Produced (kWh)	Solar Avoided Electric Rate ($/kWh)	Solar Electricity Savings	Solar O&M and M&V Costs	Energy Conservation Savings	O&M Savings	Streetlighting Controls O&M Costs	Total Program Savings	Estimated Lease Payment	Project Net Benefit	Cumulative Program Savings
	A	B	C = A * B	D	E	F	G	H = C+E+F-D-G	I	J = H - I	K
1	-	$0.000	$0	$0	$614,086	$47,577	$0	$661,663	$246,634	$415,029	$415,029
2	-	$0.000	$0	$0	$641,720	$49,005	$0	$690,725	$275,695	$415,029	$830,058
3	-	$0.000	$0	$0	$670,597	$50,475	$0	$721,072	$306,043	$415,029	$1,245,088
4	-	$0.000	$0	$0	$700,774	$51,989	$0	$752,763	$337,734	$415,029	$1,660,117
5	-	$0.000	$0	$0	$732,309	$53,549	$0	$785,858	$370,829	$415,029	$2,075,146
6	-	$0.000	$0	$0	$765,263	$55,155	$0	$820,418	$405,389	$415,029	$2,490,175
7	-	$0.000	$0	$0	$799,700	$56,810	$0	$856,510	$441,480	$415,029	$2,905,204
8	-	$0.000	$0	$0	$835,686	$58,514	$0	$894,200	$479,171	$415,029	$3,320,234
9	-	$0.000	$0	$0	$873,292	$60,270	$0	$933,562	$518,532	$415,029	$3,735,263
10	-	$0.000	$0	$0	$912,590	$62,078	$0	$974,668	$559,639	$415,029	$4,150,292
11	-	$0.000	$0	$0	$953,657	$63,940	$44,530	$973,067	$602,568	$370,499	$4,520,791
12	-	$0.000	$0	$0	$996,571	$65,858	$44,530	$1,017,900	$647,400	$370,499	$4,891,290
13	-	$0.000	$0	$0	$1,041,417	$67,834	$44,530	$1,064,721	$694,222	$370,499	$5,261,790
14	-	$0.000	$0	$0	$1,088,281	$69,869	$44,530	$1,113,620	$743,121	$370,499	$5,632,289
15	-	$0.000	$0	$0	$1,137,253	$71,965	$44,530	$1,164,688	$794,189	$370,499	$6,002,788
16	-	$0.000	$0	$0	$1,188,430	$74,124	$44,530	$1,218,024	$847,525	$370,499	$6,373,287
17	-	$0.000	$0	$0	$1,241,909	$76,348	$44,530	$1,273,727	$903,228	$370,499	$6,743,786
18	-	$0.000	$0	$0	$1,297,795	$78,638	$44,530	$1,331,903		$1,331,903	$8,075,690
19	-	$0.000	$0	$0	$1,356,196	$80,997	$44,530	$1,392,663		$1,392,663	$9,468,353
20	-	$0.000	$0	$0	$1,417,225	$83,427	$44,530	$1,456,122		$1,456,122	$10,924,475
21	-	$0.000	$0	$0	$1,481,000	$0	$44,530	$1,436,470		$1,436,470	$12,360,945
22	-	$0.000	$0	$0	$1,547,645	$0	$44,530	$1,503,115		$1,503,115	$13,864,059
23	-	$0.000	$0	$0	$1,617,289	$0	$44,530	$1,572,759		$1,572,759	$15,436,818
24	-	$0.000	$0	$0	$1,690,067	$0	$44,530	$1,645,537		$1,645,537	$17,082,355
25	-	$0.000	$0	$0	$1,766,120	$0	$44,530	$1,721,590		$1,721,590	$18,803,945
26	-	$0.000	$0	$0	$0			$0		$0	$18,803,945
27	-	$0.000	$0	$0	$0			$0		$0	$18,803,945
28	-	$0.000	$0	$0	$0			$0		$0	$18,803,945
29	-	$0.000	$0	$0	$0			$0		$0	$18,803,945
30	-	$0.000	$0	$0	$0			$0		$0	$18,803,945
Total	-		**$0**	**$0**	**$25,600,752**	**$1,278,422**		**$27,977,344**	**$9,173,399**	**$18,803,945**	

