City of Santa Rosa EV Infrastructure Master Plan (EVIMP)

October 2025

Prepared For:

City of Santa Rosa
69 Stony Circle
Santa Rosa, CA 95401

NV5
101 Lucas Valley Road, Suite 302
San Rafael, CA 94903

5980824-2304101.00

EXECUTIVE SUMMARY

Fleet operators are focusing on battery electric vehicles as one of the levers to reduce greenhouse gas emissions and operational costs. In 2020, the City of Santa Rosa (City) declared a climate emergency and established a goal of net zero greenhouse gas emissions (GHGs) by 2030. As part of the effort to reach this goal and comply with California Air Resources Board zero-emission vehicle regulations, the City contracted with NV5 and the Center for Transportation and the Environment (CTE) to develop a fleet electrification plan.

This report provides a plan for how the City can meet its fleet electrification goals and state mandates. In 2025, the City owned 383 light, medium, and heavy duty vehicles (excluding first-responder vehicles). A transition of these vehicles to battery electric by 2040 would result in approximately 12,500 metric tons of tailpipe CO_2 avoided over the next 15 years. This reduction is equal to a removal of 22% of the total municipal emissions in the last GHG inventory done in 2010.

2040 Electric Fleet

383 Electric Vehicles

207 Charging Ports

$38 Million
Cumulative Incremental Cost

12,500 MT
Cumulative CO_2 avoided

Under the transition plan developed by the NV5 team and City staff, fleet electrification will cost an estimated $157M in nominal dollars from 2025 to 2040, which represents a $38M (32%) increase compared to a baseline of operating the current internal combustion engine fleet ($119M). The major cost driver is the incremental cost of electric vehicles ($33M) compared to internal combustion engine vehicles, as well as the expense of developing the charging infrastructure ($12M). These costs are offset slightly by operational cost savings (-$7M). Due to the volatile nature of available local, state, federal, and utility incentives, the potential savings from incentives are not included in the financial summary provided in this report. Potential incentives which the City can pursue are outlined in Appendix A.4 and A.5.

The study also reviewed fueling resiliency, including scoping and concepts for back-up power systems at 6 sites to provide charging during grid outages. The study estimates a generator-only configuration to cost $3.4 million, whereas a microgrid incorporating solar photovoltaic and battery energy storage systems paired with generators would cost $9.4 million.

Lastly, the study developed strategies to encourage private sector investments in EV charging infrastructure across the City, including: performing public outreach to understand where EV chargers should be prioritized; investigating feasibility of levying impact fees on real estate developments to pay for EV charger programs; and establishing streamlined permitting pathways for private EV charging developers to deploy projects in Santa Rosa.

This plan provides a roadmap for the City to successfully meet state regulatory requirements and achieve its own sustainability goals. Fleet electrification is an attainable technical goal, particularly as the electric vehicle market matures over time. However, the transition is costly, and will require strategic planning and further evaluation of fleet priorities to execute successfully. This fleet electrification plan serves as a guideline and should be adapted over time as the EV market develops and when additional grants and incentives become available.

TABLE OF CONTENTS

1.0 BACKGROUND INFORMATION

1.1 CLIMATE ACTION PLAN

On January 14, 2020, the City of Santa Rosa adopted Resolution RES-2020-002 declaring a climate emergency and immediate mobilization to restore a safe climate.[1] The resolution includes a goal of carbon neutrality by 2030. In August 2024, Santa Rosa created a Greenhouse Gas (GHG) Reduction Strategy, in which Measure 5.3 calls for budgeting for zero-emission vehicles in the City's long-range capital expenditure plans to transition the existing fleet of gasoline- and diesel-powered vehicles, and work to make the City's fleet among the cleanest in the North Bay.[2]

The City last performed a greenhouse gas inventory for municipal operations in 2010. In that year, Santa Rosa's vehicle fleet was estimated to generate 5,727 metric tons of emissions,[3] which was 21% of the city's emissions. This transition plan will fully transition the City's fleet of 383 vehicles to zero-emission vehicles by 2040 (excluding the majority of police and fire vehicles).

1.2 REGULATORY ENVIRONMENT

California is pursuing innovative and accelerated EV adoption goals through regulations and incentives. Transportation GHG emissions are the state's largest share of total emissions. Efforts to electrify the transportation network are core to achieving GHG reduction targets, and regulations are the primary driver for ZEV adoption for most public agencies.

In 2020, California's Governor Newsom issued executive order N-79-20. This order mandated the timeline upon which fossil fueled vehicles would no longer be sold in California. Many of the regulations discussed below are a consequence of N-79-20.

As the agency governing vehicle emission standards, California Air Resources Board (CARB) regulates ZEV adoption rates. Table 1 below summarizes relevant CARB regulations governing ZEV adoption.

[1] Climate Action Planning in Santa Rosa
[2] Page 44 of 2024 Greenhouse Gas Reduction Strategy
[3] Page 7 of 2013 Municipal Climate Action Plan

Table 1. Summary of CARB Regulations Governing EV Adoption

CARB Regulation	Vehicle Weight Class	Regulates	Status in 2025	Description
Small Off-Road Engine (Effective Dec 2021)	*Small Off-Road Vehicles*	Automakers	Unchanged	• Small engines defined as 19 kW or 25 horsepower or below. Includes vehicles such as ATVs and UTVs. • Starting in 2024, manufacturers must sell increasingly efficient small off-road vehicles. • In 2028, all small off-road vehicles must be zero-emission.
Off-Road Engine (PENDING - To be developed in 2027)	*All Off-Road Vehicles*	Automakers	Unchanged	• Increasing percentage of annual statewide sales must be zero-emission off-road vehicles.
Advanced Clean Cars II (Effective Nov 2022)	*Class 1-2a*	Automakers	Revoked by federal government. See discussion in 1.2.1	• Starting in 2026, manufacturers must sell an increasing percentage of ZEV Class 1-2A vehicles annually. • By 2035, 100% of all new passenger cars, light duty trucks, and SUVs sold in California will be zero emission.
Advanced Clean Fleet (Effective October 2023)	*Class 2b-8*	Fleet Owners	Upcoming changes. See discussion in 1.2.1	• Depending on the pathway chosen, requires either: ○ 50% of new vehicle purchases from 2024 to be ZEVs, and 100% from 2030;[4] or ○ Increasing percentage of fleet to be ZEVs from 2025. • Certain vehicle types are exempt from compliance.[5] Notably, emergency vehicles defined under California Vehicle Code 165.[6]
Advanced Clean Trucks (Effective March 2021)	*Class 2b-8*	Automakers	Revoked by federal government. See discussion in 1.2.1	• Starting in 2024, manufacturers must sell an increasing percentage of Class 2b-8 ZEVs. • By 2035, this is 55% of Class 2b-3 truck sales, 75% of Class 4-8 truck sales, and 40% of truck tractor sales.

[4] This study assumed compliance with the initial set of ACF regulations whereby fleets were required to buy 100% ZEVs by 2027. CARB has since amended the ACF rules to move this requirement to 2030.

[5] ACF Regulations Exemptions and Extensions Overview

[6] ACF Regulation - Declared Emergency Response Exemption

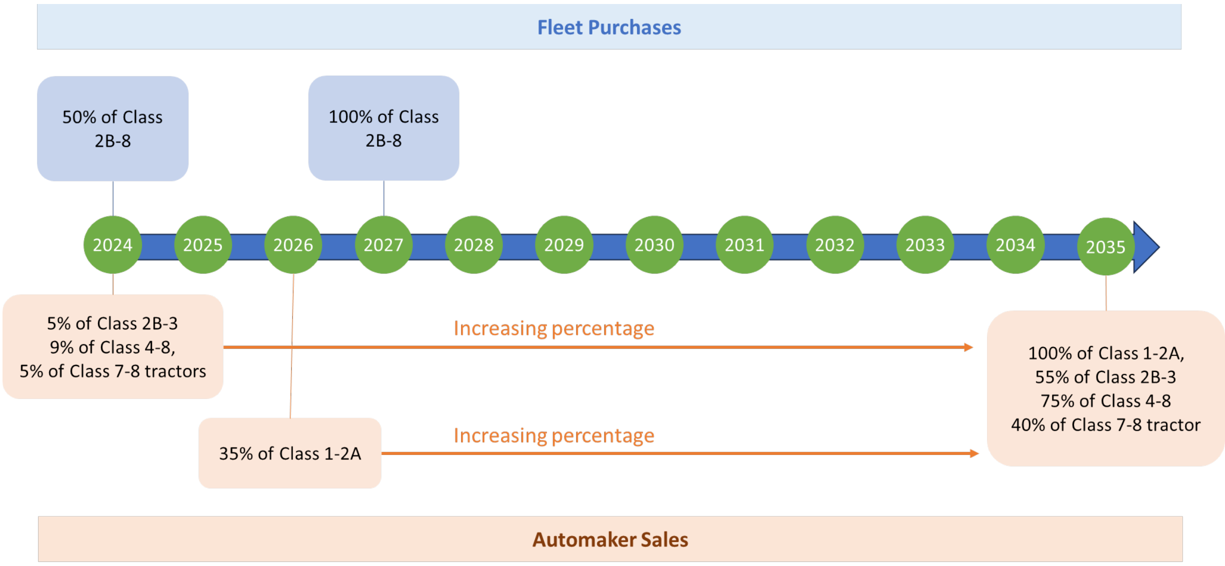


Figure 1. Graphic representation of zero-emission vehicle sale and purchase regulations affecting the City of Santa Rosa.

1.2.1 Actions from the State and Federal Government in 2025

Some of the regulations listed above, including Advanced Clean Fleet, Advanced Clean Cars II, Advanced Clean Trucks, are facing a dynamic future.

Advanced Clean Fleet (ACF): In January 2025, CARB withdrew its request for a waiver from the U.S. Environmental Protection Agency (EPA), which would have allowed it to enforce the ACF rules on private or federal vehicle fleets. As a result, ACF compliance is no longer required for those fleets.[7] However, CARB does not need the EPA waiver to require ACF compliance for state and local government fleets and is currently still enforcing those rules.[8] CARB has been reluctant to clarify what penalties would be levied against local government fleets that do not comply with ACF. In the worst-case scenario, penalties can be up to $10,000 per day per vehicle.[9]

Additionally, CARB has been adding flexibility to the ACF regulations in response to legislation and industry feedback. For example, in a September 25, 2025 board meeting, CARB unveiled a series of approved and proposed changes which include moving the 100% ZEV purchase requirement year from 2027 to 2030, allowing additional exemptions for highly used vehicles, and lowering the burden of documentation to access certain exemptions.[10] CARB will be finalizing the regulation changes throughout 2026. This will provide additional ACF compliance flexibility for Santa Rosa.

Advanced Clean Cars II (ACC II) and Advanced Clean Trucks (ACT): In May 2025, these regulations were eliminated through a Congressional Review Act.[11] The consequence of the ACC and ACT

[7] CARB letter to EPA on withdrawing ACF for Federal and high priority fleets
[8] CARB ACF homepage
[9] CARB Regulations Enforcement Policy
[10] CARB presentation on ACF Proposed Amendments
[11] US Congress FAQ on California's Clean Air Act and recent Congressional Review Act

elimination is that EVs might be manufactured in fewer numbers, which may increase the price of EVs.

In response to actions from the federal government, California's Governor Newsom signed Executive Order N-27-25 on June 12, 2025.[12] The executive order reaffirms the state's commitment to ZEV adoption. In particular, the executive order initiates the development of Advanced Clean Cars III regulation. This new regulation will combine the existing vehicle regulations such as ACC II and ACT, and act as an alternative measure if the federal actions that eliminated ACC II and ACT are not overturned.

1.3 FEDERAL REGULATORY ENVIRONMENT

While there are no strict requirements from the federal government for fleets to adopt ZEVs, the EPA sets emission standards for vehicles.[13] [14] Automakers can achieve those standards through selling more ZEVs. However, in July 2025, the EPA announced plans to rescind the endangerment finding that currently allows the EPA to regulate emissions.[15] If the EPA rescinds its endangerment finding, there will be no regulations from the federal government to encourage ZEV adoption.

There are two tax credits that were established from the Inflation Reduction Act: 1) Code Section 30C for Alternative Fuel Vehicle Refueling Property credit, and 2) Code Section 45W for Qualified Commercial Clean Vehicle Credit.

- The 30C credit[16] is for alternative fuel stations installed in low-income communities or non-urban census tracts, and these stations must be placed in service before June 30, 2026. Eligible census tracts can be identified through the IRS link in footnote 16. City Hall, Brown Farm, and Laguna Treatment Plant are in eligible census tracts. Fleets can get up to 6% of the project cost back as tax credits, or 30% when prevailing wage and apprenticeship requirements are met. Credits are up to $100,000 per charging port.

- The 45W credit[17] is for zero-emission vehicle purchases. Vehicle purchase orders and downpayments needed to be placed before September 30, 2025 to qualify for this credit. Vehicles with GVWR less than 14,000 lbs get a maximum credit of $7,500. Vehicles with GVWR above 14,000 lbs get a maximum credit of $40,000.

[12] Governor Newsom Executive Order N-27-25
[13] EPA GHG Emission Regulations for Passenger Cars and Trucks
[14] EPA GHG Emission Regulation for Heavy-Duty Vehicles
[15] EPA proposal to rescind GHG Endangerment Finding
[16] IRS Alternative Fuel Vehicle Refueling Property Credit
[17] IRS Commercial Clean Vehicle Credit

2.0 FLEET ELECTRIFICATION STUDY RESULTS

2.1 EXISTING VEHICLE INVENTORY

The City's non-emergency vehicle fleet consists of 383 vehicles. 73% of vehicles are light-duty vehicles (Class 1-2), 16% are medium-duty vehicles (Class 2-6), 4% are heavy-duty vehicles (Class 7-8), 4% are non-road vehicles, and 3% are construction vehicles.

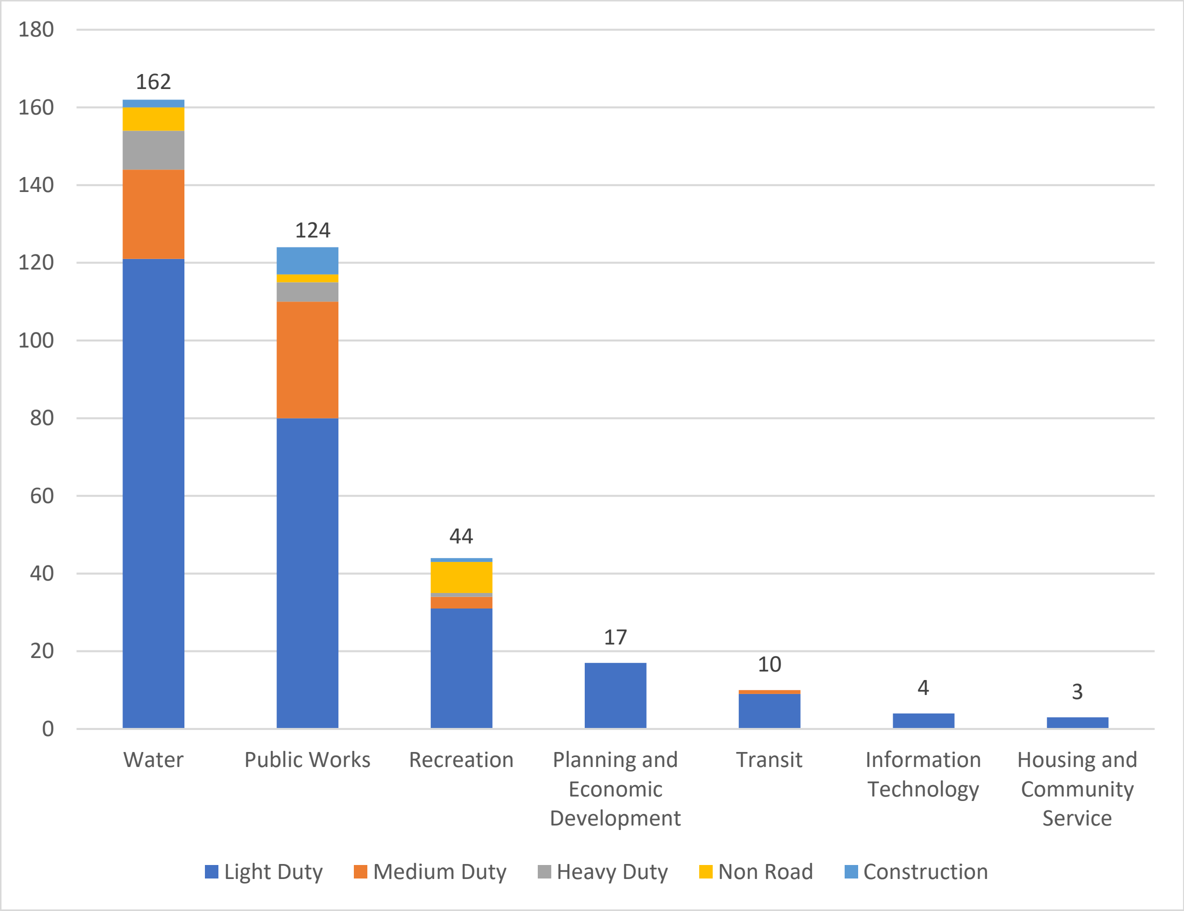


Figure 2. Vehicle ownership by City Department and Weight Class

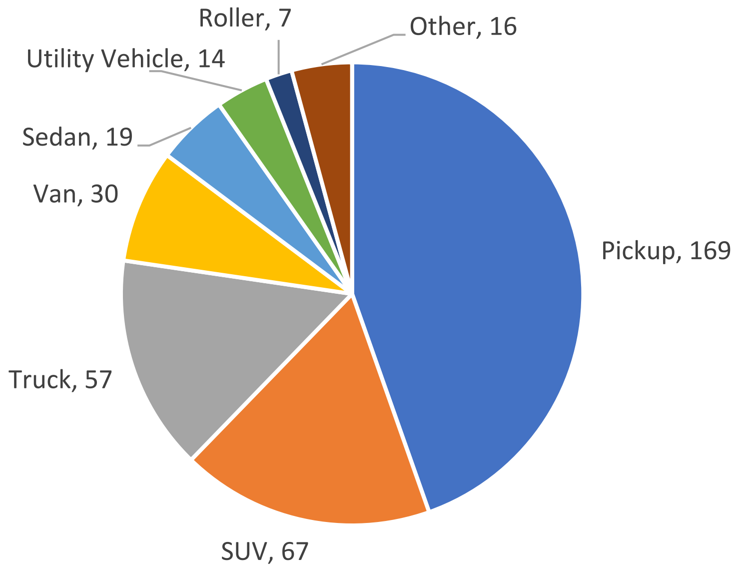


Figure 3. Santa Rosa Vehicle Fleet by Type

For Santa Rosa, the biggest driver for EV adoption is the ACF rule, which mandates an increasing percentage of vehicles purchased to be zero-emission vehicles. Vehicles above 8,501 lbs in gross vehicle weight rating (GVWR) are under the ACF rule. Santa Rosa has 202 total vehicles in this weight class. Of the 202 vehicles, 12 vehicles have short-term exemption.[18] These are vehicles that CARB has identified as having no ZEV equivalent currently available in the market.

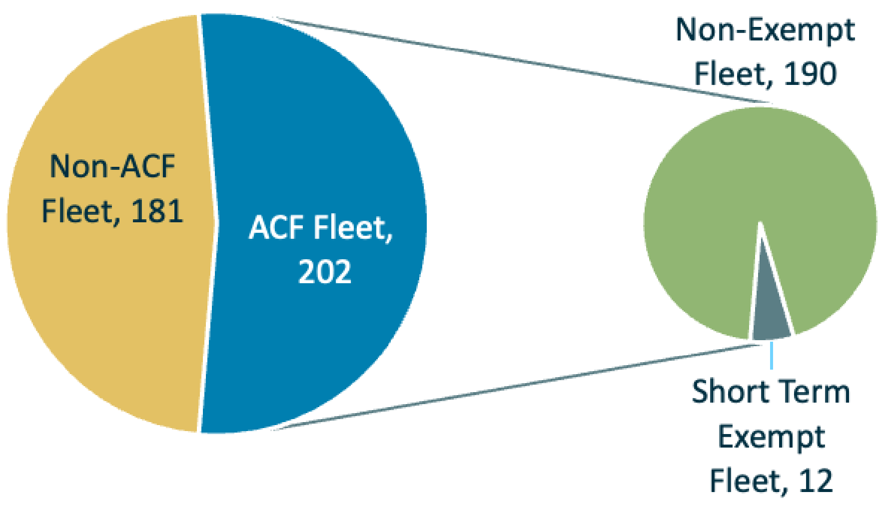


Figure 4. Santa Rosa Vehicle Fleet by ACF regulated status.

[18] CARB ACF Streamlined ZEV Purchase Exemption List

The team reviewed the feasibility and suitability of each vehicle in Santa Rosa's fleet, using telematics data to determine the operating profiles of each vehicle type and comparing that to the capabilities and price of EVs on the market and expected technology developments over time. The methodology is further explained in the Fleet Assessment Memo in Appendix A.4. In 2025, over a third of Santa Rosa's fleet is immediately feasible and suitable for transition, while the rest of the fleet becomes feasible and suitable over time as the ZE market is projected to develop.

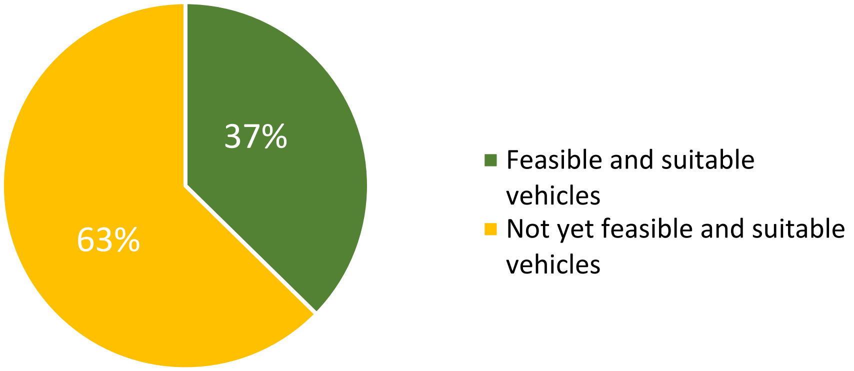


Figure 5. Fleet Feasibility and Suitability in 2025.

The study uses feasibility and suitability scores to determine an EV's market maturity, and the EV's suitability for Santa Rosa's operations. The following Table 2 shows the expected EV suitability for various vehicle types in Santa Rosa's fleet over time.