Table 33. Bundle C1 – Resiliency at Senior Center and Community Center

Year	Solar Electricity Produced (kWh)	Solar Avoided Electric Rate ($/kWh)	Solar Electricity Savings	Solar O&M Costs	Solar M&V Costs	Solar O&M and M&V Costs	Net Solar Project Savings	Energy Conservation Savings	Energy Storage Savings	SGIP and SVCE Funds	EV Charging Network Costs	Total Program Savings	Estimated Lease Payment	Project Net Benefit	Cumulative Program Savings
	A	B	C = A * B	D	E	F = D + E	G = C - F	H	I	J	L	M = G+H+I+J-L	N	O = M - N	P
1	335,539	$0.236	$79,312			$0	$79,312	$0	$625	$727,622		$807,559	$982,944	($175,385)	($175,385)
2	333,861	$0.247	$82,467			$0	$82,467	$0	$618	$18,000		$101,085	$276,470	($175,385)	($350,771)
3	332,192	$0.258	$85,747			$0	$85,747	$0	$616	$18,000		$104,363	$279,749	($175,385)	($526,156)
4	330,531	$0.270	$89,157			$0	$89,157	$0	$621	$18,000		$107,779	$283,164	($175,385)	($701,542)
5	328,878	$0.282	$92,704			$0	$92,704	$0	$641	$18,000		$111,345	$286,730	($175,385)	($876,927)
6	327,234	$0.295	$96,391	$9,675	$1,942	$11,617	$84,774	$0	$662		$6,400	$79,035	$260,821	($181,785)	($1,058,713)
7	325,598	$0.308	$100,225	$9,965	$2,000	$11,966	$88,259	$0	$683			$88,942	$264,327	($175,385)	($1,234,098)
8	323,970	$0.322	$104,211	$10,264	$2,060	$12,324	$91,887	$0	$704			$92,591	$267,976	($175,385)	($1,409,483)
9	322,350	$0.336	$108,356	$10,572	$2,122	$12,694	$95,662	$0	$726			$96,388	$271,774	($175,385)	($1,584,869)
10	320,738	$0.351	$112,666	$10,889	$2,186	$13,075	$99,591	$0	$749			$100,340	$275,726	($175,385)	($1,760,254)
11	319,135	$0.367	$117,147	$11,216	$2,251	$13,467	$103,680	$0	$731			$104,411	$279,796	($175,385)	($1,935,640)
12	317,539	$0.384	$121,807	$11,552	$2,319	$13,871	$107,936	$0	$763			$108,699	$284,085	($175,385)	($2,111,025)
13	315,951	$0.401	$126,652	$11,899	$2,388	$14,287	$112,364	$0	$798			$113,162	$288,548	($175,385)	($2,286,411)
14	314,371	$0.419	$131,689	$12,256	$2,460	$14,716	$116,973	$0	$834			$117,807	$293,192	($175,385)	($2,461,796)
15	312,800	$0.438	$136,927	$12,624	$2,534	$15,158	$121,770	$0	$871			$122,641	$298,026	($175,385)	($2,637,181)
16	311,236	$0.457	$142,374	$13,002	$2,610	$15,612	$126,761	$0	$910			$127,672	$303,057	($175,385)	($2,812,567)
17	309,679	$0.478	$148,037	$13,392	$2,688	$16,081	$131,956	$0	$951			$132,907	$308,293	($175,385)	($2,987,952)
18	308,131	$0.500	$153,925	$13,794	$2,769	$16,563	$137,362	$0	$994			$138,356		$138,356	($2,849,596)
19	306,590	$0.522	$160,047	$14,208	$2,852	$17,060	$142,987	$0	$1,039			$144,026		$144,026	($2,705,570)
20	305,057	$0.546	$166,413	$14,634	$2,937	$17,572	$148,841	$0	$1,086			$149,927		$149,927	($2,555,643)
21	303,532	$0.570	$173,032	$15,073	$3,026	$18,099	$154,933	$0				$154,933		$154,933	($2,400,710)
22	302,014	$0.596	$179,914	$15,526	$3,116	$18,642	$161,272	$0				$161,272		$161,272	($2,239,438)
23	300,504	$0.623	$187,070	$15,991	$3,210	$19,201	$167,869	$0				$167,869		$167,869	($2,071,569)
24	299,002	$0.651	$194,511	$16,471	$3,306	$19,777	$174,734	$0				$174,734		$174,734	($1,896,835)
25	297,507	$0.680	$202,248	$16,965	$3,405	$20,370	$181,877	$0				$181,877		$181,877	($1,714,957)
26	296,019	$0.710	$210,292	$17,474	$3,507	$20,982	$189,311	$0				$189,311		$189,311	($1,525,647)
27	294,539	$0.742	$218,657	$17,998	$3,613	$21,611	$197,046	$0				$197,046		$197,046	($1,328,601)
28	293,067	$0.776	$227,354	$18,538	$3,721	$22,259	$205,094	$0				$205,094		$205,094	($1,123,507)
29	291,601	$0.811	$236,397	$19,094	$3,833	$22,927	$213,470	$0				$213,470		$213,470	($910,037)
30	290,143	$0.847	$245,799	$19,667	$3,948	$23,615	$222,184	$0				$222,184		$222,184	($687,853)
Total	**9,369,310**		**$4,431,528**			**$423,547**	**$4,007,981**	**$0**	**$15,623**	**$799,622**	**$6,400**	**$4,816,826**	**$5,504,679**	**($687,853)**	
													Outlay	$0	
													Net Benefit	($687,853)	
													NPV	($1,094,259)	