Table 2. EV suitability score for vehicle types in Santa Rosa

Category	Vehicle Type	Commercially Available in 2025	2026	2027	2028	2029	2030
Construction	Excavator	Yes	3	3	3	4	4
Construction	Loader, Skid-steer	Yes	3	3	3	3	3
Construction	Loader, Track Steer	Yes	3	3	3	3	3
Construction	Roller	Yes	3	3	4	4	5
Construction	Wheel Loader, Compact	Yes	3	3	4	4	5
Light-Duty	Compact Pickup	No	2	3	3	3	4
Light-Duty	½-Ton Pickup	Yes	5	5	5	5	5
Light Duty	¾-Ton Pickup	No	2	3	3	3	4
Light-Duty	1-Ton Pickup	No	2	3	3	3	4
Medium Duty	1 ½-ton Pickup	No	2	3	3	3	4
Light-Duty	Minivan	No	4	5	5	5	5
Light-Duty	Sedan	Yes	5	5	5	5	5
Light-Duty	SUV	Yes	5	5	5	5	5
Light-Duty	Van, Cargo	Yes	5	5	5	5	5
Light-Duty	Van, Passenger	Yes	5	5	5	5	5
Medium-Duty	Chassis	Yes	3	3	4	4	5
Heavy-Duty	Chassis	Yes	3	3	4	4	5
Heavy-Duty	Semi-Truck	Yes	3	3	4	4	5
Non-Road	Boom lift	Yes	5	5	5	5	5
Non-Road	Forklift	Yes	3	3	3	3	3
Non-Road	Mower	Yes	5	5	5	5	5
Non-Road	Tractor, Medium	Yes	3	3	4	4	5
Non-Road	Utility Vehicle / ATV	Yes	3	3	4	4	5

2.2 FLEET ELECTRIFICATION TREND

NV5 and CTE reviewed Santa Rosa's vehicle fleet and planned for future purchases to be electric vehicles to pursue compliance with ACF rules whenever possible. There are several times when there are no suitable EVs for replacing an outgoing vehicle. In that case, Santa Rosa should request exemption from ACF to purchase an ICE vehicle. EVs are only planned to be acquired when there is a feasible and suitable model available. Refer to the Fleet Assessment Memo in Appendix A.4 for a detailed explanation of the methodology.

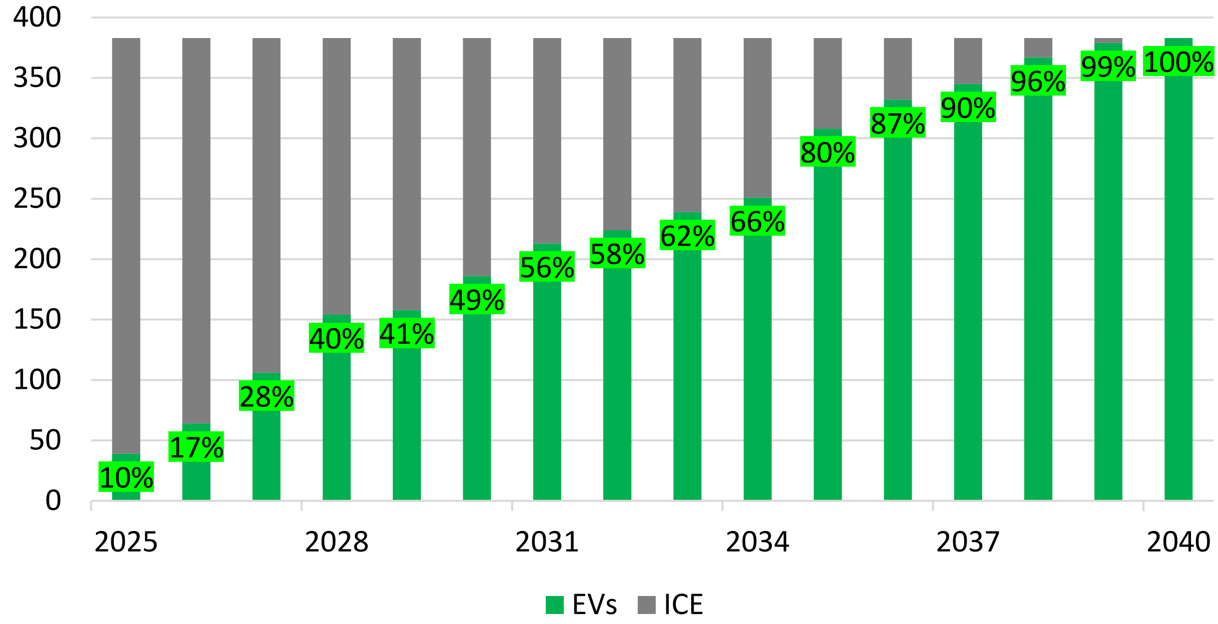


Figure 6. Fleet Composition over Time from 2025 to 2040 (EV versus ICE)

2.3 EV CHARGING INFRASTRUCTURE

CTE determined the vehicle to charging port ratio according to the average percentage of battery consumed on a typical day for a vehicle type. For example, a vehicle that uses 25% battery per day is assigned a ratio of two vehicles to one charging port. This way, the two vehicles can switch off and use the same charger on alternate days. After two days in this scenario, this vehicle is charged 50% overnight. Then, for an assumed overnight dwelling period of 7 hours, CTE determined the minimum charger power level needed to recharge the vehicles. For example, if 50% of this vehicle's battery is equal to 35 kWh, the chargers for this vehicle type needs to have at least 5 kW in power output to fuel the vehicle over 7 hours of dwell time.

Over the 15 years of fleet transition, NV5 and CTE planned for 3 phases of EV charger installations, in 2027, 2030, and 2035. All behind-the-meter infrastructure for EV chargers in Phase 2 and 3, such as conduits and additional electrical panel capacity, would be installed in Phase 1. This will both reduce overall construction cost and minimize construction disruption to city operations. We anticipate that phasing will likely change over time on a site-by-site basis depending on budgets and actual vehicles purchased, including merging or incremental addition of chargers.

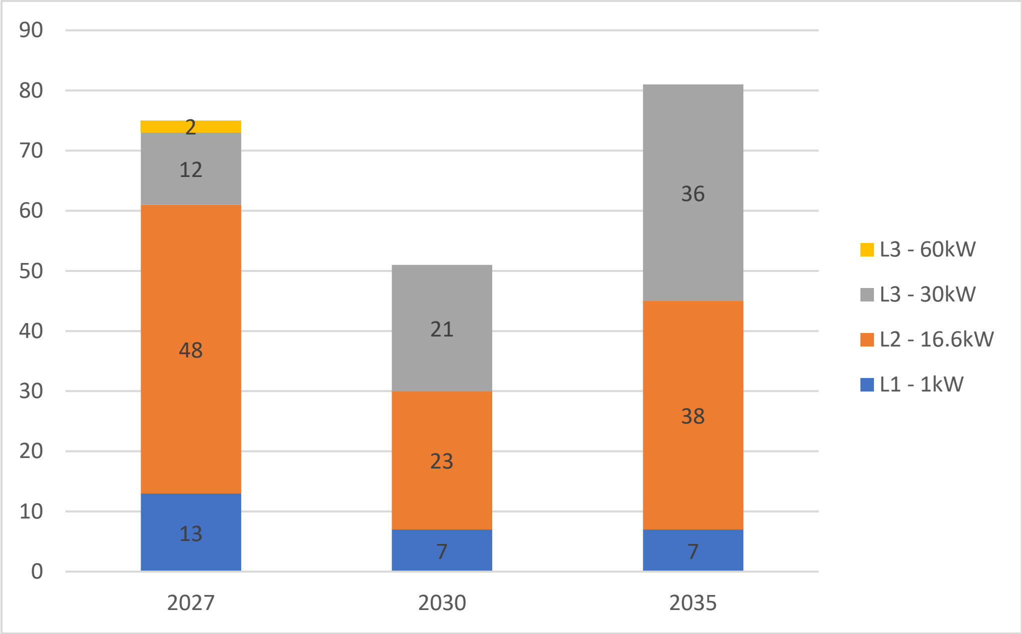


Figure 7. Expected EV Charger Ports Added by Phase across all Santa Rosa Sites.

For the selected eight higher priority sites, NV5 developed conceptual site designs, and coordinated with PG&E to understand electric grid constraints compared to the three phases of charger deployment. The maximum power demand of the chargers in each phase of charger installations (2027, 2030 and 2035), along with PG&E's grid constraints are shown in Figure 8. This is a snapshot in time and additional demand may come online from electric customers on the same distribution line as Santa Rosa's sites.

PG&E's Fleet Advisory Services performed a portfolio assessment for Santa Rosa's fleet sites (See Appendix O). At the time of this report, only MSC North and Laguna Treatment Plant are likely to encounter electric grid capacity constraints.

At MSC North, grid limitations could be mitigated by using a charger management system to limit the total site power draw from the grid to within the available power supply.

At Laguna Treatment Plant, the site is currently undergoing a UV filtration project that is expected to substantially decrease electricity consumption at the site, whereby capacity can be made available for the EV chargers.

Therefore, grid constraints should not pose a significant hurdle to the development of the charging infrastructure needed to supply Santa Rosa's fleet.

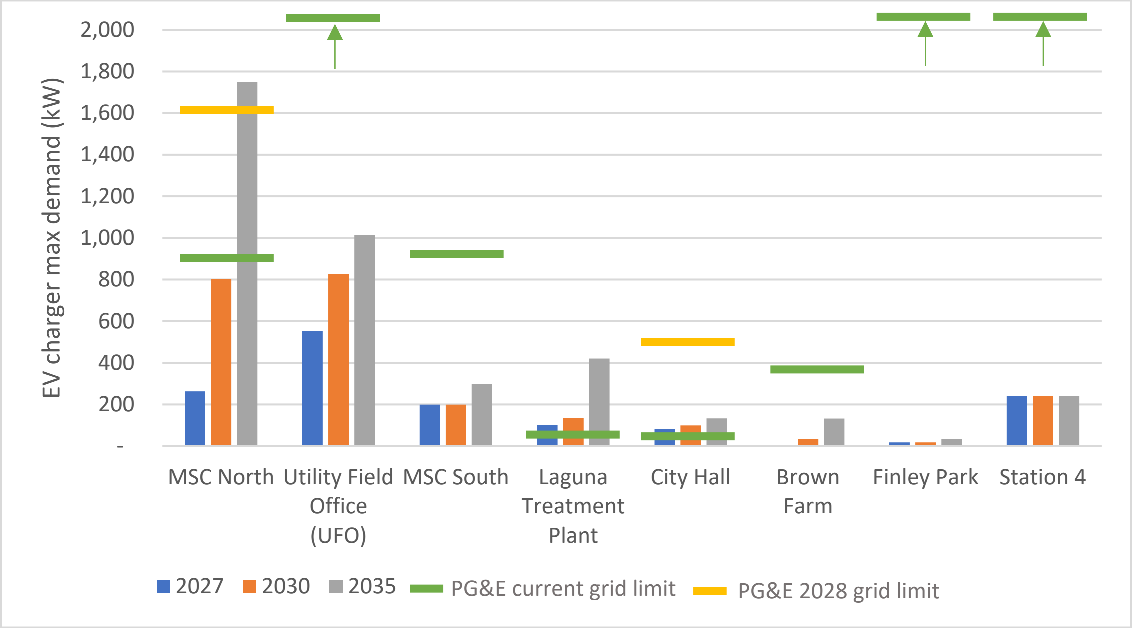


Figure 8. Planned EV charger cumulative nameplate power by installation phase, vs PG&E grid availability

2.4 TOTAL COST OF OWNERSHIP COMPARISON

NV5 compared the total 15-year transition costs comparing a baseline fossil fuel vehicle fleet with an electrified vehicle fleet as summarized in Table 3 below as the Total Cost of Ownership (TCO) for the fleet.

Table 3. 15-Year Total Cost of Ownership (TCO) Comparison, Baseline ICE Fleet vs Electrified Fleet

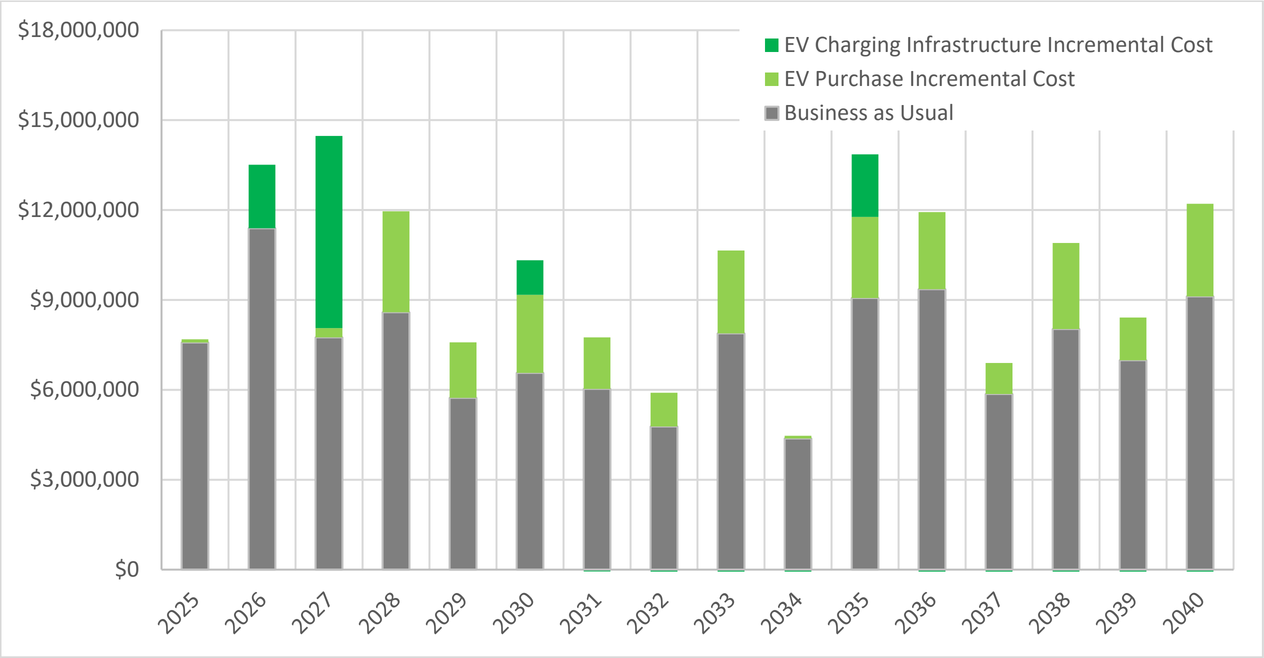
	CapEx - Vehicle Purchase ($)	CapEx – Charging Station ($)	Operating Expenses** ($)	Total ($)
Baseline*	$76,278,000	$725,000*	$42,103,000	$119,100,000
Electrification	$109,134,000	$12,610,000	$35,605,000	$157,350,000
Incremental Cost	$32,857,000	$11,885,000	-$6,498,000	$38,244,000
Incremental Cost (NPV, 2025$)	$26,468,000	$10,909,000	-$4,984,000	$32,393,000

**The current Santa Rosa fleet has some EVs in the existing fleet that requires installing several EV chargers for long-term EV charging.*

***Operational Expenses include fuel, maintenance, and EV charger software costs.*

While operational expense savings with an electric vehicle fleet occur from decreased maintenance and fuel costs, the high cost of the EV charging infrastructure, along with the expected higher upfront cost of EVs compared to fossil fuel vehicles, ultimately leads to a cumulative $38 million increase in cost by 2040 for the City to transition to an electric vehicle fleet.

Table 4. Annual All-In CapEx and OpEx for Baseline vs Fleet Electrification options



2.5 RECOMMENDED ACTIONS

2.5.1 Pursue ACF Exemptions

Certain ACF exemptions require documentation to be submitted to CARB. These exemptions include: ZEV Purchase Exemption,[19] Daily Usage Exemption,[20] Backup Vehicle Exemption,[21] Declared Emergency Response Exemption,[22] Non-Repairable Vehicle Exemption.[23]

For the Daily Usage example, an exemption can be granted if the daily driving distance of a vehicle exceeds the driving range of an EV. To receive this exemption, the City needs to collect a daily usage report for each vehicle of the same configuration for 30 consecutive workdays within the past 12 months. The 3 highest daily mileage records will be excluded, except for public agency utilities (e.g., water departments). Another example is the Infrastructure Delay Extension, which allows compliance delays of up to 5 years if a project to install charging is started one year ahead of the compliance date, and it is delayed.

The City should identify vehicles that meet may meet exemption requirements and collect the necessary data to file for exemptions with CARB. Exemptions will provide additional operational and budget flexibility for managing the fleet.

---

[19] CARB ACF ZEV Purchase Exemption
[20] CARB ACF Daily Usage Exemption
[21] CARB ACF Backup Vehicle Exemption
[22] CARB ACF Declared Emergency Vehicle Exemption
[23] CARB ACF Non-repairable Vehicle Exemption

2.5.2 Fleet Right-Sizing

The City should consider a fleet right-sizing exercise to identify vehicles with minimal use and opportunities where vehicles can be shared. The City could also consider reducing the weight class of some vehicles where a medium duty vehicle is not required. This would create the opportunity to move some fleet vehicles into classes not regulated by ACF, providing additional operational flexibility. This also provides the opportunity to explore more available EV options in lighter weight classes, which typically have the best TCO due to more price parity to ICE vehicles.

2.5.3 Start small with EV rollouts

Begin the fleet electrification process with vehicles that are the “easy wins.” These are vehicles that are mature in technology, have approached price parity with fossil fuel vehicles, and will easily integrate with operations. Light-duty vehicles such as sedans, SUVs, and half-ton pickup trucks will be easy wins for the City.

Additionally, CARB has indicated that certain vehicle categories will not receive a categorical “ZEV Purchase Exemption,” since these vehicles are not on the Streamlined Short Term Exemption List.[24] This decision affects medium to heavy-duty pickup trucks (similar to Ford F250 – F450 weight class), which CARB determines to have EV equivalents since a Class 4 EV cab and chassis can be upfit with a pickup truck body.

Even though these EV chassis/body custom vehicles exist, they are not widely produced. These vehicle configurations will need further experimentation and testing from Santa Rosa’s transportation department to determine suitability for its daily operations. NV5 recommends starting with a pilot with several of these EV chassis vehicles, before committing to a larger order to replace existing medium/heavy-duty pickup trucks across its fleet.

2.5.4 Prepare for project funding

EV purchases account for 73% of the net incremental cost ($33M incremental cost for EVs, $12M for EV charging infrastructure, and $6.5M in OpEx savings. The net incremental cost is $38M). To comply with ACF regulations, Santa Rosa will need to secure the funding source(s) and budget for the fleet electrification process. Aside from cash purchase or loans and securing grants and incentives, Santa Rosa could consider financing options such as Charging-as-a-Service, Vehicle-as-a-Service, or straight vehicle lease options to shift capital expenditures into operational expenses. Organizations such as the California Green Bank may also offer attractive financing options.

2.5.5 Initiate PG&E new service process at sites where EV purchases can be committed to in the near term

Key considerations for leveraging PG&E’s EV Fleet program include:

1. The PG&E EV Fleet program is almost fully subscribed as of Q3 2025 and will sunset in Summer 2026. After which, PG&E will stop providing the higher subsidies available under EV Fleet, which includes all to-the-meter costs and some behind-the-meter incentives. The

[24] CARB ACF Streamlined ZEV Purchase Exemption List

program also allows customers to apply early in the planning process, prior to extensive design by the customer.

2. Once EV Fleet is closed to new applicants, a less generous program to establish new service for EV loads exists, referred to as Electric Rule 29. Under Rule 29, PG&E provides a new service for EV loads covering all to-the-meter infrastructure upgrade costs. However, the City will need to advance designs further and follow more of a standard new service application process. Rule 29 also does not provide any behind-the-meter incentives.

3. The PG&E new service process typically takes a minimum of 18 months to complete. This is likely similar to the design, procurement and construction timeline of the behind-the-meter infrastructure that Santa Rosa is responsible for. Therefore, it is important to pursue both processes concurrently.

2.5.6 Determine the preferred project delivery method for infrastructure projects

Potential project delivery options for EV infrastructure include:

1. Traditional Design-Bid-Build: The City works with an engineering consultant to fully design the systems, put the project out to bid, and hires an installation contractor.

2. Design-Build: The City develops bridging documents to solicit a design-build contractor to design, permit, and construct the project.

3. Public Private Partnership (P3) or “Charging-as-a-Service” (CaaS): This method is commonly implemented similar to a design-build project. However, private capital is used to finance the project, with the City paying a higher operational cost over time. The CaaS entity typically also provides operational services. CaaS arrangements can be structured for the City to eventually own the infrastructure.

Santa Rosa should consider which delivery method aligns with internal resources and capital to best deliver charging infrastructure.

2.5.7 Prepare for the procurement process

Depending on the project delivery method, the City will need to consider how to best procure the EVSE projects as well as the subsequent operating agreements. A key consideration regardless of delivery method is to decide whether to group phases and/or sites into a single procurement versus separating into individual procurements.

Table 5. Procurement responsibility depending on project delivery method.

Project Scope	Design-Bid-Build	Design-Build	P3 or CaaS
1. Hardware with optional Service Level Agreement	Owner or contractor	Contractor	Contractor
2. Software	Owner or contractor	Owner or contractor	Contractor
3. Installing Contractor	Owner	Contractor	Contractor

1. Hardware (switchgear, transformers, and EV chargers) can be procured ahead of time to accelerate the construction schedule and potentially realize some cost efficiency. In addition, service level agreement (SLAs) are often offered by the EV charger vendor to maintain the chargers and provide an uptime guarantee.
2. Software to control chargers (charger management system, or CMS) is typically a recurring annual commitment.
3. The contractor to install and commission the above items.

If needed, the city may choose to procure items 1-3 through traditional Request for Proposals (RFP), or by using cooperative or piggyback agreements. Using cooperative agreement allows the City to access pre-negotiated prices without an RFP. Common cooperative agreements include Sourcewell,[25] TIPS,[26] CMAS,[27] etc.

2.5.8 Standardize on a charge management software (CMS)

NV5 recommends that the City vet and select a City-wide CMS for fleet charging to ensure interoperability across departments. The specific recommendations for procuring CMS include:

1. The City should consider selecting a CMS provider early in the process of scoping and designing infrastructure. Most CMS have vetted hardware that has been tested with the software, which will narrow the basis of design for the EVSE. Conversely, if the City has a preferred EVSE hardware, this may narrow the field of CMS providers. A CMS provider can also be brought in to collaborate on the design process and help select/optimize hardware.

2. A CMS can be a significant operational expense and the offerings vary widely. The City should carefully consider the software features needed. A core functionality should be the software's ability to mitigate fueling costs on the retail electricity tariff by maximizing fueling during periods when electricity costs are lowest.

[25] https://www.sourcewell-mn.gov/
[26] https://www.tips-usa.com/
[27] https://cmassearch-prod.apps.dgs.ca.gov/

3.0 EV CHARGING RESILIENCY STUDY RESULTS

Whereas a traditional vehicle fleet can depend on onsite gasoline and diesel fuel tanks to refuel during emergencies such as a power outage, an increasingly electrified vehicle fleet will need electricity sources to maintain operations. NV5 performed an analysis to determine the appropriate size of electricity generation and storage systems to provide resiliency to Santa Rosa's EV fleet.

We first met with each department in Santa Rosa to understand their critical operations during natural disasters, and how much power is required to support those operations. Then, NV5 reviewed constraints at each site, such as available space for onsite generation and storage. We then performed a microgrid optimization analysis using HOMER and Helioscope software to right-size the electricity generation and storage systems. Lastly, NV5 compared different configurations of generation and/or storage, including solar photovoltaics (PV), battery energy storage systems (BESS), and diesel gensets. The results are shown in the table below.

Table 6. Recommended Microgrid System Sizes by Technology and Site

	Brown Farm	City Hall	Laguna Treatment Plant	Municipal Services Center North	Station 4	Utilities Field Operations
Solar PV	36 kW-DC	17 kW-DC	71 kW-DC	240 kW-DC	62 kW-DC	223 kW-DC
BESS*	100kW 203 kWh	50kW 203 kWh	200kW 406kWh	550kW 1,218 kWh	100kW 406 kWh	450kW 1,015 kWh
Diesel Genset	80 kW	30 kW	200 kW	750 kW	100 kW	750 kW

**BESS sizes are defined by both maximum output power (kW) and storage capacity (kWh) values.*

Due to the EV charging needs at each site, a generator would need to be at the same size under either scenario to provide the needed resiliency (Diesel genset only, or Solar, BESS, and generator microgrid). However, under the scenario that includes solar and batteries, diesel refueling of the genset would be less frequent under an extended outage.

A microgrid incorporating solar and BESS can generate energy and store it for use in an outage as well as during off-peak rate periods. As an example, the following figure shows the flow of electricity between the various resources to support EV charging including PV, BESS, PG&E grid, and a diesel genset.

In Figure 9, a 24-hour operation was simulated for a typical (non-outage) day at UFO:

- 6:30am to 8:30pm: The PV is generating electricity which is stored in the BESS or exported to the grid.
- At 3:30pm: The BESS becomes fully charged, and all excess solar PV generated electricity is exported to PG&E's grid. Theoretically, this exported energy could be charging any EVs that are plugged in.
- 8:00pm to 3:00am: EVs are charged, with energy drawn from the BESS until the BESS is depleted. EV charging then occurs from the PG&E grid. Roughly 10% of the battery is kept unused for critical needs.

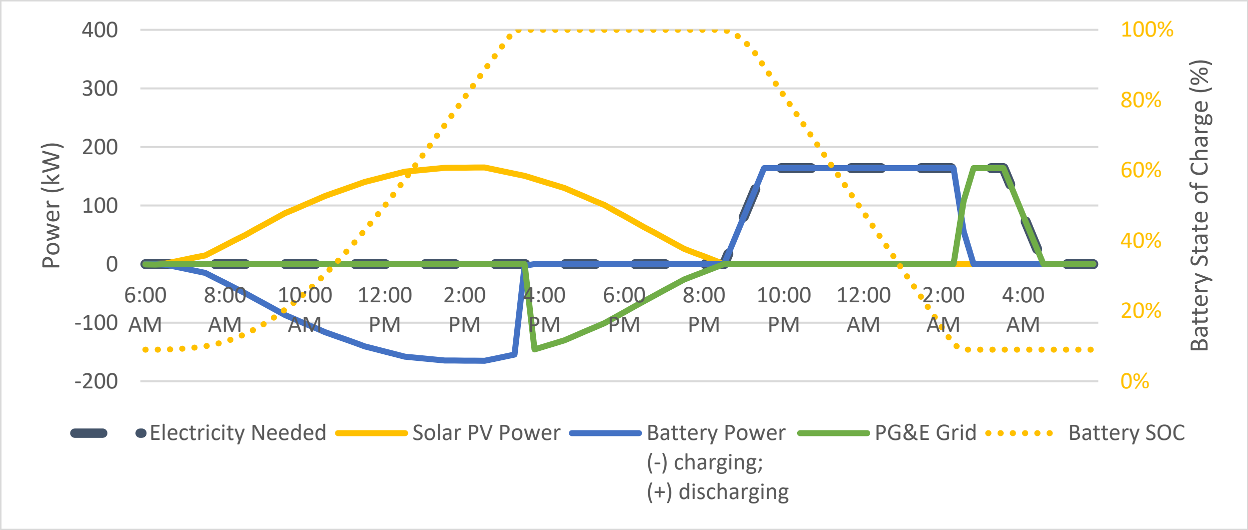


Figure 9. PV, BESS, and PG&E Grid load profile during a 24-hour non-outage operation at Utilities Field Operations.

In Figure 9, a 24-hour load profile is shown for a 24-hour outage at UFO:

- From 6:30am to 8:30pm, the PV is generating electricity which is stored in the BESS.
- At 3:30pm, the BESS becomes fully charged, and all excess generated electricity gets curtailed. Theoretically, this exported energy could be charging any EVs that are plugged in.
- From 8:30pm to 5:00am, EVs are charged, with energy drawn from the BESS until the BESS is depleted, with the generator then supplying the remainder of the EV charging. Roughly 10% of the battery is kept unused for critical needs. Note that the EV charging load is higher during an outage at UFO because UFO expects to have higher vehicle operations during an outage.

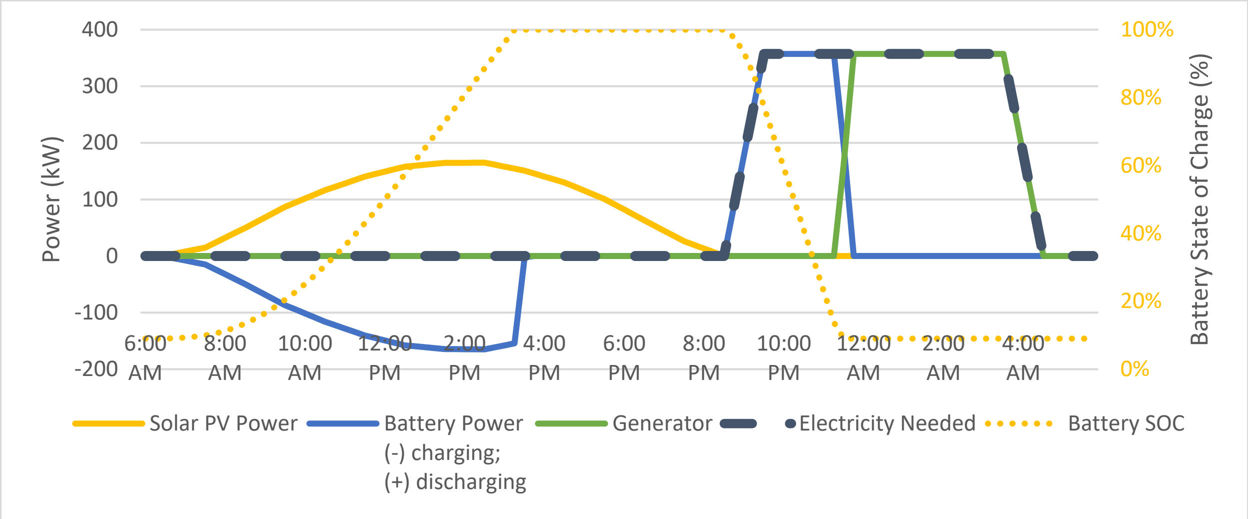


Figure 10. PV, BESS, and PG&E Grid load profile during a 24-hour outage operation at Utilities Field Operations.

Next, NV5 analyzed the capital and operating costs as well as emissions for the two major configurations: 1) Diesel generator only, and 2) Solar, BESS, and generator microgrid. Both configurations require significant investments, but fill a critical need for vehicle charging in emergency situations.

Although the microgrid option has the potential to provide cleaner back up power for the EV charging system, the high cost of such an investment makes the diesel generator-only option more financially feasible. However, the diesel generator option will emit higher amounts of greenhouse gases.

Additionally, due to numerous factors such as high upfront capital cost of the PV and BESS system and low electricity cost for grid electricity during a typical day, installing PV and BESS across the 6 Santa Rosa sites all result in negative net present value over a 25-year analysis period.

Table 7. 25-Year Financial Analysis Overview Results: Cash Purchase

Metric	Brown Farm	City Hall	LTP	SR Transit at MSC North	Station 4	UFO
Capital Costs						
Generator	$305,000	$72,000	$414,000	$732,000	$307,000	$732,000
Solar PV	$363,000	$188,000	$398,000	$1,686,000	$612,000	$1,259,000
BESS + Microgrid controls	$609,000	$478,000	$821,000	$2,077,000	$836,000	$1,786,000
Soft Costs	$107,000	$62,000	$121,000	$253,000	$135,000	$218,000
Total	**$1,384,000**	**$800,000**	**$1,755,000**	**$4,748,000**	**$1,890,000**	**$3,994,000**
25-Yr Savings Analysis (NPV at 2% Discount Rate)						
1) Generator-only	-$408,000	-$167,000	-$522,000	-$951,000	-$415,000	-$965,000
2) Generator+PV+BESS	-$1,228,000	-$790,000	-$1,449,000	-$3,500,000	-$1,813,000	-$3,011,000

Table 8. Greenhouse Gas Emission Calculations for the 6 Sites for each Resiliency Option.

Metric	Brown Farm	City Hall	LTP	SR Transit at MSC North	Station 4	UFO
Diesel Fuel Consumption per Year						
1) Generator-only (gal*)	199	70	470	1,689	237	1,849
2) Generator+PV+BESS (gal)	68	19	257	1,037	63	1,261
Greenhouse Gas Emission per Year						
1) Generator-only (MTCO2e*)	2,027	714	4,790	17,213	2,412	18,844
2) Generator+PV+BESS (MTCO2e)	698	197	2,623	10,567	640	12,854
25-Year Summary (Assume Cash Purchase)						
Emission Savings (kgCO2e, Genset vs Genset+PV+BESS)	33,232	12,922	54,162	166,162	44,295	149,750

Metric	Brown Farm	City Hall	LTP	SR Transit at MSC North	Station 4	UFO
NPV Difference ($, Genset vs Genset+PV+BESS)	$820,000	$623,000	$927,000	$2,549,000	$1,398,000	$2,046,000
Emission Mitigation Cost ($/MTCO2e)	24,675	48,211	17,115	15,340	31,561	13,663

**MTCO2e = Metric Tons of CO_2 equivalence, gal = gallons*

3.1 RECOMMENDED ACTIONS

3.1.1 Refine generator feasibility

The City should engage with generator vendors to explore detailed feasibility, regulatory requirements, and costs of installing generators at the EV charging depots as the EV fleet expands.

3.1.2 Identify key sites as resiliency hubs in the near term

The best candidates are Laguna Treatment Plant, MSC North, and UFO. To optimize capital expenditure, Santa Rosa should explore the potential for sharing existing backup power with EV charging, such as relying on the existing generators in Laguna Treatment Plant. Santa Rosa should first confirm if existing backup generation could support the EV loads. If they are insufficient, review how much additional capacity is needed.

3.1.3 Integrate future backup power capability into EVSE designs

Design switchgear on EVSE projects for backup power compatibility and install infrastructure for future backup systems. For example, if the EVSE project involves trenching, conduits for future generators, and/or PV, BESS should be installed as well.

3.1.4 Be cognizant of microgrid implementation timeline

NV5 recommends that Santa Rosa proceed first with the fleet electrification process before making further investments into the PV and BESS systems. As BESS technology and cost improves,[28] more real-life electricity use data becomes available, and as the fleet is electrified, the City should re-evaluate the cost effectiveness of PV and BESS.

If the City decides to adopt solar PV and BESS for some sites, build them in phases as funding sources are identified.

3.1.5 When ready to implement, engage with trusted designers

When the City is ready to adopt solar PV and BESS, engage with a trusted engineering company to develop detailed designs. Ensure optimal placement of solar PV, BESS, and generators, and procure and install the energy resources.

[28] NREL study show that future battery storage prices are expected to decrease

4.0 PRIVATE SECTOR EV CHARGING POLICY STUDY

Santa Rosa's Planning and Economic Development department collaborated with NV5 for this phase of the project. This study determined several best practices and strategies to encourage private sector investments into public facing EV chargers in Santa Rosa's public right of way such as sidewalks. For this work, NV5 and Santa Rosa interviewed with the City of San Francisco, City of Alameda, Voltpost, It's Electric, and Santa Rosa's Parking Division.

4.1 STRATEGIES TO INCREASE EV CHARGER DEPLOYMENT

4.1.1 Impact fees

In this model, Santa Rosa owns, operates, and maintains public curbside EV charging stations. The City will establish an impact fee to fund these installations. Santa Rosa will need to develop a Capital Improvement Plan to use the funds to construct, operate, and maintain city-owned EV chargers.

4.1.2 Facilitate private agreements between private providers and private property owners

In this model, Santa Rosa will not own, operate, or maintain public chargers. Instead, EV charging companies specializing in curbside EV chargers, such as It's Electric, will directly engage with property owners and install EV chargers. Santa Rosa's involvement will be in permitting the design and construction of these chargers.

To adopt this model, Santa Rosa will take a regulatory and planning role. Santa Rosa will first need to determine where in the City these chargers would be permitted, and then partner with EV charging companies to determine the regulatory framework for deployments, such as ADA and fire code compliance, and creating a streamlined permitting process to accelerate charger rollout. Last but not least, Santa Rosa will need to determine enforcement mechanisms for maintaining privately owned equipment within public right-of-way.

4.2 RECOMMENDED ACTIONS

4.2.1 Perform public outreach

It is generally recommended that, if the City embarks on any mechanism of installing public, curbside EV chargers, that the City engage the public as part of developing the program.

- Determine demand. The City should determine the demand (location, quantity) for public, curbside EV charging stations prior to implementation of any plan to install chargers.
- Involve City staff and stakeholders. Santa Rosa should engage with staff and community stakeholders to create a map where on-street curbside chargers or off-street chargers are more appropriate. Obtaining feedback from residents that may desire these improvements or those that may object should help pave the way for a smoother process and a more targeted approach.

4.2.2 Incentivize clean energy usage

To the extent that it is feasible, NV5 recommends that the City operate any program or initiative to install public, curbside EV charging stations in tandem with incentives to generate on-site power or obtain power from clean energy sources, such as those provided by the Sonoma Clean Power Authority's EverGreen rate.

EVs will reduce tailpipe air pollution in Santa Rosa. Air pollution will be further reduced if the power generated to charge EVs is from clean sources as well.

A. APPENDIX

A.1 BACKGROUND INFORMATION

A.1.1 Vehicle Classifications

The Federal Highway Administration (FHWA) classifies vehicles by their gross vehicle weight rating (GVWR), or the vehicle manufacturer's specification of the vehicle's loaded weight. The vehicle weight class determines which zero-emission regulation applies to them.

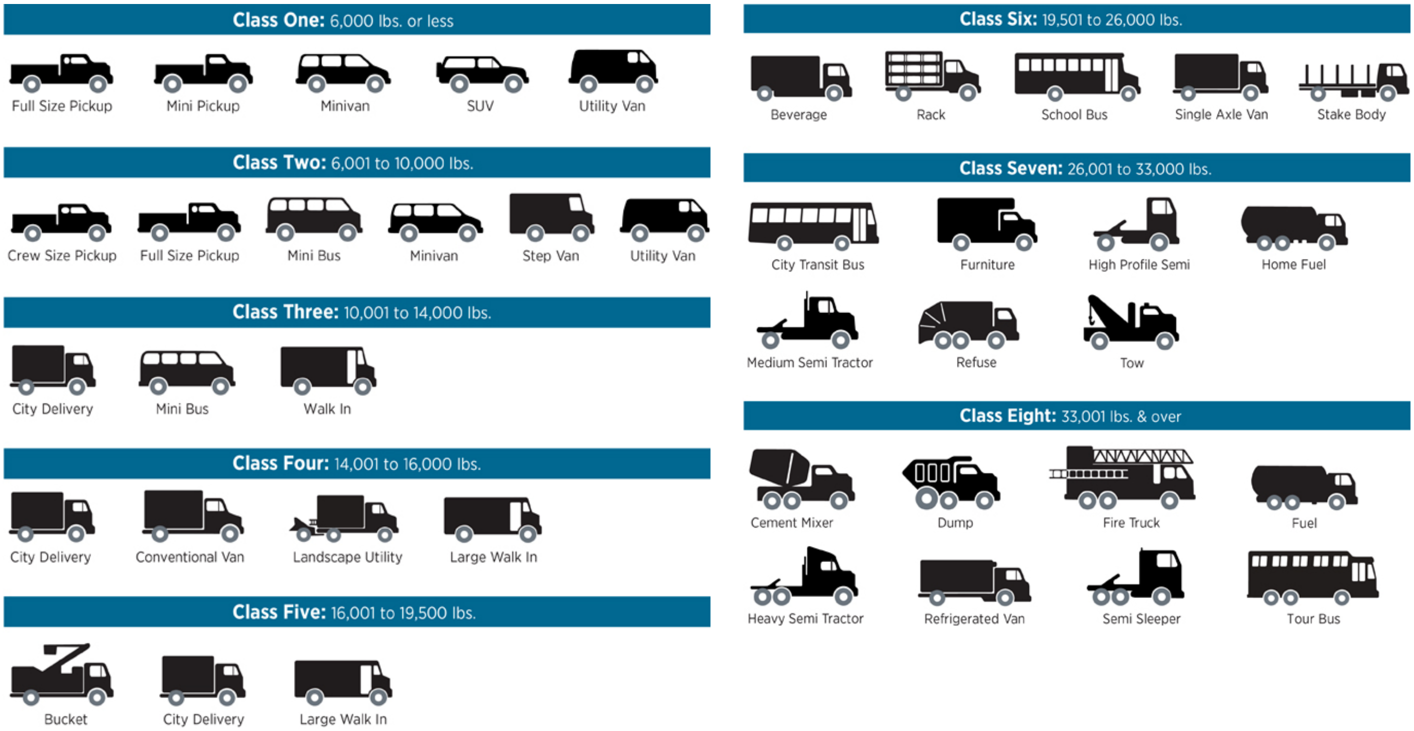


Figure 11. Vehicle weight classes and typical vehicle type in class.[29]

A.1.2 ZEV Types

Types of ZEVs include:

- Plug-in hybrid vehicles (PHEV)
- Battery Electric Vehicles (BEV)
- Hydrogen Fuel Cell electric vehicles (FCEV)

PHEVs are both charged by electricity and fueled at a gas station. These have larger batteries than HEV and are equipped with electric motors. In PHEV, the fuel engine serves as a back-up for the electric motor. PHEVs are not considered ZEVs as they are still powered by fossil fuel.

---

[29] Department of Energy Alternative Fuels Data Center [Types of vehicles by Weight Class]

BEVs are currently widely available for cars and light duty vehicles (LDV) like pickup trucks. Medium duty vehicle (MDV) and heavy-duty vehicle (HDV) electric options are still in development, and solutions for many municipal services like trash trucks and firetrucks are not yet widely available in the market. New MDV and HDV technologies are currently in development and are anticipated to become widespread in the next 5-10 years.

FCEVs are powered by hydrogen. At the tailpipe, FCEVs produce water vapor and air as the only emissions. However, the source of hydrogen affects its lifecycle emissions drastically. Green hydrogen is hydrogen created from renewable energy powering electrolysis to split water into hydrogen and oxygen. More commonly though, hydrogen is gray hydrogen, which is made from natural gas and other fossil fuels. In 2020, 99.6% of worldwide hydrogen was gray hydrogen, and only 0.1% was green hydrogen. Additionally, there is a lack of hydrogen vehicle fueling stations and expertise in the US. Therefore, to meet local and federal emissions and GHG reduction goals, NV5 encourages our clients to transition to BEVs rather than FCEVs where appropriate.

A.1.3 EVSE Types

Electric vehicle charging equipment includes three standard options: Level 1, Level 2, and direct current fast chargers (DCFC, also known as Level 3). An electric vehicle charging station delivers either alternating current (AC) or direct current (DC). Levels 1 and 2 deliver AC electrical power, while DCFC provides DC electrical power to the EV batteries at a rate dependent on the type of charger and battery architecture (i.e., operating voltage, operating current, and capacity).

Level 1 charging utilizes the residential standard outlet and provides around 1kW of power. Charging at this level is only applicable for residential use only since it is too slow for fleet use.

Level 2 chargers typically provide around 10 kW of power. Level 2 charging is acceptable for most fleet applications where vehicles may park overnight at a depot. Charging can take place overnight when vehicles are not in use and vehicles can typically complete their charging session in less than 12 hours.

Level 3 (aka DCFC) stations charge EVs the quickest, cost the most to install and use, and take considerably more effort to operate and maintain due to its intricate technology with many potential points of failure. DCFCs typically provide between 24 to 360 kW power. Except for low-powered DC charging, vehicles can typically be fully charged in under an hour.

A.1.4 Charge Management Systems

A Charge Management System (CMS) is the software that controls all chargers at a site. One of the key features of a CMS is to avoid expensive utility upgrades by throttling the EV charging load to keep the site’s total demand under limit, while ensuring the vehicles are charged by the time they are needed. Other CMS capabilities include charging session scheduling and reporting, recording vehicle telematics, optimizing charging times for lowest electricity time-of-use rates, and participating in utility demand response programs. NV5 recommends selecting one CMS vendor to control all EVSEs across a clients’ sites to reduce service fees, ensure ease of asset management, and reduce redundancy.

A.1.5 EV and EVSE Interoperability

In an EV charging system, there are multiple components that need to work together. They are 1) The EV charger (aka EVSE), 2) The CMS, 3) The Vehicles. There are standards that each component could comply with to ensure it is operable with the other components. Choosing an interoperable platform allows flexibility to choose different hardware and software vendors. For example, if a EVSE model consistently malfunctions, a different EVSE that complies with the interoperability standards can be swapped in. Therefore, NV5 always recommends procuring equipment that complies with the following standards:

Table 9. Interoperability standards to consider when procuring EV and EVSEs

Standard Name	Description
Open Charge Point Protocol 2.0	• Ensures interoperability between EVSE and CMS.
Open Charge Point Interface	• Ensures interoperability between EV and EVSE.
ISO-15118	• Enables vehicle-grid-integration capability, such as EV energy export to the grid. • Enables plug-and-charge capability thereby avoiding need for payment cards. (Standard will be ISO-15118 PnC)

Some vendors such as ChargePoint have integrated proprietary hardware and software offerings that are not compatible with third-party services. They may provide a high level of customer support, training, and promise scalability. However, proprietary systems could require the complete replacement of existing equipment if different vendors are selected in the future.

A.1.6 California Public Utilities Commission (CPUC) Regulations

CPUC regulates electric companies such as PG&E, and sets electricity distribution policies.

Table 10. Summary of CPUC Regulations Governing EV Adoption

Key CPUC Decisions	Description
EV Infrastructure Rule PG&E Rule 29 SCE Rule 29 SDG&E Rule 45 (Effective Oct 2021)	• Utility will pay for all service extension work to-the-meter, including transformer upgrades and all civil engineering work. • Customer responsible for any behind-the-meter work, which can be subsidized by utility incentive programs.
Service Energization Timeline E-5247 (Effective Dec 2022)	• Required utilities to target 125 business days on average from the time a customer submits an application for service to the energization of the EVSE.
Transportation Electrification Framework D.22-11-040	• Created a statewide EV charger incentive program to provide $1 billion in funding from 2025 to 2030 for EV chargers. • 30% of funding for light duty vehicle chargers. • 70% of funding for medium/heavy duty vehicle chargers.