Table 34. Bundle C2 – Resiliency at City Hall, Sports Center, Public Works

Year	Solar Electricity Produced (kWh)	Solar Avoided Electric Rate ($/kWh)	Solar Electricity Savings	Solar O&M Costs	Solar M&V Costs	Solar O&M and M&V Costs	Net Solar Project Savings	Energy Storage Savings	SGIP Rebate	EV Charging Network Costs	Total Program Savings	Estimated Lease Payment	Project Net Benefit	Cumulative Program Savings
	A	B	C = A * B	D	E	F = D + E	G = C - F	I	J	L	M = G+H+I+J-L	N	O = M - N	P
1	1,449,910	$0.150	$217,453			$0	$217,453	$14,049	$85,430		$308,132	$517,322	($209,190)	($209,190)
2	1,442,660	$0.157	$226,102			$0	$226,102	$13,892	$57,000		$292,254	$497,384	($205,130)	($414,320)
3	1,435,447	$0.164	$235,095			$0	$235,095	$13,857	$57,000		$301,213	$506,343	($205,130)	($619,451)
4	1,428,270	$0.171	$244,446			$0	$244,446	$13,964	$57,000		$310,670	$515,800	($205,130)	($824,581)
5	1,421,129	$0.179	$254,169			$0	$254,169	$14,412	$57,000		$320,841	$525,971	($205,130)	($1,029,711)
6	1,414,023	$0.187	$264,279	$42,064	$8,443	$50,507	$213,772	$14,872		$23,700	$228,644	$429,034	($200,390)	($1,230,101)
7	1,406,953	$0.195	$274,790	$43,326	$8,696	$52,022	$222,768	$15,345			$238,113	$438,503	($200,390)	($1,430,492)
8	1,399,918	$0.204	$285,720	$44,626	$8,957	$53,583	$232,138	$15,830			$247,967	$448,357	($200,390)	($1,630,882)
9	1,392,918	$0.213	$297,085	$45,964	$9,226	$55,190	$241,895	$16,327			$258,222	$458,612	($200,390)	($1,831,272)
10	1,385,954	$0.223	$308,901	$47,343	$9,503	$56,846	$252,055	$16,837			$268,893	$469,283	($200,390)	($2,031,662)
11	1,379,024	$0.233	$321,188	$48,764	$9,788	$58,551	$262,637	$16,422			$279,059	$479,449	($200,390)	($2,232,052)
12	1,372,129	$0.243	$333,963	$50,227	$10,081	$60,308	$273,655	$17,161			$290,816	$491,206	($200,390)	($2,432,443)
13	1,365,268	$0.254	$347,246	$51,733	$10,384	$62,117	$285,129	$17,933			$303,063	$503,453	($200,390)	($2,632,833)
14	1,358,442	$0.266	$361,058	$53,285	$10,695	$63,981	$297,078	$18,740			$315,818	$516,208	($200,390)	($2,833,223)
15	1,351,650	$0.278	$375,419	$54,884	$11,016	$65,900	$309,519	$19,583			$329,103	$529,493	($200,390)	($3,033,613)
16	1,344,892	$0.290	$390,352	$56,530	$11,347	$67,877	$322,475	$20,465			$342,939	$543,330	($200,390)	($3,234,004)
17	1,338,167	$0.303	$405,878	$58,226	$11,687	$69,913	$335,965	$21,386			$357,350	$557,740	($200,390)	($3,434,394)
18	1,331,476	$0.317	$422,022	$59,973	$12,038	$72,011	$350,011	$22,348			$372,359		$372,359	($3,062,035)
19	1,324,819	$0.331	$438,808	$61,772	$12,399	$74,171	$364,637	$23,354			$387,990		$387,990	($2,674,045)
20	1,318,195	$0.346	$456,261	$63,625	$12,771	$76,396	$379,865	$24,405			$404,270		$404,270	($2,269,775)
21	1,311,604	$0.362	$474,409	$65,534	$13,154	$78,688	$395,721				$395,721		$395,721	($1,874,054)
22	1,305,046	$0.378	$493,279	$67,500	$13,548	$81,049	$412,230				$412,230		$412,230	($1,461,824)
23	1,298,521	$0.395	$512,899	$69,525	$13,955	$83,480	$429,419				$429,419		$429,419	($1,032,406)
24	1,292,028	$0.413	$533,299	$71,611	$14,373	$85,984	$447,315				$447,315		$447,315	($585,091)
25	1,285,568	$0.431	$554,511	$73,759	$14,805	$88,564	$465,947				$465,947		$465,947	($119,144)
26	1,279,140	$0.451	$576,567	$75,972	$15,249	$91,221	$485,346				$485,346		$485,346	$366,202
27	1,272,744	$0.471	$599,500	$78,251	$15,706	$93,958	$505,542				$505,542		$505,542	$871,744
28	1,266,381	$0.492	$623,345	$80,599	$16,177	$96,776	$526,569				$526,569		$526,569	$1,398,313
29	1,260,049	$0.514	$648,138	$83,017	$16,663	$99,680	$548,459				$548,459		$548,459	$1,946,772
30	1,253,748	$0.538	$673,918	$85,507	$17,163	$102,670	$571,248				$571,248		$571,248	$2,518,020
Total	**40,486,071**		**$12,150,101**	**1,533,621**	**$307,821**	**$1,841,441**	**$10,308,660**	**$351,179**	**$313,430**	**$27,760**	**$10,945,509**	**$8,427,489**	**$2,518,020**	
												Outlay	$0	
												Net Benefit	$2,518,020	
												NPV	$783,865	

Table 35. Bundle D – Building Systems Upgrades

Year	Solar Electricity Produced (kWh)	Solar Avoided Electric Rate ($/kWh)	Solar Electricity Savings	Energy Conservation Savings	High Efficiency Transformers	HVAC Upgrades	O&M Savings	Total Program Savings	Estimated Lease Payment	Project Net Benefit	Cumulative Program Savings
	A	B	C = A * B	F	F1	F2	I	K= F+I	L	M = K - L	N
1	-	$0.000	$0	$29,363	$23,609	$5,754	$90,250	$119,613	$186,437	($66,824)	($66,824)
2	-	$0.000	$0	$30,684	$24,671	$6,013	$92,958	$123,642	$190,466	($66,824)	($133,649)
3	-	$0.000	$0	$32,065	$25,782	$6,284	$95,746	$127,811	$194,636	($66,824)	($200,473)
4	-	$0.000	$0	$33,508	$26,942	$6,566	$98,619	$132,127	$198,951	($66,824)	($267,297)
5	-	$0.000	$0	$35,016	$28,154	$6,862	$101,577	$136,593	$203,417	($66,824)	($334,121)
6	-	$0.000	$0	$36,592	$29,421	$7,171	$104,624	$141,216	$208,040	($66,824)	($400,946)
7	-	$0.000	$0	$38,238	$30,745	$7,493	$107,763	$146,001	$212,826	($66,824)	($467,770)
8	-	$0.000	$0	$39,959	$32,129	$7,830	$110,996	$150,955	$217,779	($66,824)	($534,594)
9	-	$0.000	$0	$41,757	$33,574	$8,183	$114,326	$156,083	$222,907	($66,824)	($601,419)
10	-	$0.000	$0	$43,636	$35,085	$8,551	$117,756	$161,392	$228,216	($66,824)	($668,243)
11	-	$0.000	$0	$45,600	$36,664	$8,936	$121,288	$166,888	$233,713	($66,824)	($735,067)
12	-	$0.000	$0	$47,652	$38,314	$9,338	$124,927	$172,579	$239,403	($66,824)	($801,891)
13	-	$0.000	$0	$49,796	$40,038	$9,758	$128,675	$178,471	$245,295	($66,824)	($868,716)
14	-	$0.000	$0	$52,037	$41,840	$10,197	$132,535	$184,572	$251,396	($66,824)	($935,540)
15	-	$0.000	$0	$54,379	$43,723	$10,656	$136,511	$190,890	$257,714	($66,824)	($1,002,364)
16	-	$0.000	$0	$56,826	$45,690	$11,136	$140,607	$197,432	$264,257	($66,824)	($1,069,188)
17	-	$0.000	$0	$59,383	$47,746	$11,637	$144,825	$204,208	$271,032	($66,824)	($1,136,013)
18	-	$0.000	$0	$62,055	$49,895	$12,160	$149,169	$211,225		$211,225	($924,788)
19	-	$0.000	$0	$64,848	$52,140	$12,708	$153,645	$218,492		$218,492	($706,296)
20	-	$0.000	$0	$67,766	$54,486	$13,279	$158,254	$226,020		$226,020	($480,276)
21	-	$0.000	$0	$56,938	$56,938			$56,938		$56,938	($423,338)
22	-	$0.000	$0	$59,500	$59,500			$59,500		$59,500	($363,838)
23	-	$0.000	$0	$62,178	$62,178			$62,178		$62,178	($301,660)
24	-	$0.000	$0	$64,976	$64,976			$64,976		$64,976	($236,684)
25	-	$0.000	$0	$67,900	$67,900			$67,900		$67,900	($168,784)
26	-	$0.000	$0	$70,955	$70,955			$70,955		$70,955	($97,829)
27	-	$0.000	$0	$74,148	$74,148			$74,148		$74,148	($23,681)
28	-	$0.000	$0	$77,485	$77,485			$77,485		$77,485	$53,804
29	-	$0.000	$0	$80,972	$80,972			$80,972		$80,972	$134,776
30	-	$0.000	$0	$84,616	$84,616			$84,616		$84,616	$219,392
Total	-		**$0**	**$1,620,827**	**$1,440,316**	**$180,511**	**$2,425,051**	**$4,045,878**	**$3,826,487**	**$219,392**	**$0**
									Outlay	$0	
									Net Benefit	$219,392	
									NPV	($135,901)	

6. Proposed Construction Schedule

ENGIE is committed to begin construction as soon as possible, following the completion of final engineering and City approval. Material procurement and construction will be coordinated and scheduled to cause the least impact possible on City staff and citizens, while maintaining steady progress towards final completion. ENGIE is committed to working as quickly as possible and will also make any required schedule adjustments to meet the needs of the City.