(Effective Nov 2022)	
EV Submetering Protocol D.22-08-024 (Effective Aug 2022)	• Approved usage of submeters for EV loads. • Requires chargers installed under utility programs to be ISO 15118 certified (plug and charge and vehicle-grid integration ready).

A.1.7 Workforce Development Requirements

Maintenance staff training

Technician training for electric vehicles will be an ongoing process, with upfront education required to prepare technicians for the new EVs added each year. Routine maintenance items, such as oil changes, will decrease over time. Mechanics will need education to troubleshoot and maintain electric engines and battery systems. Rarely oil changes will be required if motor maintenance is necessary, and this skill should be maintained for EVs in the event an OEM-certified technician needs to access the motor.

Maintenance tasks are minimal for Level 2 stations, and mostly comprise of regularly cleaning the station and checking the charging cable for damage. Level 3 may require cleaning of vents and louvers, replacement of air filters, topping off coolant, and checking/reporting on the status of individual power modules, breakers, and tilt/water sensors.

Maintenance and operations parts and inventory items will gradually change as the number of EVs increases and ICE vehicles are reduced. Careful inventory analyses can reduce excess waste parts through the transition period. In general, the amount of spare and consumable parts decreases with EV and EVSE maintenance. EVs still require tire rotations and replacement, as well as servicing the braking system. Due to the regenerative breaking for EVs compared to ICE vehicles, brake pads typically degrade slower on EVs. The batteries in EVs are generally designed to last for the expected lifetime of the vehicle but are subject to failure. Currently battery replacement in EVs can be a significant expense, but battery prices are expected to decline as technology improves and production volumes increase. Figure 12 shows maintenance costs for light duty ICE vehicles compared to various ZEVs using 2021 data[30].

[30] Department of Energy Fact of the Week: BEVs have Lower Scheduled Maintenance Costs

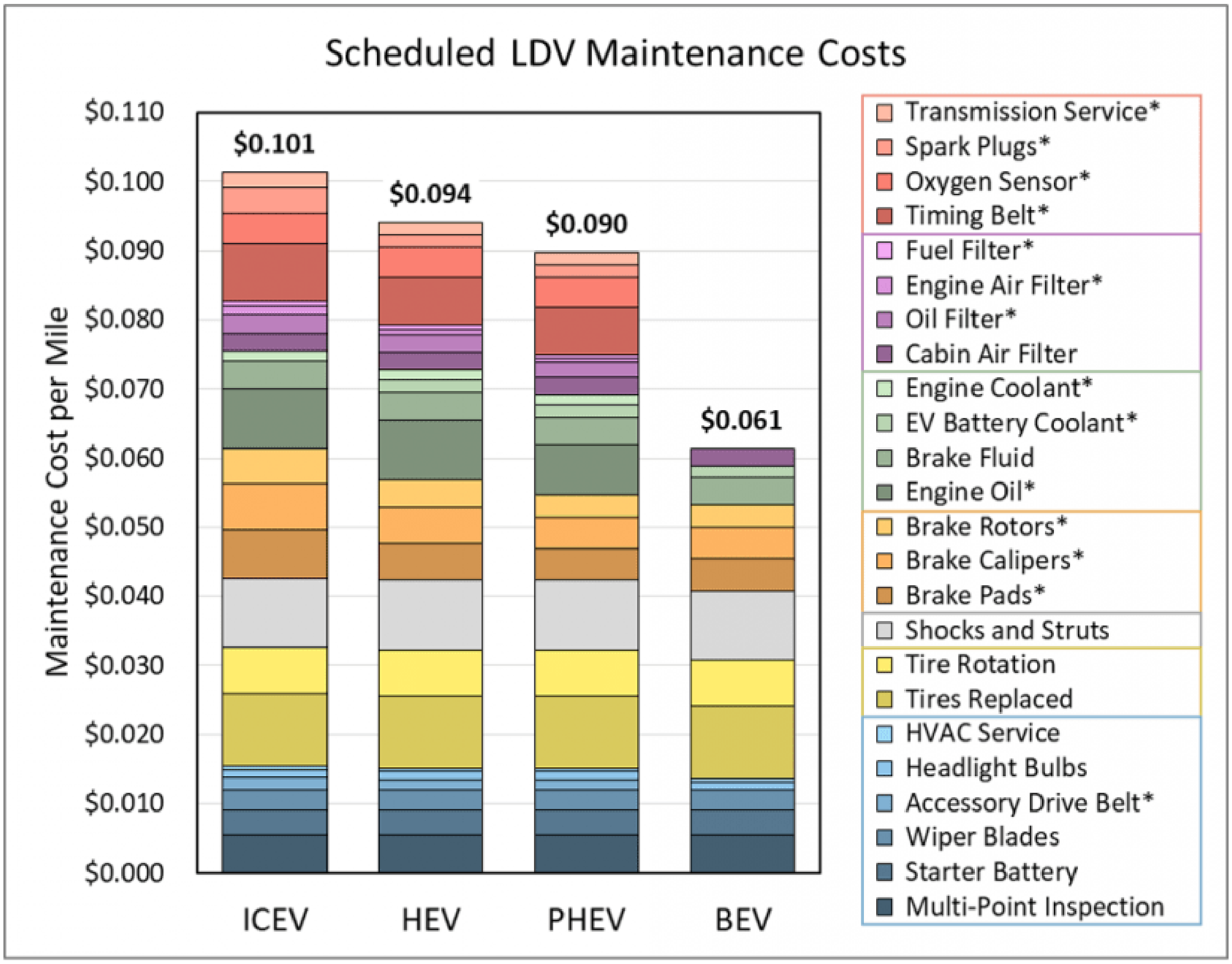


Figure 12. DOE 2021 LDV Maintenance Costs

Maintenance shops will still require lifts and tools for servicing vehicle HVAC systems, lights, and other standard items. With the adoption of EVs, maintenance shops should also invest in electrical training and safety equipment for handling the components of the EVs electrical systems. Specialized tools and testing equipment that may be required include insulated hand tools, battery lifts, leather or rubber gloves, insulation testers, or CAT III multimeters. EV Battery lifts cost between $8,000-$12,000 each. Diagnostic software may also be required and can cost between $1,500 and $3,500 per year in addition to technician training.

Vehicle Operator Training

Vehicle training encompasses teaching safe and effective operation of EVs in a manner that encourages operator behaviors that take advantage of range extending and cost saving practices. These include use of regenerative braking, single-pedal driving, identification of charging stations best suited for the EV's state of charge and battery technology, and charge session management. Maintenance activities for an electric fleet include wheel and rim checks, 12V car battery and high-voltage battery pack heath checks, air filter changes, and regular software updates.

Fleet Manager Training

Charging management system training teaches fleet managers and technicians how to use the charger's online dashboard to view or change charger status, diagnostic tools, station usage history, OCPP error logs, and even carbon offsets. It may also cover how to create maintenance tickets, deploy technicians for service and maintenance activities, and manage open orders for replacement parts. Additionally, CMSs should be used to optimize charging schedules, and ensure vehicles are sufficiently charged prior to working hours. The City should request periodic training from the selected CMS provider to keep fleet managers updated on latest product features.

A.2 PG&E FLEET ADVISORY SERVICES PORTFOLIO REVIEW RESULTS

PG&E EV Fleet Advisory Services
Portfolio Assessment (RAG) Status

City of Santa Rosa

Facility Name	Address	City	Latitude	Longitude	Customer Load (kW)	Capacity Check (kW)	EVFAS #	Notes
(1) MSC North	55 Stony Point Road	Santa Rosa	38°26'29"N	122°45'00"W	1722	0 / GRIP 900 kW	EVFAS010658329	2028 Capacity Project supports 1,611 kW
(1) Utility Field Office	35 Stony Point Road	Santa Rosa	38°26'27"N	122°44'50"W	891	891 / GRIP 2260 kW	EVFAS016967272	EV Fleet application Sept 2025
MSC South	69 Stony Circle	Santa Rosa	38°26'26"N	122°44'47"W	365	365 / GRIP 910 kW	EVFAS016969874	
(1) Laguna Treatment Plan	4300 Llano Road	Santa Rosa	38°22'08"N	122°46'05"W	562	562 / GRIP 50 kW	EVFAS016971504	
City Hall	100 Santa Rosa Ave	Santa Rosa	38°26'16"N	122°42'40"W	282	0 / GRIP 0 kW	EVFAS016973104	2028 Capacity Project supports 439 kW
Brown Farm	2200 LLANO RD	Santa Rosa	38°24'13.3"N	122°47'43.6"W	160	160 / GRIP 380 kW	EVFAS016975882	
Finley Park	2060 West College Avenue	Santa Rosa	38°26'36"N	122°44'55"W	133	133 / GRIP 2330 kW	EVFAS016975882	
Station 4	2260 Sonoma Ave	Santa Rosa	38°26'37"N	122°41'16"W	240	240 / GRIP 2610 kW	EVFAS016977730	

The above table was provided by PG&E as part of their Fleet Advisory Services. PG&E reviewed their distribution network load hosting capacity at each of the eight Santa Rosa fleet locations (under the “Capacity Check (kW)” column, compared to load increases at each site expected when all EV chargers are installed (under the “Customer Load (kW)” column).

Appendix A.3

Market Analysis Memo

November 2024

Prepared For:

City of Santa Rosa

Prepared By:

101 Lucas Valley Road, #302
San Rafael, CA 94903

NV5 PROJECT 5980824-2304101

1.0 MARKET ANALYSIS

Vehicle availability is one of the most important factors for transition feasibility. The market for electric vehicles varies greatly depending on the type of vehicle. Santa Rosa's fleet is made up of a diverse array of vehicles, all of which have varying degrees of electric models currently available. We anticipate that electric vehicles will become more available over the coming years. CTE updated its Zero Emission Vehicle (ZEV) market assessment to account for new EVs available for Santa Rosa's fleet by vehicle type. OEMs are continually improving exiting ZEV models and introducing new models in most vehicle categories.

Santa Rosa's fleet contains light-duty, medium-duty, heavy-duty, and non-road vehicles. The spreadsheet attached to the email provides tables of current EV models by type that could be suitable for Santa Rosa fleet. The specific vehicle and equipment types that make up each of these four categories are described in detail below.

1.1 LIGHT-DUTY

The light-duty category—including sedans, SUVs, vans, pickups, and motorcycles—is well suited for EV adoption. Many OEMs produce commercial models that are readily available for purchase. Most vehicles in this segment can be transitioned as soon as an asset reaches its planned service life. The exception to this is the pickup category. Although there are many models of half-ton pickups currently available on the market, compact and heavier models (three-quarters ton, 1-ton, 1.5-ton) have yet to be introduced. Ford has announced it plans to offer the heavier models by 2027 or 2028, however no OEM has indicated it will produce the smaller size pickup. The lack of compact and heavier pickups is a challenge for Santa Rosa. Santa Rosa currently uses the compact pickups for specific duties that could not be handled by the larger half-ton pickup. Similarly, Santa Rosa has uses for the heavier pickups that would not be well suited for the half-ton pickup. Depending on the specific use of these pickups, Santa Rosa may need to delay replacement until a suitable model is available.

Sedans: There are various electric vehicle options available to replace Santa Rosa's current passenger vehicle fleet. There should be no limitation to transitioning Santa Rosa's passenger cars to electric vehicles in the near term.

Pickup Trucks: Light-duty pickups are classified according to their payloads; the current categories in North America include compact, half-ton, three-quarter-ton, 1-ton, and 1-and-a-half-ton. Santa Rosa can transition its half-ton pickups to EV models in the short term but will have to delay replacement of heavier and compact models until the market matures. Depending on use, Santa Rosa may elect to replace some of its compact or heavier pickups with a half-ton pickup.

Sport Utility Vehicles (SUVs): There are multiple OEMs currently offering SUVs in both smaller and larger sizes. Santa Rosa should be able to transition its SUVs with no limitations.

Vans: The current market for light-duty vans is healthy, with various models available on the market. These models are primarily outfitted for cargo, which fits well with how Santa Rosa operates its vans. Chrysler has announced a minivan will be available in 2025. Santa Rosa should be able to transition its van fleet in the short-term.

Refuse Bin Trucks: Refuse trucks are light duty, utility vehicles that serve the sole purpose of removing waste.

1.2 MEDIUM-DUTY

There are multiple medium duty electric chassis available on the market, though their current price point is 2 - 4 times that of their diesel equivalents. Santa Rosa uses its medium duty vehicles for applications such as pickup and delivery trucks, small utility bodies, service bodies, small dump trucks, vans, and lighter garbage truck applications due to a tight turning radius. Medium-duty trucks are ideal for almost any industry due to customizable features such as cab configurations, bodies, and chassis-mounted equipment. Santa Rosa could transition these vehicles in the near term; however, the capital costs are high, and lead times are long. Fleets can apply for rebates through CARB's HVIP program. These funds are limited and available on a first-come-first-served basis. Santa Rosa should prioritize HVIP requests when planning procurements to off-set the costs, but award of these funds is not guaranteed.

1.3 HEAVY-DUTY

Heavy-Duty Trucks: Heavy-duty trucks are motor vehicles that refer to truck Class 7 - 8, which have a gross vehicle weight rating of 26,001+ lbs. Applications include 18-wheelers, sleeper cabs, dump trucks, refuse trucks, and tractor trailers. There are 10 OEMs offering heavy-duty ZE models for sale in the United States that can be outfitted for specific applications. As with medium-duty EVs, the primary challenge is the high capital cost.

1.4 NON-ROAD VEHICLES

Non-road vehicles are used for a variety of reasons including park maintenance, construction, public works projects, electric and water services, traffic safety, etc. Many of these vehicle types have been available in an EV version for years, such as utility vehicles and forklifts. OEMs are continually adding EV models of all types. While there are many EV models for construction applications, most are smaller compact sizes. Santa Rosa can begin transition for most of its non-road fleet in the near-term.

End of Memo

Appendix A.4

Fleet Assessment Technical Memo

March 2025

Prepared For:

City of Santa Rosa

Prepared By:

CTE
NV5

NV5

101 Lucas Valley Road, #302
San Rafael, CA 94903

NV5 PROJECT 5980824-2304101

EXECUTIVE SUMMARY

The City of Santa Rosa (Santa Rosa or City) is evaluating the transition to a zero-emission operational vehicle fleet. This transition is driven both by the City's climate goals, as well as the State of California's vehicle emission regulations.

This memo focuses on the vehicle transition from internal combustion engine (ICE) vehicles to electric vehicles (EV), and its associated costs. This analysis did not include first-responder, emergency services, or parking enterprise vehicles, which are also part of the city's fleet. The analysis also excluded Transit, which has a separate transition plan. This analysis also did not explore hydrogen fuel cell vehicles as an option for Zero-Emission Vehicles (ZEV) technology.

The estimated incremental cost for EV procurements and maintenance is $28 million over the years of 2025 to 2040. It will cost $133 million for the fleet electrification pathway, versus $105 million to maintain the current vehicle composition. Combining the cost for constructing and operating the EV chargers, which is discussed in a separate memo, the estimated incremental cost for fleet electrification is $38 million, before considering incentives.

Santa Rosa has a large operations fleet of medium and heavy-duty vehicles. This market sector for EVs is still nascent, and many vehicle configurations are not widely available. Therefore, this assessment projected that many vehicle classes will not be easily converted to EVs until later in the proposed transition schedule.

1.0 PURPOSE

For fleet transition planning, the goals of the fleet assessment component are:

1. Establish existing fleet inventory and operating requirements.
2. Determine the feasibility and suitability of an EV replacement for each asset type based on the operating requirements and available EV market options.
3. Create a procurement schedule following the existing procurement cycle over the transition period to determine fleet composition versus a baseline (no transition) scenario.

Because Santa Rosa's transition is driven by California's Advanced Clean Fleet (ACF) regulation, the goal of the transition plan is to meet the ACF requirements. Based on the transition modeling, we have determined that Option 1, the ZEV Milestones Option[1], is the most cost-efficient option to transition the fleet. The ZEV Milestone Option requires:

1. Starting January 1, 2024, 50% of annual purchases are ZEVs.
2. Starting January 1, 2027, 100% of annual vehicle purchases are ZEVs.

1.1 METHODOLOGY OVERVIEW

The fleet assessment methodology can be broken into three components: Service Assessment, Suitability Assessment, and Feasibility Assessment (Figure 1).

1.1.1 Service:

Inputs: The Center for Transportation and Environment (CTE) used Santa Rosa's fleet inventory data including asset numbers, vehicle types, vehicle fuel economies, and usage data such as mileage or operating hours, including Geotab[2] data. Where data were not readily available, CTE worked with the City to set assumptions for individual vehicle operating requirements.

Outputs: CTE determined the operating requirements for each type of vehicle, including average fuel economy, nominal daily usage, days in use per year, and strenuous daily usage. Nominal daily usage represents a typical day of use, and strenuous daily usage represents a day of heavy usage. Nominal daily usage determines the typical fuel usage, while strenuous daily usage determines whether an equivalent EV can feasibly perform the same maximum daily work without operational modifications.

1.1.2 Suitability:

Inputs: CTE analyzed the available 2024 EV market for all vehicle types in Santa Rosa's fleet to determine how suitable the available options are for replacement and to manage the risk of new ZE technologies.

Outputs: CTE assigned a "suitability score" to each vehicle type to indicate whether a vehicle type is a) available, b) commercially viable, and c) less than 2x the cost of the baseline vehicle to indicate that it is ready for purchase.

---

[1] CARB ACF Regulation for State and Local Government Agency Fleets

[2] Geotab is a fleet telemetry software that tracks per-vehicle usage data, including odometer, fuel consumption, and engine hours.

1.1.3 Feasibility:

Inputs: CTE created a purchase schedule based on Santa Rosa's existing fleet asset age, average service life, purchase/replacement costs, and a desired maximum annual capital limit ($10 million). Then, CTE used the operating requirements for each vehicle type defined in the Service Assessment and the available EV options, combined with the Suitability Scores, to determine whether each purchase was feasible for a switch to EV. Feasibility defines whether the purchased EV can perform under Santa Rosa's operating conditions. CTE considered the ACF purchase requirements and specific vehicle exemptions in creating the purchase schedule and assumed, based on discussions with the City, that no vehicles would be replaced by a different type of vehicle (e.g., a Class 3 pickup with a Class 2a pickup) in the purchase schedule because of the individual use cases for each asset. Please see the section *ACF Exempt Vehicles* for a detailed discussion of how the ACF requirements are affected by the suitability and feasibility of vehicles.

Outputs: CTE created a purchase schedule for traditional ICE vehicles and EVs, a fleet composition by year, and the procurement costs for the EV transition scenario versus the baseline scenario where no additional ZE vehicles are purchased.

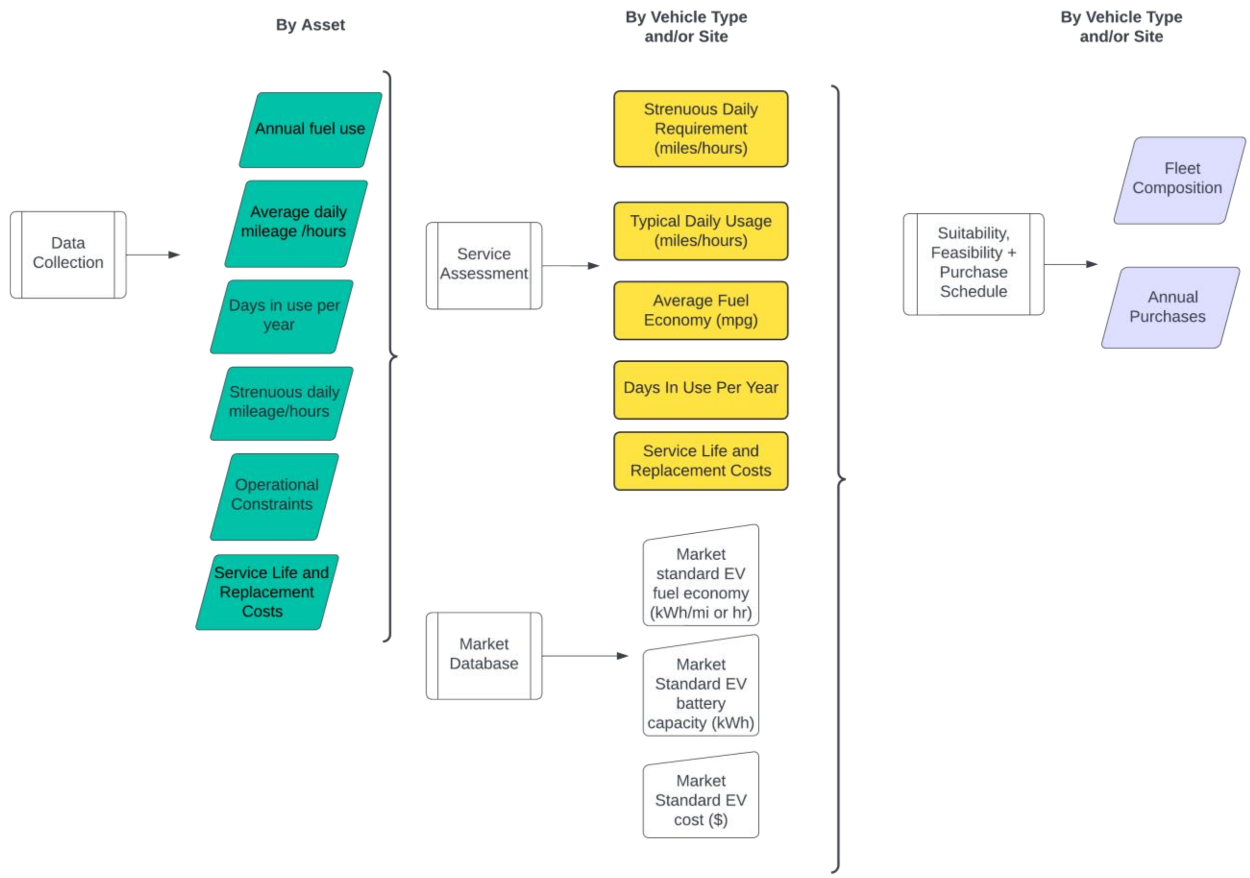


Figure 1: The Fleet Assessment major inputs, outputs, and processes.

1.2 SCOPE

The scope of the assessment included 383 vehicles across 17 sites (
Table 1, Figure 2)[3]. Only self-propelled, city-owned assets were included. Asset statuses A (Active), O (Ordered), and G (Ghost) were included per Santa Rosa's direction. No expansions or retirements are planned, so the fleet size of 383 remains constant throughout the plan. Because only a small number of the fleet are take-home vehicles and employees may not have charging infrastructure at home, CTE assumed that all vehicles will be charged on-site and should be included in the infrastructure assessment.