All projects that require permitting will be permitted by the Authority Having Jurisdiction – City of Milpitas. Solar PV systems installed in parking lots will also be reviewed by the fire department to ensure fire trucks can maintain proper ingress and egress to each site.

The final project schedule will depend on the mix of measures selected by the City for implementation.

Table 36. Preliminary Implementation Schedule

Milestones	Estimated Date
Contract approval and NTP issued	October 2020
Final engineering and design	Q4 2020
Drawing sets issued for City permits	Q4 2020 / Q1 2021
Equipment procurement	Q4 2020 / Q1 2021
Construction starts	Q4 2020
Construction complete, ribbon cutting celebration	Q4 2022

7. Additional Program Features

7.1. Continuous Monitoring Pilot

ENGIE offers Continuous Monitoring (CM) services that aim to increase the maintenance and operational efficiency of the City's existing facilities, systems, and critical equipment through real-time monitoring and remote support. Our CM services include hardware, software, and a team of building system analysts that remotely manage City facility systems through data collection, advanced analytics, and vendor management of any required work orders. When a system anomaly is registered, our team will triage the situation and take corrective action to reset controls, open a ticket with Public Works maintenance staff, and/or dispatch a service provider to fix the problem. Further, over time with the analysis of data, we start to incorporate predictive analytics to inform maintenance schedules, prevent failures, and plan replacements. The goal of CM is to save the City time and resources while optimizing energy, maintenance, and operational efficiency.

While we have not designed or priced a CM solution for the City at this time, we propose offering a no-cost pilot for 60-90 days. Such a pilot would collect sufficient data to inform the potential savings and ongoing costs of a CM solution. The pilot would involve tying into the City's EMS system and any additional lighting, SCADA, or mechanical controls, in addition to the potential installation of submeters. The CM solution from ENGIE would be designed to maximize savings and minimize maintenance costs – our expectation is that if the City elects to implement a CM solution, it will more than pay for itself.

Please note that a Continuous Monitoring pilot would be distinct from any ongoing measurement and verification related to the performance guarantee of new equipment and measures outlined in Section 8 of this CEA.

7.2. Community Outreach Program

At ENGIE, we value the positive impact we have on the communities in which we work. We measure Impact not only by the savings we generate and emissions we offset but also by the number of community members we engage and inspire. Our ENGIE Community Impact team – comprised of former educators and outreach experts – is dedicated to building comprehensive energy programs that deliver valuable, high-quality, and engaging resources for communities. Through conversations with key stakeholders at the City, we have developed a plan for community engagement and outreach alongside the energy and water measures that the City chooses to implement. Below are the goals we hope to help the City achieve and some specific initiatives we look forward to incorporating into the partnership.

7.2.1. Goals

- Provide greater **capacity for City-wide resiliency initiatives** that will in turn support the City's Climate Action Goals
- Promote **enhanced environmental awareness and stewardship** among City residents
- Garner recognition for the City as a **sustainability and resiliency leader**

7.2.2. Initiatives

- Sponsor a CivicSpark Fellow for the September 2020-August 2021 Fellowship Year. The City has already received confirmation that it has been selected as a host for a CivicSpark Fellow

- Create and participate in City Events, including Earth Day and an inaugural Public Works Biking Tour
- Provide support from our Communications Team on augmenting use of Social Media for residential engagement
- Empower the Public Works Team to communicate real-time updates through a one-stop Sustainable Milpitas Webpage with real-time energy data from the City's infrastructure upgrades, conversions of the data into dollars saved and other metrics, and tips on how residents can go green
- Communicate sustainability leadership by organizing Groundbreaking Celebrations and identifying potential Sustainability Awards

8. Guarantee and Monitoring

8.1. Overview

To give the City peace of mind that the proposed measures will deliver on the promised savings throughout the years, ENGIE offers an industry-leading savings and performance guarantee.

For any energy services performance contracting program, an appropriate Measure and Verification (M&V) plan is key to success. To assure confidence in these processes, ENGIE follows the International Performance Measurement and Verification Protocol (IPMVP). The National Association of Energy Service Companies (NAESCO) recognizes this protocol as the standard guideline of how savings resulting from energy conservation projects should be measured. ENGIE M&V professionals will work with the City of Milpitas to develop a tailored M&V plan in accordance with IPMVP guidelines. The IPMVP options are categorized in Figure 15 below.