Table 1: Sites included in transition plan and number of assets at each site

Asset Location	Number of Assets
A Place to Play	1
Bennet Valley Golf Course	2
Brown Farm	15
City Hall - 100 Santa Rosa Avenue	21
City Hall Annex	2
Compost Facility	8
Finley Park	5
Fire Station 10	1
Galvin Community Park	1
Geysers	1
Howarth Park	4
Laguna Treatment Plant	52
Municipal Services Center North	154
Municipal Services Center South	46
Rincon Valley Community Park	1
Steele Lane Recreation Center	4
Utilities Field Operations	65
Total	**383**

[3] An additional four medium duty pickups were added at Laguna Treatment Plant.

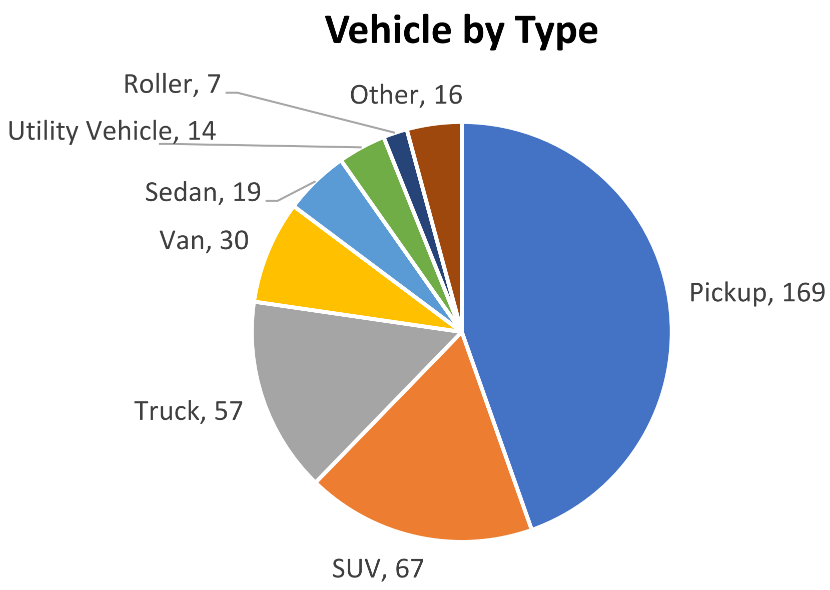


Figure 2: Top ten vehicle types within the 383-vehicle fleet.

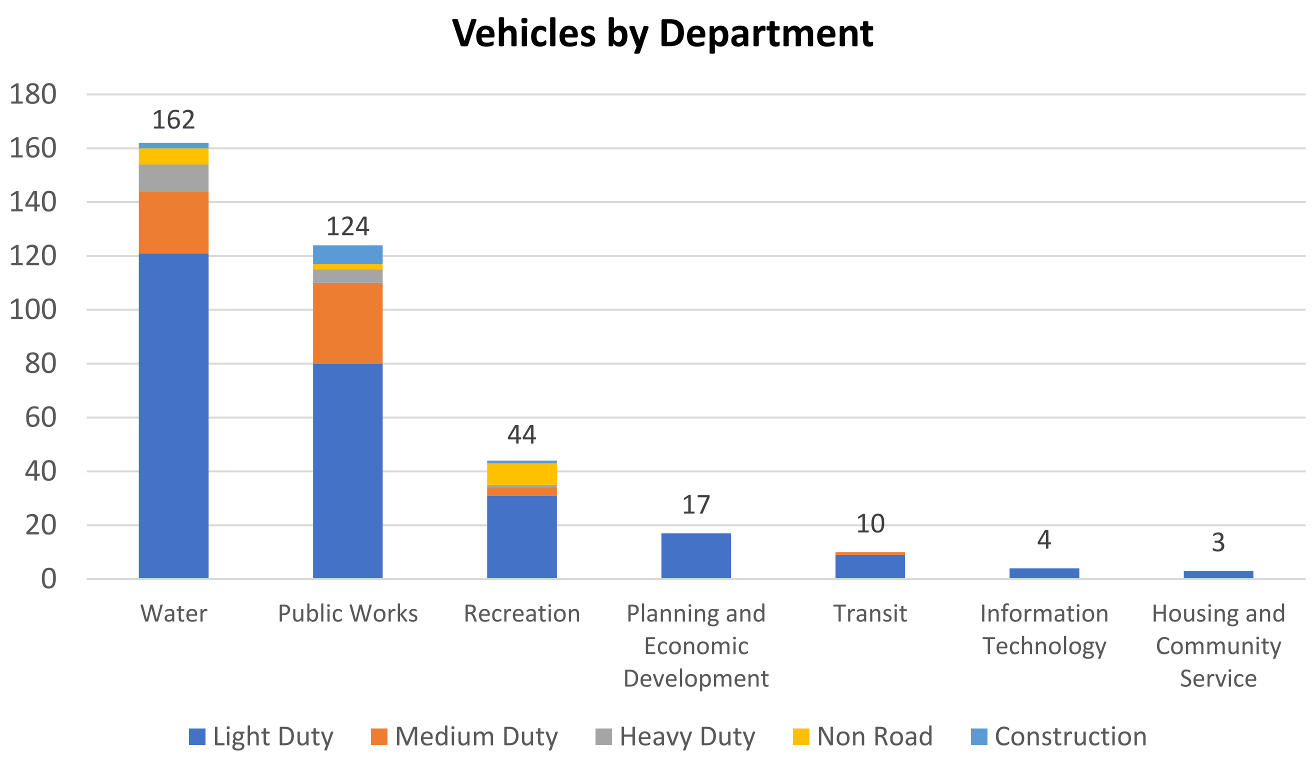


Figure 3. Number of Vehicles by Department and Vehicle Weight Class.

1.3 DETAILED METHODOLOGY AND ASSUMPTIONS

1.3.1 Operating Requirements Assumptions and Methodology:

1. Santa Rosa gathered vehicle asset data through on-board telematics provided by Geotab. When detailed Geotab data was available for the vehicle type, the Geotab data were used to calculate the total number of miles or hours operated over the past year (August 2023 – July 2024) as well as the total number of active days (defined as days with any operating data). The average daily usage for the vehicle type was calculated as:

$$Average\ Daily\ Usage\ = \frac{Total\ Usage\ (miles\ or\ hours)}{Total\ Active\ Days}$$

2. For vehicles with Geotab data, the active days per year over all the vehicles within a type was calculated as:

$$Active\ Days\ per\ Year\ per\ Vehicle\ = \frac{Total\ Active\ Days}{Number\ of\ Vehicles\ with\ Data}$$

3. For vehicles with Geotab data, the strenuous daily usage was calculated as the single vehicle day across all vehicles within the vehicle type with the most mileage. In the case of SUVs and ½ Ton Pickups, the maximum single day (542 and 512 respectively) was an outlier over all the vehicle type data (Appendix, Figure 6). CTE and Santa Rosa agreed on a more representative strenuous daily requirement, equal to the 99.9th percentile mileage. The final strenuous daily usage mileage was determined to be 250 miles for SUVs, and 150 miles for the ½ Ton Pickups.
4. For vehicles with Geotab data, the average fuel economy across all vehicles within the vehicle type was determined as:

$$Average\ Fuel\ Economy\ (mpg) = \frac{Total\ Usage\ (miles)}{Total\ Fuel\ Consumption\ (gallons)}$$

   Or, for vehicles measured in hours:

$$Average\ Fuel\ Economy\ (gallons\ per\ hour) = \frac{Total\ Fuel\ Consumption\ (gallons)}{Total\ Usage\ (hours)}$$

   If a vehicle did not have both fuel consumption data and usage data, it was excluded from the totals.

5. For vehicles without Geotab data or with incomplete Geotab data, CTE estimated missing values based on any available Geotab data, annual data provided directly by Santa Rosa, and valid data from similar vehicles. These assumptions were provided to Santa Rosa for approval prior to analysis. All operating requirements and assumptions are shown in the Appendix, Table 9.

6. The operating requirements are assumed to remain constant throughout the transition.

1.3.2 Suitability Methodology and Assumptions:

Not all types of vehicles operated by Santa Rosa are available in an EV model. Early adopters face a higher level of risk in introducing new technologies that are not yet proven. To manage this risk, CTE assigned a "Suitability Score" based on 2024 market research to each vehicle type or chassis in the fleet each year.

CTE also projected cost decreases over time to estimate when costs would reach a threshold acceptable to Santa Rosa (twice the cost of baseline fossil fuel vehicles). Table 2 explains the criteria for the Suitability Score, where here each criterion equals 1 point. Table 3 defines the suitability scoring – CTE considers a vehicle suitable for purchase once the score is 4 or 5.

Table 2: Suitability Criteria

#	Criteria	Definition
1	More than One Manufacturer	• Vehicle options available from more than one manufacturer available.
2	Readily Available	• **Light-Duty Vehicles:** Ready for purchase, can drive off the lot. • **Medium and Heavy-Duty Vehicles:** Can immediately go into production when purchase order is awarded.
3	Available for Purchase	• Available to be procured by Santa Rosa.
4	No Additional Customizations	• Delivered meeting technical specifications. • Does not require additional non-standard upfitting to be put into service.
5	Cost Effective	• Less than twice the cost of current vehicle type in conventional fuel equivalent.

Table 3: Suitability Score Definitions

Score		Definition
Eligible for transition	5	**Very High Suitability (Widespread Adopters)** Meets all commercial availability criteria, can likely be a one to one replacement with proper charging infrastructure, vehicle options from more than five original equipment manufacturers (OEM) available. Costs estimated at 1.6x that of baseline vehicles.
	4	**High Suitability (Limited Adopters)** Meets all commercial availability criteria, can likely be a 1:1 replacement with proper charging infrastructure. Costs ~2x that of baseline.
Not eligible for transition	3	**Medium Suitability (Early Adopter)** Meets all commercial availability criteria except for "cost effective." Costs between 2x to 3x that of baseline vehicle. Available for purchase, few commercial deployments, but past the prototyping stage. May not be a 1:1 replacement.
	2	**Low Suitability (First Customer)** Can be ordered but may not be able to be immediately entered into production. In pilot/prototyping stage of development.
	1	**Not Yet Available for Purchase**

1.3.3 Feasibility Methodology and Assumptions

1. Based on market research, CTE established a "market standard" usable battery capacity for each vehicle type. If no models were available, CTE based the capacity on a similar vehicle type.
2. To account for technology improvements, CTE modeled a 5% improvement in the market standard EV capacity every two years[4].
3. CTE estimated the EV fuel consumption (kWh per mile or kWh per hour) for each vehicle type based on Santa Rosa's operations.
4. To determine feasibility, CTE compared the energy consumption for the strenuous and nominal daily usage with the market standard battery capacity over each year of the transition (i.e., if the EV could complete the nominal and strenuous daily usage on a single battery charge with no operational modifications). If the energy consumption was less than the usable battery capacity in the projected year of purchase, the asset is feasible for transition. If the asset is both feasible and suitable, the purchase is modeled as an EV. If the asset is not feasible and suitable, the purchase defaults to ICE.

1.3.4 Purchase Schedule Assumptions

1. CTE used a standard service life for each vehicle type based on the average projected replacement age for assets in the class (Appendix, Table 9).
2. All overdue replacements are spread over the first four years of the transition plan.
3. CTE manually adjusted some vehicle purchases to avoid more than $10 million in vehicle procurement costs in each year of the transition. This was at the direction of Santa Rosa, in order to prevent large spikes and to smooth the capital investment funding needs. Purchases were adjusted only to delay EV purchases, not to accelerate transition.
   In the purchase schedule, all vehicles are replaced with the same vehicle type and class. Based on vehicle suitability and ACF requirements, the City may consider replacing some vehicles with different types of vehicles or not replacing them at all depending on use case versus the available ZEV capabilities. Please see the *Purchase Schedule* under *Results and Discussion* for further details.

1.3.5 ACF Exempt Vehicles

1. Not all vehicles in the fleet are subject to the ACF regulation.[5] Vehicles under 8,500 lbs. (light-duty automobiles, pickups and vans, etc.) are subject to the Advanced Clean Cars (ACC) regulation which is only applicable to OEMs and dealers. Sales of new light-duty vehicles must be 100% ZEV by 2035 in California. Based on the feasibility and suitability of these vehicles, Santa Rosa will be purchasing 100% ZEV for the light-duty fleet before 2035. Larger off-road assets and some auxiliary equipment such as excavators are subject to the Off-Road Diesel Fleets regulation which regulates overall emissions levels.[6] By 2031 based on feasibility, suitability, and asset age, the City will no longer purchase ICE off-road equipment which will aid in compliance and provide more flexibility for remaining ICE equipment.[7] Small off-road assets are subject to Small Off-Road Engines regulation which is only applicable to manufacturers, and CARB will begin enforcing 100% ZE sales for new assets in this category (small landscaping equipment, lawnmowers, and utility vehicles) in 2026[8][9], Based on the feasibility, suitability, and asset age, Santa Rosa will purchase 100% ZEVs in this category starting in 2026.

---

[4] Bloomberg NEF, "Hitting the EV Inflection Point" (2021)

[5] CARB, Final Regulation Order, Advanced Clean Fleets Regulation, Appendix A-1

[6] CARB, Guide to Off-Road Vehicle and Equipment Regulations

[7] CARB, Addition of Zero-Emission Equipment, April 2024

[9] CARB, Small Off-Road Engines

2. Vehicles subject to ACF may be exempt in the short term due to availability of ZE models. Categories that are already exempt include two-engine vehicles. Two-engine vehicles (TEV) are defined by CARB as a specially constructed on-road mobile vehicle that was designed by the OEM to be equipped with two engines, one that provides motive power and one that provides auxiliary power for additional equipment. These vehicles have two separate fuel tanks, one for the motive engine on the chassis and one for the accessory equipment. The fuel consumptions reported by Santa Rosa for TEVs are separated by chassis and accessory equipment.

   There are no existing completely electrified TEVs commercially available. The TEV market is still in the early stages of electrification, and it is unclear whether the market will follow the existing design with separate electric motors and batteries for the base chassis and accessories, or whether future EVs will power accessory equipment from the chassis battery in an integrated design. Therefore, CTE assumed that the base chassis for all TEVs can be electrified with available models of medium- and heavy-duty EV chassis, and that Santa Rosa will upfit the EV chassis with available accessory equipment that may be either ICE or EV. The electrification of accessory equipment will be included in the energy and power estimates in the Fuel Assessment. However, for the Fleet Assessment, the accessory equipment is excluded, and the replacement schedule and feasibility of the base chassis determined the transition speed for all TEVs. Thus, the energy needs of the auxiliary engine can be noted in the Fuel Assessment because of their ACF exemption, but the availability of the auxiliary engine was not used as a disqualifying factor for the Fleet Assessment.

3. ACF also has exemptions for vehicles where there is no new ZEV model capable of meeting the daily mileage or energy needs or there is no ZEV in the necessary configuration available to purchase. CARB published a short-term exemption list in January 2025. [10] Santa Rosa can apply for additional exemptions by following the designated CARB process.[11] CARB has provided a list of medium and heavy-duty ZE vehicle options.[12] The Class 2b-3 category includes ½-ton pickup options such as the Ford Lightning and some cab and chassis models such as the Ford T350 that are van style. There are no heavier pickups; however, heavier pickups are not exempt due to the options provided on the list. Because there is no exact equivalent available for heavier pickups, CTE did not change the EV suitability for heavy pickups from the rating of five in the years 2028-2030. Santa Rosa will need to individually evaluate vehicles when replacing them to achieve compliance and pursue exemptions with CARB where needed.

1.3.6 Financial Assumptions

To estimate capital costs for vehicle procurements, Santa Rosa provided the estimated replacement costs for all assets. The average ICE vehicle costs for Santa Rosa was used as the 2024 ICE baseline vehicle price. If no costs were provided, CTE provided a cost estimate. For EV prices, three methods were used to estimate cost. For EVs already purchased by the City, the average cost of the EV for that vehicle type was used (½-Ton Pickups). For well-commercialized EVs such as those in the light-duty category, the average of models on the market, excluding luxury models, was used. For all other EVs, especially those where special upfitting is needed and would not be included in a base EV cost, a cost multiplier based on Santa Rosa's ICE cost was used. For light-duty vehicles, 1.2x was used based on the difference between EV and ICE vans which are relatively well commercialized. For all other vehicles, 2.5x was used based on current price differences between medium- and heavy-duty EV and ICE vehicles.

[10] CARB ZEV Purchase Exemption List
[11] CARB Exemptions Overview
[12] CARB Certified Medium and Heavy Duty ZEV List

To estimate the changes in costs for both ICE and EV vehicles over time, NV5 applied future EV cost projections provided by the International Council for Clean Transportation.[13][14]

The following assumptions were used when calculating the Total Cost of Ownership for the fleet transition:

Table 4: Assumption for financial assessment for the fleet electrification pathway

Metric	Value
Annual escalation rate for fuel	2%
Annual escalation rate for electricity	3%
Net Present Value discount rate	2.5%
Reduction in maintenance cost for EV vs. ICE counterpart	30%

[13] For light-duty vehicles, [ICCT Assessment of Light-Duty Electric Vehicle Costs and Consumer Benefits In The United States In The 2022–2035 Time Frame]

[14] For medium and heavy duty vehicles, Appendix of [ICCT Purchase costs of zero-emission trucks in the United States to meet future Phase 3 GHG standards]

1.3.7 Results and Discussion

Suitability

The vehicle types in the fleet were rated for Suitability in

Table 5 according to the scores and criteria defined in Table 3 where a 4 or 5 indicates that it is suitable for purchase. Most vehicles are suitable for purchase by 2028-2030. Santa Rosa should note:

- The medium- and heavy-duty chassis can be outfit for any use, so CTE used it as the basis for specialty medium- and heavy-duty vehicle types.
- Similarly, CTE used pickup trucks of the appropriate class as the basis for any specialty pickup configurations. Ford announced a medium sized pickup model for late in 2027 which is the basis for a score of 4 in 2028.
- CTE assumed the available EV cargo vans could be outfitted for passenger use.
- Though there are no minivans currently available, there are two EV models slated for 2025.

Because the market for EVs is developing quickly, the availability of each vehicle type is only an estimation and should be re-evaluated throughout the transition.

Table 5: Suitability Rankings

Category	Vehicle Type	Commercially Available in 2024	2025	2026	2027	2028	2029	2030	2031
Construction	Excavator	No	2	3	3	3	4	4	5
Construction	Loader, Skid-steer*	Yes	3	3	3	3	3	3	3
Construction	Loader, Track Steer*	Yes	3	3	3	3	3	3	3
Construction	Roller	Yes	3	3	3	4	4	5	5
Construction	Wheel Loader, Compact	Yes	3	3	3	4	4	5	5
Light-Duty	1-Ton Pickup	No	2	2	3	3	3	4	4
Light Duty	¾-Ton Pickup	No	2	2	3	3	3	4	4
Medium Duty	1 1/2-ton Pickup	No	2	2	3	3	3	4	4
Light-Duty	Compact Pickup	No	2	2	3	3	3	4	4
Light-Duty	½-Ton Pickup	Yes	5	5	5	5	5	5	5
Light-Duty	Minivan	No	4	4	5	5	5	5	5
Light-Duty	Sedan	Yes	5	5	5	5	5	5	5
Light-Duty	SUV	Yes	5	5	5	5	5	5	5
Light-Duty	Van, Cargo	Yes	5	5	5	5	5	5	5
Light-Duty	Van, Passenger	Yes	5	5	5	5	5	5	5
Medium-Duty	Chassis	Yes	3	3	3	4	4	5	5
Heavy-Duty	Chassis	Yes	3	3	3	4	4	5	5
Heavy-Duty	Semi-Truck	Yes	3	3	3	4	4	5	5
Non-Road	Boom lift	Yes	5	5	5	5	5	5	5
Non-Road	Forklift*	Yes	3	3	3	3	3	3	3
Non-Road	Mower	Yes	5	5	5	5	5	5	5
Non-Road	Tractor, Medium	Yes	3	3	3	4	4	5	5
Non-Road	Utility Vehicle / ATV	Yes	3	3	3	4	4	5	5

** Forklifts and loaders become suitable in 2035 due to high cost.*

Feasibility

The vehicle types in the fleet were rated for feasibility, as shown in Table 6. The table shows which vehicle types currently have, or are projected to have, sufficient capacity to perform at either the strenuous or nominal daily usage. As technology progresses, a vehicle type may transition from Infeasible to Feasible, or from only nominal feasible to strenuous feasible. The feasibility table is blank for years where an EV model is not yet commercially available.

Santa Rosa should note that the feasibility projections are based on estimated daily usage and estimated EV vehicle energy consumption. For vehicles that are not deployed widely or even in existence, these estimations should be used with caution. Many factors—including HVAC use, driving style, idling behavior, and variations in daily operations—can affect actual energy consumption and therefore vehicle range.

The roller is the only vehicle type that does not meet the nominal daily usage throughout the transition. Based on the market standard battery capacity and the estimated EV energy consumption, EV rollers can likely run for 3-4 hours on a single charge. CTE did not have detailed Geotab data for Santa Rosa's rollers; therefore, the estimated nominal requirement of six hours may overestimate the true requirements for the roller. Note that roller vehicles as a construction vehicle is exempt from ACF regulations.

Table 6: Feasibility of each Vehicle Type

Key:	Description
	Not Yet Suitable
	Nominal Use Infeasible Without Modifications
	Nominal Usage Feasible, Strenuous Usage Infeasible
	Strenuous Usage Feasible

Vehicle Class	Vehicle Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Construction	Excavator																
Non-Road	Forklift																
Non-Road	Mower																
Construction	Roller																
Construction	Loader, Skid Steer																
Construction	Loader, Track Steer																
Non-Road	Tractor, Medium																
Non-Road	Utility Vehicle																
Construction	Wheel Loader, Compact																
Light, Class 3	1-Ton Pickup Crane																
Light, Class 3	1-Ton Pickup Dump																
Light, Class 3	1-Ton Pickup Flatbed Dump																
Light, Class 3	1-Ton Pickup Utility																
Medium, Class 3-4	1 1/2-Ton Pickup (Diesel, Propane)																
Medium, Class 3-4	1 1/2-Ton Pickup (Gasoline)																
Medium, Class 3-4	1 1/2-Ton Pickup Platform Lift																
Medium, Class 3-4	1 1/2-Ton Pickup Utility																
Light, Class 2a	1/2-Ton Pickup																
Light, Class 2b	3/4-Ton Pickup																
Light, Class 2b	3/4-Ton Pickup Dump																
Light, Class 2b	3/4-Ton Pickup Utility																
Non-Road	Boom Lift																
Light, Class 1	Compact Pickup																
Light, Class 1	Minivan																

Vehicle Class	Vehicle Type	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Light, Class 1	Sedan																
Light, Class 1	SUV																
Medium, Class 4-6	Truck, Asphalt Patcher																
Heavy, Class 7-8	Truck, Cleaner Heavy																
Heavy, Class 7-8	Truck, Crane Heavy																
Heavy, Class 7-8	Truck, Dump Heavy																
Medium, Class 4-6	Truck, Excavator Medium																
Medium, Class 4-6	Truck, Flatbed Dump Medium																
Medium, Class 4-6	Truck, Pole Setter Medium																
Medium, Class 4-6	Truck, Road Service Medium																
Heavy, Class 7-8	Truck, Rolloff Heavy																
Medium, Class 4-6	Truck, Sewer Jetter Medium																
Medium, Class 4-6	Truck, Tanker Medium																
Heavy, Class 8	Semi-Truck																
Light, Class 2a	Van, Cargo																
Light, Class 2a	Van, Passenger																
Light, Class 2a	Van, Utility																
Light, Class 2a	Van, Workshop																
Medium, Class 4-6	Work Truck, Boom Lift																
Medium, Class 4-6	Work Truck, Dump Medium																
Medium, Class 4-6	Work Truck, Mobile Workshop																
Medium, Class 4-6	Work Truck, Utility Medium																
Medium, Class 4-6	Work Truck, Utility Street Flusher																
Heavy, Class 7-8	Work Truck, Utility Heavy																

Purchase Schedule

Because Santa Rosa's goal for the transition plan is electrification and to ensure compliance with ACF purchase requirements, CTE considered a vehicle feasible for EV purchase if the nominal operating requirement based on daily Geotab data was feasible. There are several reasons why this is appropriate:

1. The strenuous mileage or operating hours is outside of typical operation based on daily Geotab data (see Appendix, Figure 6).
2. Because the fleet is transitioning as vehicles retire, ICE vehicles will be available in the fleet to perform the most strenuous operations for several years into the transition.

3. CTE does not have visibility into the details of vehicle operation. For example, a strenuous requirement of 200 miles per day for the ¾-ton utility pickup may not be continuous driving; it may be 100 miles each way which may allow for charging at the destination. As another example, the tractor's eight-hour requirement also does not account for potential charging over a lunch break, which would increase feasibility.

The Appendix (Table 11) contains a full list of vehicles purchased that only meet the nominal requirement and not the strenuous requirement and the estimated performance delta.

To provide Santa Rosa with a complete electrification plan, CTE made the following edits to the purchase schedule:

1. CTE planned for the purchase of the asphalt rollers despite not meeting the feasibility requirement. The rollers will still be able to operate on a job site but may require some operational modifications such as midday charging. The rollers are currently projected to operate for 3-4 hours on one charge given the available data on Santa Rosa's operations, and the total of seven rollers is projected to become fully electric in 2037, providing time to adjust gradually to necessary changes.
2. CTE delayed the purchase of the Pole Setter Truck from 2027 to 2029 to allow for the EV chassis to become suitable and to keep purchases under the annual capital limit.
3. CTE accelerated the second purchase of the Propane Forklift by one year so that it could be electrified within the transition timeframe (EV purchased in 2040).
4. CTE delayed the purchase of Crane Trucks and Road Service Trucks in 2028, Sewer Jetters in 2035, and 1 1/2-ton Utility Pickups in 2040 to keep purchases under the annual capital limit. Each purchase was delayed for one year.

Figure 4 shows the projected annual procurements based on the purchase schedule and feasibility. Based on the replacement schedule determined by service life and purchasing feasible and suitable EV replacements, Santa Rosa will purchase 28% EVs in 2025, 38% EVs in 2026, and will gradually reach 100% EV purchase by 2031.

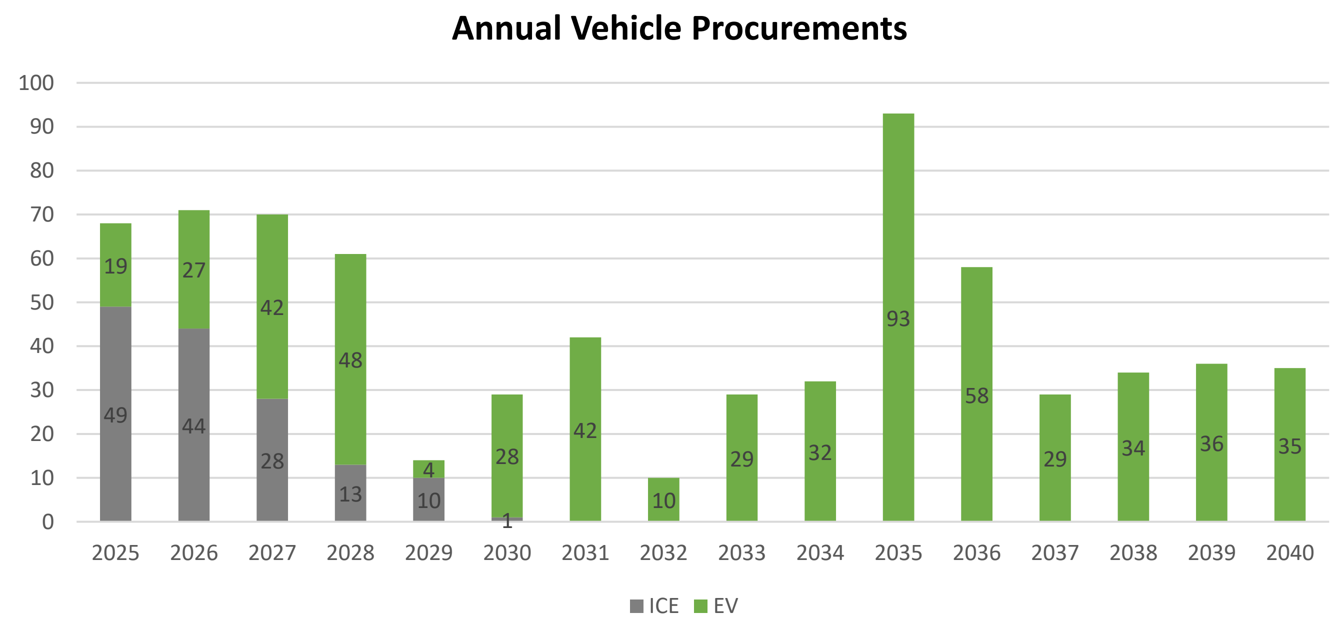


Figure 4: Annual procurements. Colors on bar represent propulsion type of purchased vehicles.

To evaluate the ACF compliance of the recommended purchase schedule, CTE divided Santa Rosa's vehicle categories into exempt and non-exempt categories. Light duty (less than 8,500 lbs.) and off-road vehicles fall under other CARB regulations. For on-road vehicles heavier than 8,500 lbs., all pickups, semis, and basic chassis were considered included and non-exempt. Configurations such as cranes and tanker trucks were considered exempt.[15] The full list of vehicles in each category is in the Appendix, Table 12.

Based on this categorization, the purchase schedule is shown in Table 7.

Note: The current purchase schedule does not meet ACF purchase requirements until 2030 without additional exemptions or purchase delays due to the lack of affordable ZE ¾-ton, 1-ton, and 1 ½-ton pickups until approximately 2030.

As shown in the table below and highlighted in red, there are 35 ICE vehicles scheduled for purchase in 2025 that CARB does not automatically consider exempt. These are mostly heavier pickups or utility pickups. In order to comply with the 50% EV purchase requirement, Santa Rosa needs to find an alternative for between 16 and 32 of those vehicles in order to meet the 50% requirement. Santa Rosa may consider these options for compliance in the short term:

1. Delay purchase of vehicles to decrease the percentage of ICE vehicles purchased each year.
2. Replace some Class 2b-3 pickups with available EV models such as a ½-ton pickup, a van-type cab and chassis, or a heavier Class 4 trucks.
3. Explore other avenues for exemptions.[16] CARB noted that some vehicles that are not on the Streamlined Short Term Exemption List may still be eligible for exemptions but will require an exemption application and are subject to other restrictions.

This may change as CARB updates its official exemption list. There are also efforts underway by coalitions of public agencies to introduce additional exemptions for public agency fleets. Santa Rosa may want to consider identifying and joining these groups to further advocate for exemptions.

Table 7: Purchases by ACF Status

Purchases of ACF-Regulated Vehicles		2025	2026	2027	2028	2029	2030
ACF – Non-Exempt	Electric Purchases	3	4	8	31	2	24
	ICE Purchases	35	35	7	9	10	0
	% Electric Purchases	8%	10%	53%	78%	17%	100%
	% Purchase Requirement	50%	50%	100%	100%	100%	100%
ACF – Short Term Exemption	Electric Purchases	0	0	0	1	2	0
	ICE Purchases	1	0	3	0	0	0
	% Electric Purchases	0%	--*	0%*	100%	100%	--
	% Purchase Requirement	0%	50%*	100%*	100%	100%	100%

**Re-evaluate short term exemption list*

[15] CARB Streamlined ZEV Exemption List (2025)
[16] October 2024 ACF Exemption Guidance

Figure 5 shows the fleet composition over the transition period. CTE estimates complete electrification in 2040 across all sites.

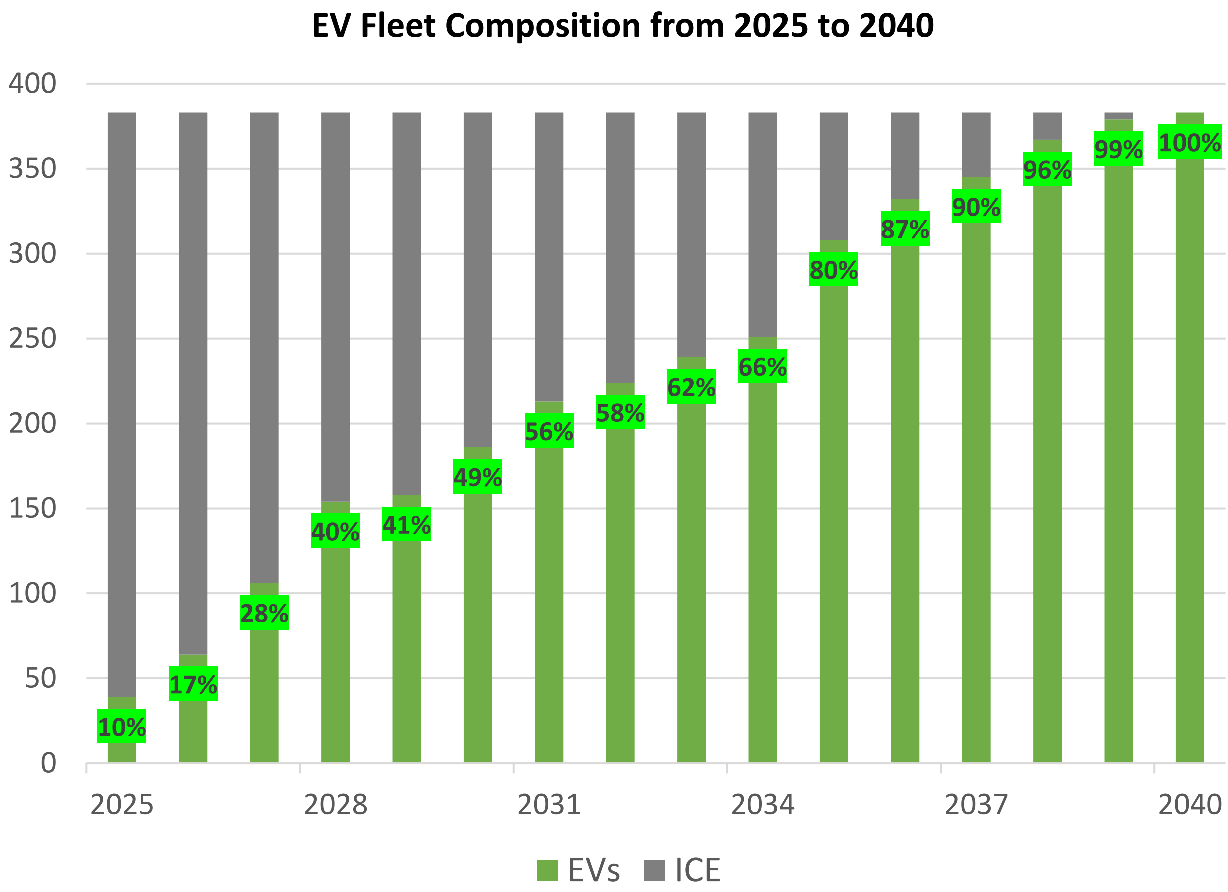


Figure 5: Fleet composition throughout the transition. The final ICE vehicles are phased out by 2040.

Procurement Costs

In calculating procurement costs, NV5 estimated:

1) The cost of procuring vehicles in the fleet transition plan, before grants and incentives.
2) The baseline cost of procuring vehicles, i.e., the “business as usual” cost of replacing ICE vehicles with ICE vehicles (“baseline cost”), before grants and incentives.
3) The value of available grants & incentives in both scenarios.

NV5 estimates that after accounting for incentives, vehicle procurement will cost an incremental $32M, almost $5M of which will be recovered as maintenance savings. Note that this does not include an estimated $3M in fuel savings, nor does it include an estimated incremental $12M in costs from charging infrastructure; both of these are covered in detail in the Fuel Assessment memo.

Table 8 shows the annual & total estimated cost of the vehicle procurements outlined above.

Table 8: Vehicle Procurement Costs by scenario, before and after incentives

	Transition Plan				Baseline Plan				Incremental Cost/Savings	
Year	Vehicle Cost	Incentive	Cost After Incentives	Vehicle MNT* Cost	Vehicle Cost	Incentives	Cost After Incentives	Vehicle MNT Cost	Difference in Vehicle Costs	Difference in MNT Costs
2025	$5.6	-$0.1	$5.4	$1.5	$5.3	-	$5.3	$1.5	$0.1	-$0.01
2026	$9.0	-$0.1	$8.9	$1.6	$8.9	-$0.01	$8.9	$1.6	$0.02	-$0.03
2027	$5.4	-$0.2	$5.2	$1.6	$4.9	-	$4.9	$1.6	$0.4	-$0.1
2028	$9.8	-$0.1	$9.7	$1.5	$6.2	-	$6.2	$1.6	$3.5	-$0.1
2029	$5.3	-	$5.3	$1.5	$3.3	-	$3.3	$1.7	$2.0	-$0.1
2030	$6.9	-$0.02	$6.9	$1.5	$4.1	-	$4.1	$1.7	$2.8	-$0.2
2031	$5.4	-	$5.4	$1.5	$3.5	-	$3.5	$1.7	$2.0	-$0.2
2032	$3.6	-	$3.6	$1.5	$2.2	-	$2.2	$1.8	$1.4	-$0.3
2033	$8.3	-	$8.3	$1.5	$5.2	-	$5.2	$1.8	$3.1	-$0.3
2034	$2.1	-	$2.1	$1.5	$1.7	-	$1.7	$1.8	$0.4	-$0.3
2035	$9.4	-	$9.4	$1.5	$6.3	-	$6.3	$1.9	$3.1	-$0.4
2036	$9.6	-	$9.6	$1.5	$6.6	-	$6.6	$1.9	$3.0	-$0.5
2037	$4.5	-	$4.5	$1.5	$3.0	-	$3.0	$12.0	$1.5	-$0.5
2038	$8.5	-	$8.5	$1.4	$5.1	-	$5.1	$2.0	$3.4	-$0.6
2039	$6.0	-	$6.0	$1.4	$4.0	-	$4.0	$2.0	$2.0	-$0.6
2040	$9.8	-	$9.8	$1.5	$6.1	-	$6.1	$2.1	$3.7	-$0.6
Total	**$109.1**	**-$0.5**	**$108.7**	**$24.1**	**$76.3**	**-$0.01**	**$76.3**	**$28.8**	**$32.4**	**-$4.7**

All numbers are in millions unless otherwise noted. Positive values are costs, negative values are savings comparing the transition to the baseline scenario.

* MNT is Maintenance.

2.0 RECOMMENDATIONS FOR NEXT STEPS

2.1 PREPARE FOR ACF EXEMPTION FILING

Certain exemptions require documentation to be submitted to CARB. For example, the Daily Usage Exemption can be granted if the daily driving distance of a vehicle exceeds the driving range of an EV. TO receive this exemption, the fleet owner needs to collect a daily usage report for each vehicle of the same configuration for 30 consecutive workdays within the past 12 months. The 3 highest daily mileage records will be excluded, except for public agency utilities (e.g. water departments). Another example is the Infrastructure Delay Extension, which allows compliance delays of up to 5 years if a project to install charging is started one year ahead of the compliance date, and it is delayed.

2.2 START WITH EV PILOTS FOR LOW-PRODUCTION EVS

CARB has informed NV5 that certain vehicle categories will not receive a categorical "ZEV Purchase Exemption", since these vehicles are not on the Streamlined Short Term Exemption List.[17] This decision affects medium to heavy duty pickup trucks (similar to Ford F250 – F450 weight class), which CARB determines to have EV equivalents since a Class 4 EV cab and chassis can be upfit with a pickup truck body.

Even though these EV chassis/body custom vehicles exist, they are not widely produced. These vehicle configurations will need further experimentation and testing from Santa Rosa's transportation department to determine suitability for its daily operations. NV5 recommends starting with a pilot with several of these EV chassis vehicles, before committing to a larger order to replace existing medium/heavy duty pickup trucks across its fleet.

2.3 PREPARE FOR PROJECT FUNDING

EV purchases account for 87% of the incremental cost ($33 million incremental cost for EVs, compared to 38 million total including the EV chargers and electricity costs). Santa Rosa will need to secure the funding source to pay for the vehicle fleet electrification. Aside from cash purchase or loans, Santa Rosa may consider exploring financing options such as Charging as a Service, or EV leases, to turn a high CapEx into more manageable OpEx. Organizations such as the California Green Bank may also offer attractive financing options.

[17] CARB Streamlined ZEV Purchase Exemption List (2025)

3.0 APPENDIX

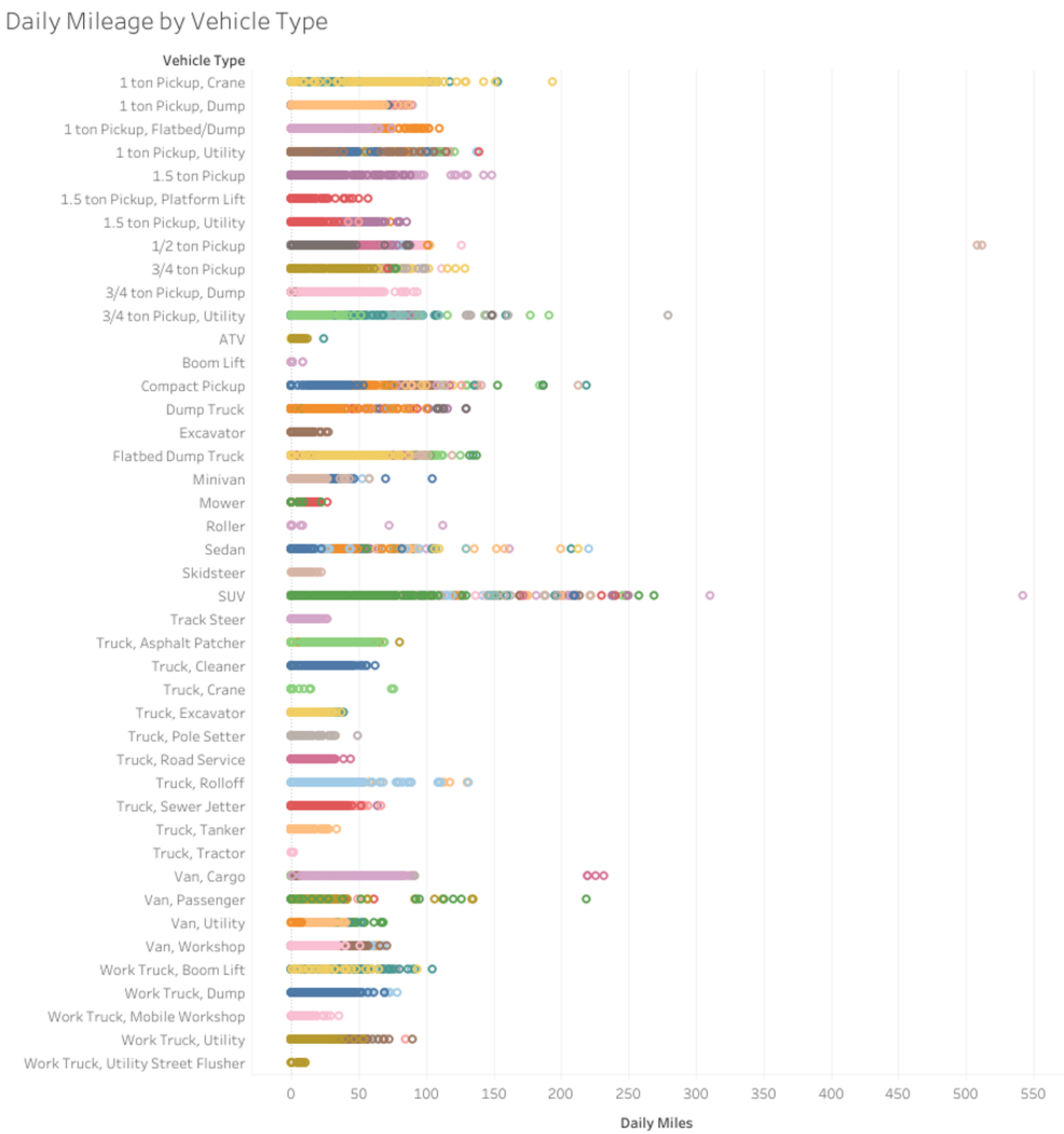


Figure 6: Daily mileage data from Geotab for available vehicles. Note that most days are clustered at a lower mileage, while there are only a few more strenuous days with higher mileage out of the year for each type.

Table 9: Operational requirements and fuel economies for the fleet sorted by vehicle type and fuel type.