Figure 15. IPMVP Options

	Option A	Option B	Option C	Option D
Savings Calculation	**Engineering Calculations:** Short-term or continuous post-retrofit measurements	**Engineering Calculations:** Short-term or continuous measurements	**Analysis of Whole Facility:** Utility meter/sub-meter data	**Energy Use Simulation:** Calibrated with hourly or monthly utility billing data of end-use metering
Example Application	Measure power draw periodically for a lighting retrofit.	Apply controls to vary the load on a constant speed pump using a variable speed drive. A kWh meter is installed to measure actual energy use of the drive.	Multifacted energy management program affecting many systems in a building. Measure energy use via gas and electric utility meters for a 12 month base-year period and throughout the post-retrofit period.	Multifacted energy management program affecting many systems in a building, but where no base year data is available. Measure post-retrofit energy use by utility meters and base year energy use is determined by simulation using a calibrated model.

ENGIE guarantees performance by establishing a baseline energy use, predicting the savings reduction by using industry established building modeling and calculations, and monitoring and verifying the energy reduction throughout the guarantee. Our goal is to select a straightforward M&V approach that can be easily verified by the City and/or their third-party reviewer.

8.2. Description of Monitoring Services Available to Ensure Continued Savings

ENGIE has one of the largest, most experienced M&V teams in the industry. A Certified Measurement and Verification Professional (CMVP) with more than 25 years in performance contracting leads a team of full-time dedicated staff, with seven certified staff members, and an average time in performance contracting of over 15 years each. The team has overseen hundreds of guarantees and currently has more than 130 clients with ongoing guarantees. The team has one of the highest success rates in the industry — 109% for the most recently reconciled year — for achieving our guaranteed performance on projects. If project performance does not meet or exceed our guaranteed performance, ENGIE writes the customer a check for the difference, without delay or hassle. This outstanding monitoring department sets ENGIE apart from other companies that engage in performance-based energy programs.

Our M&V team has extensive expertise in commissioning, monitoring, and troubleshooting over 16 different types of energy management control systems. Not only is this team responsible for delivering a functional system, they also continue to train and support our customers on that system for the duration of the contract.

8.2.1. "Energy Intelligent" M&V

ENGIE uses a proprietary web-based system, Utilityvision™, to monitor data acquired from our energy projects. As a standard, we provide monthly value reports from Utilityvision that we customize based on project and customer needs. Administrative personnel can use Utilityvision to create summary reports, while facility managers can set alarms and run trend analysis diagrams with the click of a button.

Figure 16. Utilityvision Overview screen

Figure 17. Utilityvision Performance Graph

8.3. Proposed Guarantee for the City of Milpitas

The exact scope for monitoring will be determined based on City direction, and tailored to the final energy measures selected for implementation. For the measures identified in this CEA, ENGIE recommends Option A for lighting, high-efficiency transformers, and water meters; and Option B for solar. The standard guarantee we propose will guarantees 95% of calculated energy and water savings. Those measures have significant savings and can greatly benefit from concrete yet cost-effective monitoring.

In general, the other measures yield smaller savings or are not as cost-effective to monitor and guarantee, and therefore a stipulated guarantee is proposed based on agreed-upon equipment efficiency improvements (such as HVAC and water fixtures) or reduced operating hours (such as pumping

improvements associated with the SCADA scope). Measures without any associated energy or water savings (such as EV chargers and EMS upgrades) do not have or require a savings guarantee. Additionally, the real purpose of BESS is community resiliency and not energy savings, so a Resiliency Services package is proposed instead of a traditional guarantee for this measure. This will support optimal microgrid functionality, maintaining all its different components, and providing monitoring of facility loads and post-outage analysis of system performance.

8.3.1. Option A: Lighting, Transformer Upgrades, and Water Meters

Lighting, transformers, and water meters are ideal measures for Option A. For lighting and transformers, measuring power drawn by the equipment (pre- and post-retrofit) can quickly and accurately determine existing and new consumption, proving the energy savings achieved by the measures. In the case of water meters, measuring the existing and new meters' recording accuracy helps quantify the improvements achieved and the associated revenue increases.

Please note that for lighting, ENGIE is proposing Option A only for facilities interior and exterior retrofits. Streetlights, parks and sports lighting pose a safety challenge when it comes to multiple measurements, due to their height and difficult access. Sports lighting savings are not significant enough to warrant a guarantee, and since all of the City's streetlights are in unmetered PG&E rates, there is no need to verify actual consumption. PG&E bills are simply based on the wattages provided to the utility, and ENGIE will ensure that PG&E receives all the documentation required to correctly update their billing post-retrofit, effectively securing those savings for the City.

8.3.2. Option B: Solar

For solar projects, ENGIE can monitor real time performance of the new equipment installed. New meters, cellular connections, and other monitoring components are put in place, allowing us real-time access to verify energy consumption of each facility, as well as solar production and battery use. This data is all stored and available to both the ENGIE monitoring team and the customer, on the Utilityvision™ platform. ENGIE monitoring experts work closely with customer staff, to ensure the appropriate stakeholders have the access they need, and customize templates and reports to make the process as easy as possible. ENGIE also compiles customer monthly and annual reports with this data, providing transparent feedback on the systems' performance.