Vehicle Type	Class	Fuel Type	Average Fuel Economy	Fuel Economy unit	Number of Assets	Active Days per Year	Average Daily Usage	Strenuous Daily Usage	Usage Unit	Planned Service Life (years)
Excavator	Construction	Diesel	0.68	gal/hr	1	74	1.7	3.0	hours	10
Forklift	Non-Road	Diesel	1.16	gal/hr	2	64	1.6	8.0	hours	15
Forklift	Non-Road	Propane	0.94	gal/hr	1	64	1.6	8.0	hours	15
Mower	Non-Road	Diesel	0.94	gal/hr	3	20	4.6	6.0	hours	12
Mower	Non-Road	Gasoline	1.05	gal/hr	2	20	4.6	6.0	hours	12
Roller	Construction	Diesel	0.50	gal/hr	7	3	6.0	8.0	hours	10
Loader, Skid-steer	Construction	Diesel	0.82	gal/hr	2	37	2.2	3.0	hours	12
Loader, Track Steer	Construction	Diesel	1.51	gal/hr	1	112	1.5	3.0	hours	10
Tractor, Medium	Non-Road	Diesel	1.50	gal/hr	1	250	5.0	8.0	hours	12
Utility Vehicle	Non-Road	Electric	0.83	kWh/hr	5	236	6.0	8.0	hours	10
Utility Vehicle	Non-Road	Gasoline	0.10	gal/hr	9	28	6.0	8.0	hours	10
Wheel Loader, Compact	Construction	Diesel	1.56	gal/hr	1	112	2.0	4.0	hours	10
1 ton Pickup, Crane	Light-Duty	Diesel	10.45	mpg	3	174	44.0	193.8	miles	10
1 ton Pickup, Dump	Light-Duty	Diesel	8.62	mpg	1	261	31.9	89.8	miles	10
1 ton Pickup, Dump	Light-Duty	Gasoline	7.66	mpg	8	261	31.9	89.8	miles	10
1 ton Pickup, Flatbed/Dump	Light-Duty	Diesel	15.64	mpg	1	163	32.9	109.3	miles	11
1 ton Pickup, Flatbed/Dump	Light-Duty	Gasoline	13.77	mpg	1	163	32.9	109.3	miles	11
1 ton Pickup, Utility	Light-Duty	Diesel	11.29	mpg	16	154	25.9	138.7	miles	10
1 ton Pickup, Utility	Light-Duty	Gasoline	7.83	mpg	36	154	25.9	138.7	miles	10
1 ton Pickup, Utility	Light-Duty	Propane	6.65	mpg	1	154	25.9	138.7	miles	10
1 1/2 ton Pickup	Medium-Duty	Diesel	7.69	mpg	3	104	20.3	148.9	miles	10
1 1/2 ton Pickup	Medium-Duty	Gasoline	4.89	mpg	2	104	20.3	148.9	miles	10
1 1/2 ton Pickup	Medium-Duty	Propane	4.82	mpg	1	104	20.3	148.9	miles	10
1 1/2 ton Pickup, Platform Lift	Medium-Duty	Diesel	7.63	mpg	1	73	11.8	56.5	miles	12
1 1/2 ton Pickup, Utility	Medium-Duty	Diesel	7.63	mpg	8	104	19.6	85.2	miles	12
1/2 ton Pickup	Light-Duty	Electric	0.53	kWh/mi	6	170	28.4	150.0	miles	8
1/2 ton Pickup	Light-Duty	Gasoline	15.46	mpg	15	170	28.4	150.0	miles	8
3/4 ton Pickup	Light-Duty	Diesel	9.64	mpg	5	151	26.2	129.1	miles	9

Vehicle Type	Class	Fuel Type	Average Fuel Economy	Fuel Economy unit	Number of Assets	Active Days per Year	Average Daily Usage	Strenuous Daily Usage	Usage Unit	Planned Service Life (years)
3/4 ton Pickup	Light-Duty	Gasoline	9.67	mpg	6	151	26.2	129.1	miles	9
3/4 ton Pickup, Dump	Light-Duty	Gasoline	7.54	mpg	2	262	36.1	93.2	miles	12
3/4 ton Pickup, Utility	Light-Duty	Diesel	11.63	mpg	3	158	26.5	200.0	miles	10
3/4 ton Pickup, Utility	Light-Duty	Gasoline	9.99	mpg	9	158	26.5	200.0	miles	10
Boom Lift	Non-Road	Diesel	1.92	mpg	1	33	1.0	4.0	miles	10
Compact Pickup	Light-Duty	Gasoline	15.44	mpg	41	148	30.1	218.4	miles	8
Minivan	Light-Duty	Gasoline	15.43	mpg	3	164	11.8	104.8	miles	9
Sedan	Light-Duty	Gasoline	31.99	mpg	19	76	16.8	220.6	miles	9
SUV	Light-Duty	Electric	0.32	kWh/mi	9	109	21.2	250.0	miles	8
SUV	Light-Duty	Gasoline	17.13	mpg	58	109	21.2	250.0	miles	8
Truck, Asphalt Patcher	Medium-Duty	Diesel	3.47	mpg	3	111	29.4	80.3	miles	12
Truck, Cleaner	Heavy-Duty	Diesel	2.73	mpg	2	113	22.9	62.2	miles	13
Truck, Crane	Heavy-Duty	Diesel	2.45	mpg	1	25	8.5	75.6	miles	10
Truck, Dump	Heavy-Duty	Diesel	3.28	mpg	9	79	14.0	129.9	miles	12
Truck, Excavator	Medium-Duty	Diesel	0.63	mpg	3	134	9.5	38.7	miles	10
Truck, Flatbed Dump	Medium-Duty	Diesel	7.68	mpg	11	199	34.4	137.6	miles	10
Truck, Pole Setter	Medium-Duty	Diesel	2.83	mpg	1	74	7.9	48.7	miles	15
Truck, Road Service	Medium-Duty	Diesel	2.40	mpg	1	196	11.2	44.3	miles	10
Truck, Rolloff	Heavy-Duty	Diesel	3.49	mpg	2	116	28.6	131.2	miles	12
Truck, Sewer Jetter	Medium-Duty	Diesel	2.06	mpg	7	76	17.1	66.0	miles	9
Truck, Tanker	Medium-Duty	Diesel	4.17	mpg	1	196	2.5	33.7	miles	15
Semi Truck	Heavy-Duty	Diesel	1.01	mpg	1	12	0.8	1.8	miles	12
Van, Cargo	Light-Duty	Gasoline	14.70	mpg	9	110	27.0	232.0	miles	10
Van, Passenger	Light-Duty	Gasoline	11.87	mpg	5	210	12.5	219.0	miles	11
Van, Utility	Light-Duty	Gasoline	7.63	mpg	4	115	17.0	68.4	miles	9
Van, Workshop	Light-Duty	Diesel	10.02	mpg	1	114	24.1	70.4	miles	9
Van, Workshop	Light-Duty	Gasoline	8.82	mpg	8	114	24.1	70.4	miles	9
Work Truck, Boom Lift	Medium-Duty	Diesel	8.15	mpg	4	81	27.6	104.2	miles	10
Work Truck, Dump	Medium-Duty	Diesel	8.72	mpg	2	226	21.9	78.7	miles	10

Vehicle Type	Class	Fuel Type	Average Fuel Economy	Fuel Economy unit	Number of Assets	Active Days per Year	Average Daily Usage	Strenuous Daily Usage	Usage Unit	Planned Service Life (years)
Work Truck, Mobile Workshop	Medium-Duty	Diesel	2.62	mpg	1	116	9.7	35.3	miles	12
Work Truck, Utility	Medium-Duty	Diesel	5.84	mpg	3	124	17.0	89.9	miles	10
Work Truck, Utility	Medium-Duty	Gasoline	5.45	mpg	4	124	17.0	89.9	miles	10
Work Truck, Utility Street Flusher	Medium-Duty	Propane	3.13	mpg	1	19	5.2	10.4	miles	17
Work Truck, Utility	Heavy-Duty	Diesel	5.84	mpg	1	124	17.0	89.9	miles	10

Table 10: Baseline and EV Costs and Source

Vehicle Type	Class	2024 Baseline Capital Cost ($)	Baseline Cost Source	2024 EV Capital Cost ($)	EV Cost Source
Truck, Cleaner	Heavy-Duty	$844,637	Average of Santa Rosa's ICE Replacement Costs	$2,111,592	2.5x baseline
Truck, Crane	Heavy-Duty	$918,383	Average of Santa Rosa's ICE Replacement Costs	$2,295,957	2.5x baseline
Truck, Dump	Heavy-Duty	$311,538	Average of Santa Rosa's ICE Replacement Costs	$778,845	2.5x baseline
Truck, Rolloff	Heavy-Duty	$239,195	Average of Santa Rosa's ICE Replacement Costs	$597,987	2.5x baseline
Semi Truck	Heavy-Duty	$327,057	Average of Santa Rosa's ICE Replacement Costs	$817,642	2.5x baseline
Work Truck, Utility	Heavy-Duty	$177,127	Average of Santa Rosa's ICE Replacement Costs	$442,817	2.5x baseline
1 ton Pickup	Light-Duty	$116,264	Average of Santa Rosa's ICE Replacement Costs	$290,659	2.5x baseline
1 ton Pickup, Crane	Light-Duty	$166,272	Average of Santa Rosa's ICE Replacement Costs	$415,680	2.5x baseline
1 ton Pickup, Dump	Light-Duty	$91,599	Average of Santa Rosa's ICE Replacement Costs	$228,996	2.5x baseline
1 ton Pickup, Flatbed/Dump	Light-Duty	$87,220	Average of Santa Rosa's ICE Replacement Costs	$218,050	2.5x baseline
1 ton Pickup, Utility	Light-Duty	$86,869	Average of Santa Rosa's ICE Replacement Costs	$217,173	2.5x baseline
1/2 ton Pickup	Light-Duty	$74,078	Average of Santa Rosa's ICE Replacement Costs	$118,958	Average of Santa Rosa's price for ½ Ton Electric Pickup
3/4 ton Pickup	Light-Duty	$59,092	Average of Santa Rosa's ICE Replacement Costs	$147,730	2.5x baseline
3/4 ton Pickup, Dump	Light-Duty	$72,001	Average of Santa Rosa's ICE Replacement Costs	$180,002	2.5x baseline
3/4 ton Pickup, Utility	Light-Duty	$68,989	Average of Santa Rosa's ICE Replacement Costs	$172,473	2.5x baseline
Compact Pickup	Light-Duty	$43,957	Average of Santa Rosa's ICE Replacement Costs	$109,893	2.5x baseline
Minivan	Light-Duty	$68,634	Average of Santa Rosa's ICE Replacement Costs	$82,361	1.2x baseline, based on difference between ICE and EV in cargo vans
Sedan	Light-Duty	$42,370	Average of Santa Rosa's ICE Replacement Costs	$44,629	Average base price of current EV models, not including luxury models
SUV	Light-Duty	$50,529	Average of Santa Rosa's ICE Replacement Costs	$60,634	1.2x baseline, based on difference between ICE and EV in cargo vans
Van, Cargo	Light-Duty	$65,277	Average of Santa Rosa's ICE Replacement Costs	$78,563	Average base price of current cargo van EV models, not including luxury models
Van, Passenger	Light-Duty	$54,808	Average of Santa Rosa's ICE Replacement Costs	$90,347	Average base price of current cargo EV models plus 15% (based on base price difference of cargo vs. passenger ICE models)
Van, Utility	Light-Duty	$53,964	Average of Santa Rosa's ICE Replacement Costs	$78,563	Average base price of current cargo van EV models, not including luxury models

Van, Workshop	Light-Duty	$56,897	Average of Santa Rosa's ICE Replacement Costs	$78,563	Average base price of current cargo van EV models, not including luxury models
1 1/2 ton Pickup	Medium-Duty	$130,318	Average of Santa Rosa's ICE Replacement Costs	$325,794	2.5x baseline
1 1/2 ton Pickup, Platform Lift	Medium-Duty	$202,473	Average of Santa Rosa's ICE Replacement Costs	$506,183	2.5x baseline
1 1/2 ton Pickup, Utility	Medium-Duty	$189,788	Average of Santa Rosa's ICE Replacement Costs	$474,470	2.5x baseline
Truck, Excavator	Medium-Duty	$790,913	Average of Santa Rosa's ICE Replacement Costs	$1,977,284	2.5x baseline
Truck, Flatbed Dump	Medium-Duty	$113,122	Average of Santa Rosa's ICE Replacement Costs	$282,804	2.5x baseline
Truck, Pole Setter	Medium-Duty	$408,106	Average of Santa Rosa's ICE Replacement Costs	$1,020,266	2.5x baseline
Truck, Road Service	Medium-Duty	$313,628	Average of Santa Rosa's ICE Replacement Costs	$784,070	2.5x baseline
Truck, Sewer Jetter	Medium-Duty	$714,414	Average of Santa Rosa's ICE Replacement Costs	$1,786,035	2.5x baseline
Truck, Tanker	Medium-Duty	$246,933	Average of Santa Rosa's ICE Replacement Costs	$617,333	2.5x baseline
Work Truck, Boom Lift	Medium-Duty	$189,788	Average of Santa Rosa's ICE Replacement Costs	$474,470	2.5x baseline
Work Truck, Dump	Medium-Duty	$116,076	Average of Santa Rosa's ICE Replacement Costs	$290,191	2.5x baseline
Work Truck, Mobile Workshop	Medium-Duty	$347,211	Average of Santa Rosa's ICE Replacement Costs	$868,026	2.5x baseline
Work Truck, Utility	Medium-Duty	$243,246	Average of Santa Rosa's ICE Replacement Costs	$608,114	2.5x baseline
Work Truck, Utility Street Flusher	Medium-Duty	$153,704	Average of Santa Rosa's ICE Replacement Costs	$384,259	2.5x baseline
Wheel Loader, Compact	Construction	$106,800	Price for Deere 204G Compact Loader	$267,000	2.5x baseline
Boom Lift	Non-Road	$134,885	Average of Santa Rosa's ICE Replacement Costs	$172,225	Average of quotes for EV models
Excavator	Construction	$104,551	Average of Santa Rosa's ICE Replacement Costs	$167,282	2.5x baseline
Forklift	Non-Road	$89,649	Average of Santa Rosa's ICE Replacement Costs	$299,667	Average of quotes for EV models
Loader, Skid-steer	Construction	$61,647	Average of Santa Rosa's ICE Replacement Costs	$240,000	Average of quotes for EV models
Loader, Track Steer	Construction	$104,730	Average of Santa Rosa's ICE Replacement Costs	$325,000	Average of quotes for EV models
Mower	Non-Road	$55,414	Average of Santa Rosa's ICE Replacement Costs	$71,500	Average of quotes for EV models of large mowers
Roller	Construction	$85,176	Average of Santa Rosa's ICE Replacement Costs	$212,940	2.5x baseline
Tractor, Medium	Non-Road	$77,921	Average of Santa Rosa's ICE Replacement Costs	$194,801	2.5x baseline
Truck, Asphalt Patcher	Medium-Duty	$426,860	Average of Santa Rosa's ICE Replacement Costs	$1,067,150	2.5x baseline
Utility Vehicle	Non-Road	$13,300	John Deere base cost of gasoline model	$46,000	2.5x baseline

Table 11: Electric vehicles that do not meet the strenuous requirement for some period of the transition plan, the first year of purchase affected, and the projected delta to the strenuous requirement in the first year of purchase.

Vehicle Type	Years When Only Nominal Requirement Met	Strenuous Requirement (hrs/miles)	Nominal Requirement (hrs/miles)	Unit	Projected range in first year of purchase (hs/miles)	Delta to Strenuous Requirement (hours/miles)	First year of purchase
Mowers	Until 2030	6	5	Hours	5	1	2025
Tractor	Until 2031	8	5	Hours	7	1	2025
Roller	Does not meet nominal requirement	8	6	Hours	3	5	2027
1 1/2 ton Pickup, Gasoline	Until 2032	150	20	Miles	137	13	2028
Boom Lift	Until 2029	4	1	Miles	*Not purchased until 2030*		
Compact Pickup	Entire Transition	218	30	Miles	171	47	2030
Sedan	Until 2026	220	12	Miles	218	2	2025
SUV	Until 2030	250	21	Miles	223	27	2025
Truck, Crane Heavy	Entire Transition	76	9	Miles	56	20	2029
Truck, Dump Heavy	Entire Transition	130	14	Miles	71	59	2028
Truck, Excavator Medium	Entire Transition	39	10	Miles	17	22	2030
Truck, Rolloff Heavy	Entire Transition	131	29	Miles	96	35	2039
Truck, Sewer Jetter Medium	Until 2037	66	17	Miles	52	14	2029
Van, Cargo	Until 2035	232	27	Miles	188	44	2025
Van, Passenger	Until 2040	219	12	Miles	152	67	2027

Table 12: Vehicles by ACF status

Regulated by ACF Non-Exempt	Regulated by ACF Short Term Exempt	Not Regulated by ACF
½-Ton Pickup 1-Ton Pickup, Utility ¾-Ton Pickup 1 1/2-ton Pickup ¾-Ton Pickup, Utility 1 1/2-ton Pickup, Utility Work Truck, Utility Semi-Truck Dump Truck, Heavy Flatbed Dump Truck, Medium ¾-Ton Pickup, Dump 1-Ton Pickup, Crane 1-Ton Pickup, Dump 1-Ton Pickup, Dump 1-Ton Pickup, Flatbed Dump Asphalt Patcher Truck, Medium* Truck, Excavator, Medium Work Truck, Dump Work Truck, Utility 1 1/2-ton Pickup, Platform Lift Truck, Road Service, Medium Truck, Sewer Jetter* Truck, Cleaner, Heavy*	Truck, Pole Setter, Medium Truck, Rolloff, Heavy Truck, Tanker Work Truck, Boom Lift Work Truck, Utility Street Flusher	Light Duty Vehicles Non-Road and Construction Vehicles

The following assumptions were made to match Santa Rosa's vehicles with those on the CARB exemption list:

- Assume Work Truck, Boom Lift falls under the exemption for Bucket Truck, Class 5. CARB confirmed that the Boom Lift category is inclusive of bucket trucks and crane trucks; therefore, for Santa Rosa's Boom Lift truck to be automatically exempt, it must be a bucket truck.
- Pole Setter Truck falls under the Drill Rig Truck exemption, confirmed by CARB.
- Street Flushers fall under the Water Truck exemption, confirmed by CARB.

For other highly specialized vehicles such as the Asphalt Patcher Truck, Sewer Jetter, and Cleaner Truck, CARB explained that not all vehicle configurations were included on the Streamlined Exemption List. CARB confirmed that since there are no ZEV models available to match those functions, Santa Rosa can apply for specific exemptions to these vehicles if other exemption criteria are met. CARB also indicated that for specific upfits, sometimes a specific function is not available simply because no customer has requested one yet.

No other CARB exemption rules are explicitly applied. CTE recommends verifying vehicle exemptions with CARB to ensure compliance.

Though regulations on other vehicle categories do not directly mandate ZEV purchase for Santa Rosa, the purchase schedule aligns with California's fleet decarbonization strategy as detailed in the *ACF Exempt Vehicles* section.

Appendix A.5
Fuel Assessment Technical Memo
April 2025

Prepared For:
City of Santa Rosa

Prepared By:

101 Lucas Valley Road, #302
San Rafael, CA 94903

NV5 PROJECT 5980824-2304101

EXECUTIVE SUMMARY

The City of Santa Rosa (Santa Rosa or City) is evaluating the transition to a zero-emission operational vehicle fleet. This transition is driven both by the City's climate goals, as well as the State of California's vehicle emission regulations.

This memo focuses on the fuel transition analysis (from fossil fuels to electricity) and its associated costs. This analysis did not explore hydrogen fuel cell vehicles as an option for Zero-Emission Vehicles (ZEV) technology.

While the City can expect to save over $3 million in fuel costs over this time, the cost of installing EV chargers leads to a total incremental cost for the fuel transition of about $10 million, compared to fueling the existing fleet. Including the cost for vehicle procurements in a separate memo, the incremental cost for fleet electrification is $38 million, before considering incentives.

Santa Rosa's transition to a fully EV fleet will reduce Santa Rosa's fossil fuel consumption by 1.3 million gallons and cumulatively avoid approximately 12,600 metric tons of greenhouse gas (GHG) emissions by 2040, compared to operating the existing fleet.

1.0 PURPOSE

For fleet transition planning, the goals of the fuel assessment component are:

1. Establish the annual fuel and energy consumption over the transition compared to the baseline scenario.
2. Estimate the annual cost of fuel and energy in the transition and baseline scenario.
3. Estimate the number of chargers in the transition scenario and the peak demand at each location.

1.1 METHODOLOGY OVERVIEW

The fuel assessment methodology can be broken into two components, the Charging Analysis and Fuel Assessment, which build on the results of the Fleet Assessment.

1.1.1 Charging Analysis:

Inputs: The Center for Transportation and Environment (CTE) used the service requirements established in the Fleet Assessment and the average battery capacity of the electric model of each vehicle type to determine the amount of battery capacity, or state of charge (SOC), that each vehicle type is expected to use on a typical operational day. CTE also estimated the time to charge each vehicle from 25% to 80% SOC at various charging powers to ensure that vehicles could be fully charged overnight in case of a day of strenuous usage where the majority of battery capacity is used. The 25% value was determined from Santa Rosa's fleet policy for drivers to refuel internal combustion engine (ICE) vehicles as they approach a quarter tank. The 80% value was selected according to industry standard to maintain EV battery health.[1]

Outputs: CTE provided recommendations to Santa Rosa for 1) the ratio of EVs to charging dispensers and 2) the necessary charger powers that would provide adequate charging, while also minimizing additional electrical infrastructure. Santa Rosa reviewed the recommendations and provided feedback. The agreed upon charger powers and ratios were used to project the number of chargers needed at each site annually to meet the vehicle transition and the resulting annual maximum demand.

1.1.2 Fuel Assessment:

Inputs: CTE used the fuel economies (ICE and EV), the typical daily usage, and the active days per year from the Fleet Assessment to estimate the fuel use for each vehicle. Energy use is based on a nominal day, and electrical demand assumes that at least once per year, all chargers are in use at the same time.

Outputs: CTE calculated the annual fuel consumption for each fuel type for each site over the transition scenario and the baseline scenario.

1.2 SCOPE

The scope of the assessment included 383 vehicles across 17 sites. Because only a small number of the fleet are take-home vehicles and employees may not have charging infrastructure at home, this analysis assumes that all vehicles will be charged on-site. CTE also analyzed the effect of auxiliary engine electrification for two engine vehicles (TEVs) assuming full TEV electrification including the auxiliary equipment. There are 48 TEVs in Santa Rosa's fleet.

[1] Geotab, "What analyzing 10,000 EVs tells us"(2025)

1.3 DETAILED METHODOLOGY AND ASSUMPTIONS

1.3.1 Charger Analysis Assumptions and Methodology:

1. CTE used the outputs of the Fleet Assessment as inputs to the Fuel Assessment, namely the estimated EV battery size and EV fuel consumptions.
2. To determine charger needs, CTE considered two key factors:
   a. How quickly vehicles can charge (the charger power), and
   b. How often vehicles need to charge (the EV to charger ratio).
3. CTE considered three types of chargers in the analysis Table 1:
   a. **Level 1 Proprietary Charger:** In the current smaller offroad equipment market, EVs are sold with Level 1 chargers specific to the original equipment manufacturer (OEM) and vehicle model (Table 2). These chargers plug directly into a wall outlet (120V AC) and can only achieve approximately 1 kW of charging power. These vehicles are not yet compatible with standard Level 2 or Level 3 chargers. Charging speeds are thus limited for these vehicles and are dependent on the OEM.
   b. **Level 2 AC Charger (J1772):** For EVs with smaller batteries that are compatible with standard chargers, a Level 2 charger is appropriate for overnight charging. Level 2 chargers can provide up to 19.2 kW of power to the vehicle depending on the utility service available on site and the hardware on the vehicle. CTE modeled all Level 2 chargers as 16.6 kW to reflect a 208 V three phase utility service at 80 A. Actual charging maximum power may also be limited by the onboard AC to DC converter rating for most current light-duty vehicles, which often have maximum Level 2 charge rates of 48A.
   c. **Level 3 DC Charger:** For EVs with larger batteries, higher power is needed to fully charge overnight. CTE modeled a 60-kW charger with two dispensers such that each dispenser can simultaneously provide 30 kW. For some vehicles, the full 60 kW of power is needed which is accounted for in the number of chargers and dispensers.