Additionally, this real-time data and access is invaluable for our Operation & Maintenance (O&M) team, which is responsible for ensuring the systems are performing as designed. Any alarms come straight to our team, allowing them to quickly troubleshoot and dispatch technicians on site as needed, to minimize any system down time. The O&M team is also responsible for scheduled maintenance, such as verifying electrical components and washing panels every year, to ensure systems are producing at peak performance. The O&M team can also assist with unplanned outage management, contractor management, site safety management, and any insurance claims.

8.3.3. Summary

The table below summarized the guarantee options proposed by ENGIE for the City of Milpitas.

Table 40. Guarantee Summary

	Bundle A			Bundle B				Bundle C			Bundle D		
Description	**Facilities Water Retrofits**	**Water Meters Upgrades**	**SCADA**	**LED Lighting Retrofits (Interior/Exterior for Facilities)**	**LED Park Lighting**	**LED Streetlights**	**LED Sports Lighting**	**Solar PV**	**EV Chargers**	**Battery Storage/ Resiliency**	**High Efficiency Transformers**	**HVAC Upgrades**	**EMS Upgrades**
Energy/Water Savings (MM)	$0.031	$0.682	$0.147	$0.240	$0.038	$0.324	$0.012	$0.289		$0.015	$0.024	$0.006	
5-Yr Guarantee Included in Sell Price	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			Yes	Yes	
IPMVP Option	Stipulated	A	Stipulated	A	Stipulated	Stipulated	Stipulated	B			A	Stipulated	
Guaranteed Amount (95%)	$0.029	$0.648	$0.140	$0.228	$0.036	$0.308	$0.011	$0.275			$0.023	$0.006	

9. Conclusion

ENGIE has performed a thorough audit of City facilities to fully assess opportunities for energy and water savings. This report detailed the measures identified and recommended, with associated energy, water, and operation and maintenance savings. The City has an opportunity to build on their sustainability and environmental stewardship, reducing the impact of their operations on the environment while leveraging significant savings to their general fund and engaging with the community.

ENGIE can work with City staff to select the final mix of measures for implementation, bundling them in different groups as needed. ENGIE has also identified several funding options, including City funds earmarked for some of these measures, utility incentives, and cost-effective TELPs, for the City to consider when deciding how to fund their selected paid-through-savings project.

ENGIE is proud to serve as a partner to the City of Milpitas, and looks forward to putting the findings of this report into action, helping create a more efficient and sustainable Milpitas.

10. Appendix A – Other Measures Considered

In this section, we include measures that were identified in the preliminary CEA as feasible but later dropped out of the scope due to technical, economic, or other reasons. While we no longer recommend the measures below, we would like the City to have the information and analysis in case future conditions merit their consideration.

PG&E's Renewable Energy Self-Generation Bill Credit Transfer (RES-BCT) program allows a local government with one or more eligible renewable generating facilities to export energy to the grid and receive generation credits, which benefit other program accounts. This would allow the City to install larger solar PV systems in areas that can fit these bigger designs, even though they do not have the current load to reap the full systems' benefits. This strategy takes advantage of larger systems to offset multiple smaller accounts where on-site solar may not feasible or cost effective.

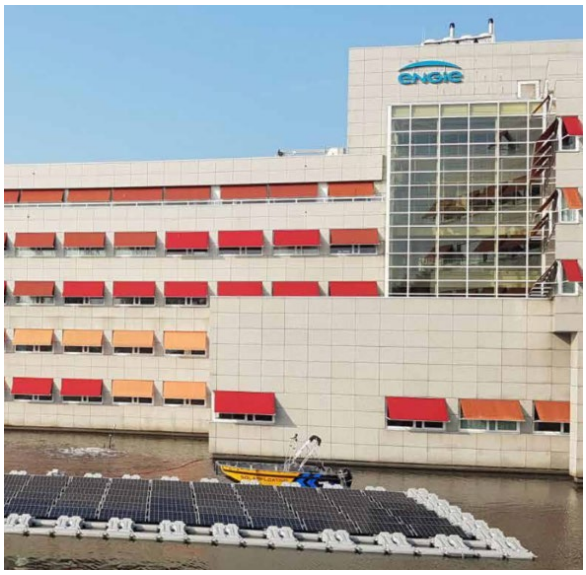
The PG&E RES-BCT program has a cap of 105.25 megawatts (MW), and once that cap is met, no more applications will be accepted. If the City is interested in pursuing these options, ENGIE can work closely with PG&E to attempt to secure the City a spot in the program.

ENGIE identified three potential sites for RES-CT. The first two sites were to install floating solar PV at two City of Milpitas Parks, Hidden Lake, and Hall Memorial. The last site identified was solar PV on the top level of the Milpitas Library parking garage.

10.1. Floating Solar PV

An innovative technology identified as an option for the City of Milpitas was floating solar PV. These systems are installed in bodies of water, on floating platforms that support the PV systems with all their components, as well as multiple people walking down the rows at the same time for any maintenance purposes. The systems are anchored to the bank or the bottom of the reservoir for security. This is an emerging technology, with 120 farms already installed across the world totaling 235 MW, and 80 more MW of ongoing projects in development.

Figure 18. Photo of 26 kW floating solar PV system installed



10.1.1. Floating Solar Benefits

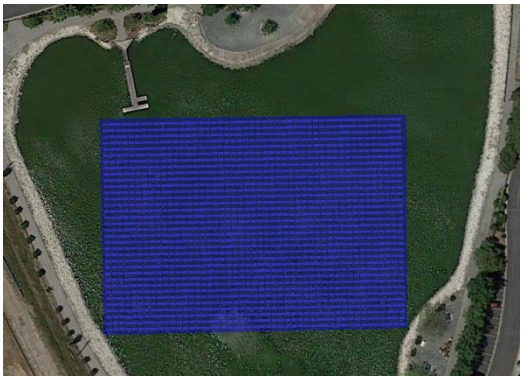
- Cost effective and easy to install
- The system conserves water by reducing evaporation, preserving existing ecosystems
- Shading from the panels limits algae growth, improving water quality
- No risks to wildlife and surrounding habitats
- Natural cooling effect of the body of water allows the solar modules to operate more efficiently, producing more power than traditional ground-mounted systems

Two potential locations were identified for the City of Milpitas: Hidden Lake and Hall Memorial Parks, with preliminary layouts shown below. Site considerations include

- Effect on the current use of the ponds, if any boating or swimming is currently allowed
- Public access and vandalism – the systems may require fencing or a floating barrier protection, surveillance cameras, and heavy signage
- Permitting issues

Based on feedback from City staff, this measure is not recommended at this time.

Hidden Lake Park (approximately 600 kW)



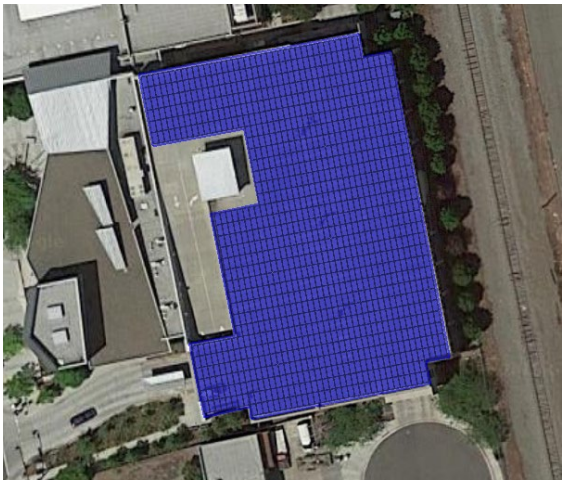
Hall Memorial Park (approximately 300 kW)

10.2. Library Parking Garage Solar PV

Another option for the City was to take advantage of the top floor of the City Library Garage to install a full coverage solar PV system as shown on the layout below. This system would provide shade for the entire top floor of the parking structure, producing more energy than what is required to offset the site's electrical consumption. Options for export include both RES-BCT, as well as Net Energy Metering Aggregation (NEM-A) tariffs. The NEM-A rate allows adjacent parcels to export excess generation to one another, while still realizing the full value of the energy savings, while on the RES-BCT rate, customers only save the generation portion since the utility still needs to distribute the renewable energy from one site to another. The City might be able to export savings to the adjacent County Library and earn revenue from the extra production. There may also be an option to provide some of this generation to the local Community Choice Aggregator (CCA).

After further investigation of existing as-built drawings, site audits, and City permitting requirements, ENGIE identified several limitations with the design. Structural upgrades might be required in the garage structure to withstand the added weight, permitting requirements significantly reduce the footprint that can be covered and used for energy production, and costly electrical upgrades would be required both on the customer and the utility side to account for the system load. Ultimately, the City of Milpitas decided to not move forward with Solar PV on the library parking garage, since it would not be cost effective. The initial design that was proposed is outlined below.

Library Parking Garage (approximately 470 kW)



A summary of all proposed sites and associated estimated benefits are shown below.

Table 371. Additional Solar Photovoltaic Summary

Site	Proposed System Type	Preliminary System Size (kW DC)	Estimated First Year kWh Generated	Estimated First Year Solar Savings	Interconnection Type
Library Parking Garage	Full Coverage Canopy	470	750,000	$95,000	RES-BCT or NEM-A
Hidden Lake Park	Floating Solar	600	990,000	$115,000	RES-BCT
Hall Memorial Park	Floating Solar	300	450,000	$60,000	RES-BCT

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