Table 1: Charger types

Type	Modeled Maximum Power
Level 1	~1 kW
Level 2	16.6 kW
Level 3	30 kW (2 dispensers) 60 kW (1 dispenser)

Table 2: Vehicle types that are only compatible with proprietary Level 1 chargers

Vehicles with Level 1 Chargers (2024)	
• Utility Vehicles (ATVs, Golf Carts) • Boom Lift	• Roller • Mower

4. To determine the charger power, CTE used the projected battery size for each vehicle type in 2024 and estimated the time to fully charge from 25%-80% SOC. These SOC bounds were chosen through discussion with Santa Rosa as the minimum SOC allowed before charging and the maximum SOC vehicles will be charged to. CTE used the minimum charging power that achieved full charging in seven

hours overnight with a one-hour buffer to account for slower charging due to temperature or battery preconditioning (including the energy usage for an auxiliary engine). For vehicles with large batteries, this is not feasible on a Level 2 charger. CTE evaluated the DC charging options and chose the minimum charging power. CTE also considered the need to limit total demand, in which case approximately eight hours to fully charge was considered acceptable for some vehicles. Table 3 shows the charger power modeled for each vehicle type. Note that while the same hardware is planned for all Level 2 chargers, some current vehicles such as sedans are limited by the onboard charger to 48A which translates to approximately 10 kW. CTE projects that future vehicles with larger batteries will have increased onboard converter capacity to the maximum 80A and will be able to utilize the full charging power available.

Table 3: Vehicle types by assigned charger power

Level 2	Level 3
• 16.6kW ○ Compact Pickup ○ Minivan ○ Sedan ○ SUV ○ Vans (All Configurations) ○ ½-Ton Pickup ○ Excavator ○ Forklift ○ Skid Steer ○ Track Steer ○ Medium Tractor ○ Compact Wheel Loader ○ ¾-Ton Pickup (Standard, Utility) ○ 1-Ton Pickup (Dump, Utility)	• 30kW ○ 1-Ton Pickups (Crane, Two-Engine Dump, Flatbed) ○ 1½ -ton Pickups (All Configurations) ○ ¾-Ton Pickups (Dump) ○ Work Trucks (All Configurations) ○ Medium Trucks (All Configurations) ○ Heavy Trucks (All Configurations) • 60kW ○ Semi-Truck

5. To determine the number of chargers needed, CTE estimated how frequently each vehicle needs charger access based on its typical daily usage and the charging SOC limits. CTE estimated the percentage of the battery capacity that would be used on a typical day using the usable battery capacity (kWh) and EV fuel economy (kWh/mi or kWh/hour).
6. Then, CTE assigned vehicle to charger ratios as follows:
    a. More than 28% SOC used per day = 1:1 vehicle to dispenser (plugged in every night)
    b. Between 19-28% SOC used per day = 2:1 vehicle to dispenser (plugged in every other night)
    c. Less than 19% SOC used per day = 3:1 vehicle to dispenser (plugged in every three nights). This option is only applicable to light-duty, construction, and non-road vehicles at Santa Rosa's request.
7. The boundaries above were chosen to approximately align with Santa Rosa's stated minimum (25%) and maximum (80%) SOC states on each vehicle. While maintaining a 20-80% SOC is recommended to maintain battery health, some vehicles may need to be charged beyond 80% in order to meet the City's operating requirements, especially those with auxiliary engine functions.
8. CTE did not consider ratios higher than 3:1 at Santa Rosa's request to avoid additional charging logistics.
9. Santa Rosa staff reviewed all charging assessment recommendations and results. In practice, additional chargers may be required if vehicles are charged more frequently. Table 4 shows the planned charger ratios (excluding vehicles in Table 2 with proprietary Level 1 chargers).

Table 4: Vehicle to Dispenser Ratios

Charging Every Night (1:1 Vehicle to Dispenser)	Charging Every Other Night (2:1 Vehicle to Dispenser)	Charging Every Three Nights (3:1 Vehicle to Dispenser)
• Medium Tractor • Track Steer • Compact Wheel Loader • All Two-Engine Vehicles	• 1 1/2-ton Pickups • 1 1/2-ton Pickup, Utility • Compact Pickup • Flatbed Dump Truck • Workshop Van • Work Truck, Boom Lift • Work Truck, Utility • Forklift (Diesel) • Skid Steer	• 1-Ton Pickup, Dump • 1-Ton Pickup, Utility • ½-Ton Pickup • ¾-Ton Pickup • ¾-Ton Pickup, Utility • Minivan • Sedan • SUV • Cargo Van • Passenger Van • Utility Van • Forklift (Propane) • Excavator

1.3.2 Fuel Assessment Methodology and Assumptions:

1. To calculate the annual fuel consumption, CTE followed the Fleet Assessment results for each vehicle's fuel type by year. CTE used the established average daily use (miles or hours) per vehicle, the average ICE and EV fuel economy, and the active days per year per vehicle type established in the Fleet Assessment.
2. The annual fuel consumption was aggregated by fuel type and by location.
3. The charging process is not 100% efficient which results in some losses between the grid and the vehicle battery. This means that the city will purchase some energy that does not reach the vehicle battery. To account for this and estimate the true capacity needed, CTE assumes 85% charger efficiency (85% of energy drawn from the grid reaches the battery).[2] Thus, if a vehicle requires 100 kWh to fully charge, the estimated energy drawn from the grid is 100 kWh * (1/0.85) = 117.6 kWh. CTE applied this efficiency factor to the electric energy estimation.
4. To estimate the number of chargers needed each year at each location, CTE used the vehicle to dispenser ratios, types of chargers, and charger powers established in the Charging Analysis and the annual fleet composition defined in the Fleet Assessment. CTE estimated the number of chargers of each type needed at each location based on the number and type of EV at each location each year of the transition. CTE aggregated the chargers such that vehicles were sharing chargers to minimize the number of chargers needed (e.g., if a Flatbed Pickup and a Cargo Van at one location need a Level 2 charger at a 2:1 vehicle to dispenser ratio, then one Level 2 charger is added to the location). In the case of a non-whole number of chargers at a location, CTE rounded up to the nearest whole charger, which provides some spare capacity (e.g., three vehicles need a Level 2 charger at a 2:1 ratio, the number of chargers needed is technically 1.5 chargers, which would be rounded up to two chargers). The spare capacity is considered for future vehicle purchases and used first before adding chargers. No additional spare chargers were added for the purposes of the fuel assessment.

[2] National Renewable Energy Laboratory, "Estimating the Breakeven Cost of Delivered Electricity to Charge Class 8 Electric Tractors" (2022)

5. The number of chargers informs the maximum unmanaged demand at each location. CTE calculated the maximum demand by multiplying the charger power[3] by the number of chargers of each type and summing for each site. This method assumes no additional charge management system (CMS) that would limit the maximum demand. CTE also applied a charger efficiency assumption to all DC chargers (Level 3) because the stated maximum charger power (e.g., 60 kW) is the maximum power reaching the vehicle. Due to inefficiencies in converting grid power to vehicle power, more power is drawn from the grid than reaches the vehicle. The modeled maximums are 64 kW from the grid for 60 kW to the vehicle and 32 kW from the grid for 30 kW to the vehicle based on 480V three phase utility service.
6. To model a typical day of managed demand, CTE used the typical percent of the fleet in use each day based on Santa Rosa's fleet usage data from Geotab (see Figure 7, Appendix). On any given day, 60% of the City's fleet is in use. Thus, CTE assumed that 60% of the chargers of each type at each site (rounded to the nearest whole charger) would be in use and that all vehicles would begin charging at the same time, when the off-peak TOU rate began. This provides a more typical number without a complex charge management system. Further charge management, such as demand caps or slowing charging to take the full off-peak period, could lower this number further.

1.3.3 Two-Engine Vehicle Electrification

Two-engine vehicles (TEV) are defined by CARB as a specially constructed on-road mobile vehicles that are designed by the OEM to be equipped with two engines, one that provides motive power and one that provides auxiliary power for additional equipment. These vehicles have two separate fuel tanks, one for the motive engine on the chassis and one for the accessory equipment. The fuel consumption reported by Santa Rosa for TEVs are separated by chassis and auxiliary equipment.

There are few existing completely electrified TEVs commercially available. The TEV market is still in the early stages of electrification, and it is unclear whether the market will follow the existing design with separate electric motors and batteries for the base chassis and accessories, or whether future EVs will power accessory equipment from the chassis battery in an integrated design.

At the time of this report, TEVs are exempt from compliance with Advanced Clean Fleet's (ACF) State and Local Government Agency Fleet regulations.[4]

In the Fleet Assessment, CTE modeled the electrification of the chassis only for all TEVs and assumed that Santa Rosa will upfit the EV chassis with available accessory equipment that may be either ICE or EV. In the purchase schedule, the replacement schedule and feasibility of the base chassis determined the transition speed for all TEVs.

To provide Santa Rosa with an appropriate estimate of energy and demand given the uncertainty around secondary engine electrification, CTE modeled the likely long-term scenario where the chassis and auxiliary equipment are integrated into one vehicle with one high-voltage system and charging port. CTE assumed that the full electrification would occur at once to provide an upper bound on demand, energy, and charging infrastructure.

CTE made the following assumptions for the auxiliary engines:

1. All auxiliary engines use the same fuel type as the baseline chassis.
2. All auxiliary engines use 8.04 gallons of fuel per day in use (source: Santa Rosa).

[3] For Level 2 chargers, 10 kW was used instead of the maximum 16.6 kW for the specified light-duty vehicles.
[4] ACF Regulation – State and Local Government Agency Fleet Requirements Overview

3. Assume all electrified auxiliary equipment is twice as efficient as ICE. This is a conservative assumption to avoid underestimating energy consumption due to the lack of performance data on electrified equipment and immature market.
4. Assume fully electrified TEVs have battery capacity sufficient to function the entire day.

While in the near term, TEVs may have separate batteries for auxiliary equipment, a mature TEV market will have integrated vehicles where auxiliary equipment is powered from one larger battery with only one charging port. CTE recommends that Santa Rosa monitor the market development of TEV integration and adjust their charging infrastructure procurement, specifically the number of dispensers needed, as they purchase electrified TEVs.

1.3.4 Financial Assumptions

The following assumptions were used in Total Cost of Ownership calculations:

Table 5. Assumptions for Financial Assessment

Metric	Value
Upfront Costs (2024)	
L1 charger cost ($/port)	$200
L2 charger cost ($/port)	$4,500
L3 charger cost, 30 kW ($/port)	$20,000
L3 charger cost, 60 kW ($/port)	$30,000
L1 Behind-the-Meter (BtM) installation cost ($/port)	$0[5]
L2 BtM initial installation cost ($/port)	$22,000
L3 BtM initial installation cost ($/port)	$50,000
L2 BtM future phases installation cost ($/port)	$5,000
L3 BtM future phases installation cost ($/port)	$10,000
Contingency	25%
Ongoing Costs (2024$)	
L2 annual software cost ($/port)	$300
L3 annual software cost ($/port)	$500
L2 annual operations & maintenance (O&M) cost ($/port)	$200
L3 annual O&M cost ($/port)	$500
Cost of gasoline ($/gallon)	$3.91[6]
Cost of diesel ($/gal.)	$3.73[7]
Cost of propane ($/gal.)	$4.38[8]
Electricity Tariff ($/kWh) PG&E BEV-2-S Off-Peak with SCP EverGreen adder	$0.18462 + $0.025
General Cost Assumptions	
Annual escalation rate for fuel	2%
Annual escalation rate for electricity	3%
Net Present Value (NPV) discount rate	2.5%
Greenhouse Gas (GHG) Assumptions[9]	
Gasoline emissions (kg/gal)	8.78
Diesel emissions (kg/gal)	10.19
Propane emissions (kg/gal)	5.75
Electricity emissions (kg/kWh)	0[10]

[5] L1 charger ports infrastructure is assumed to be negligible compared to cost of L2 and L3 chargers within the same site. L1 charging can use existing wall sockets.
[6] Santa Rosa Fuel Transaction Summary Report 7/1/2023-6/30/2024
[7] Santa Rosa Fuel Transaction Summary Report 7/1/2023-6/30/2024
[8] Santa Rosa Fuel Transaction Summary Report 7/1/2023-6/30/2024
[9] EIA Carbon Dioxide Emissions Coefficients, https://www.eia.gov/environment/emissions/co2_vol_mass.php
[10] Santa Rosa purchases electricity from Sonoma Clean Power using the EverGreen tariff, which is 100% renewable energy and carbon free. https://sonomacleanpower.org/uploads/documents/EverGreen-Service-Tariff-Final-2020.10.01.pdf

1.4 RESULTS AND DISCUSSION

1.4.1 Charging Analysis

CTE and NV5's analysis determines that Santa Rosa will need to install the quantity of EV charging ports in Table 6 in three phases.

Table 6: Cumulative Quantity of Charging Ports in 2027, 2030, and 2035 across all Santa Rosa sites

	2027	2030	2035
Level 1	13	20	27
Level 2	48	71	109
Level 3	14	32	71

For the seven main sites, the charger installation phasing is shown below in Figure 1. A phasing design table for all sites is in the Appendix.

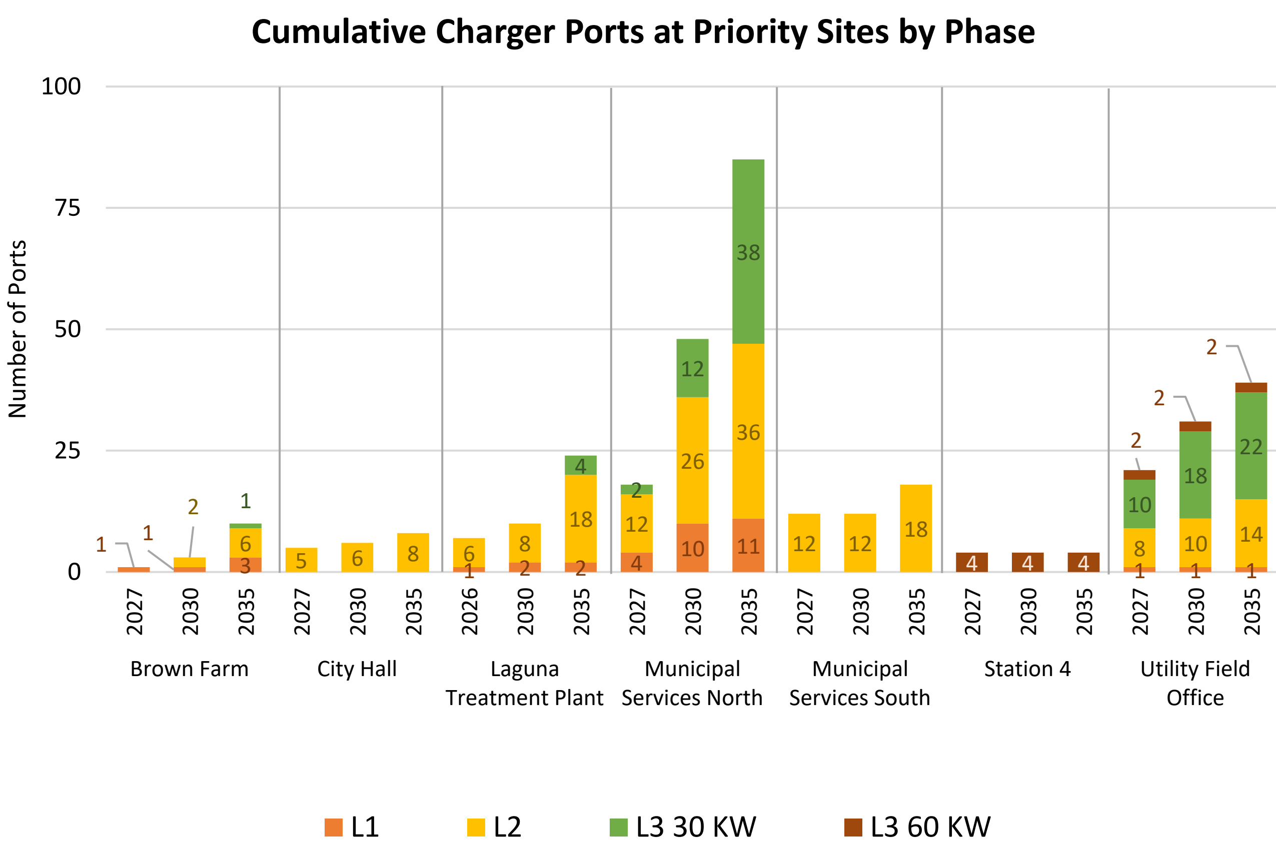


Figure 1. Cumulative charger ports per phase at each priority site

The projected demand and energy at each location are shown in the Appendix, Table 9. The projected maximum demand at the seven main sites over the transition is shown in Figure 2, representing all of the chargers being used at the same time. The Municipal Center North site has the highest demand followed by Utilities Field Office. Another demand scenario is shown in Figure 3, showing 60% of chargers active at the same time during the off-peak period.

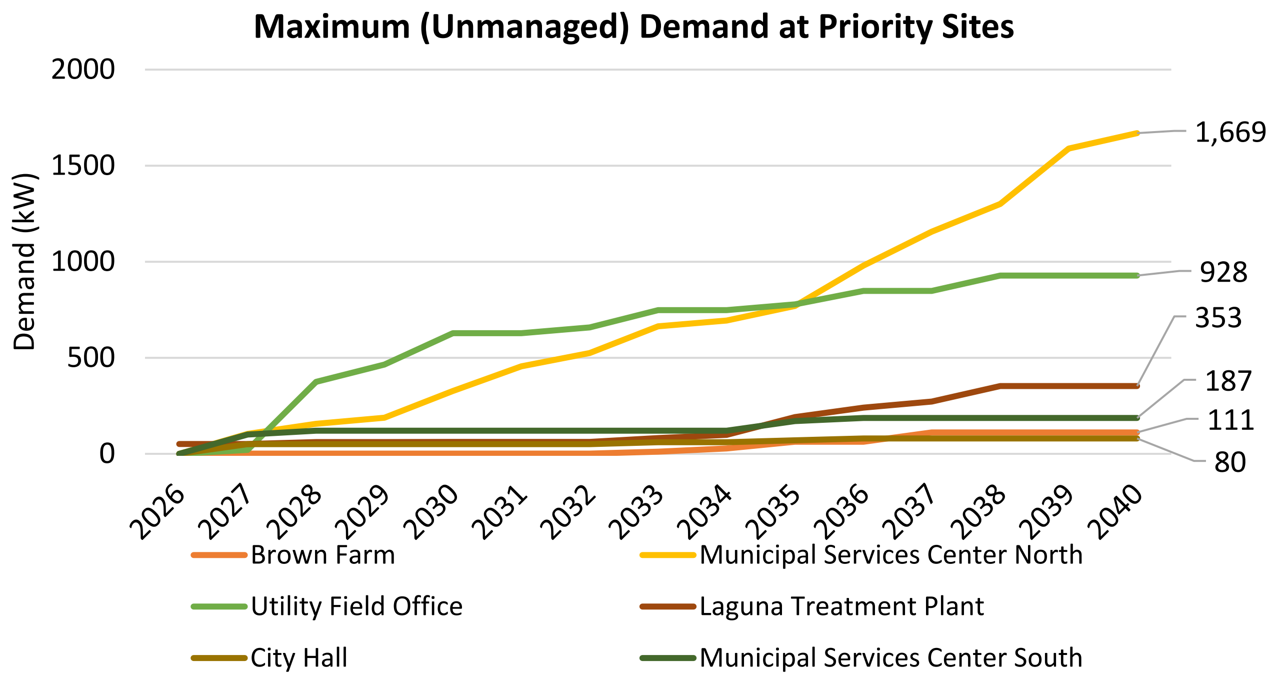


Figure 2: Unmanaged demand over the transition period at the major sites

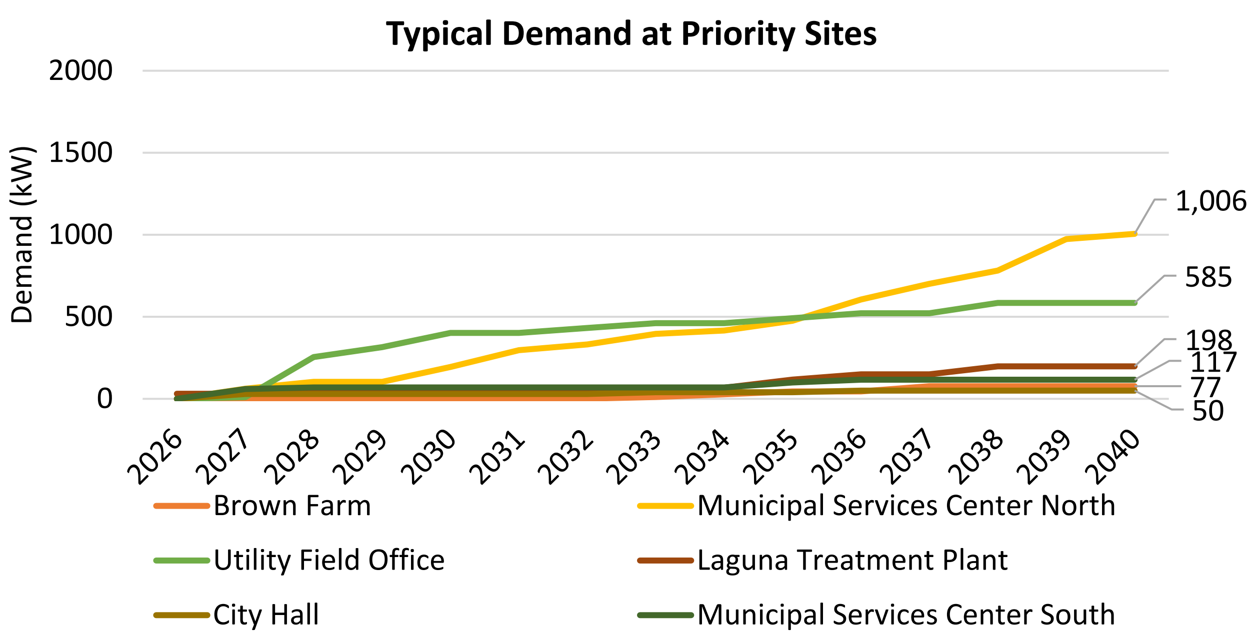


Figure 3: Typical demand over the transition period at the major sites assuming 60% of chargers used on a given day based on typical percent of fleet pullout.

Depending on the market development for TEVs, full electrification of all TEVs may not occur by 2040 in which case total demand will be lower.

1.4.2 Fleet Energy Consumption

CTE estimated the fuel and energy consumption for each year of the transition by type of fuel. For direct comparison, CTE converted each fuel type based on its energy content into gasoline gallon equivalents (GGE). The total amount of energy consumed decreases with electrification because EVs are much more efficient than ICEs. Comparing 2025 to 2040, Santa Rosa will decrease its total energy consumption from 193,433 GGE to 72,176 GGE, or a 63% decrease (Figure 4), and fully eliminate fossil fuel consumption by 2040. These scenarios may change depending on regulations, market developments, and the speed of the transition, especially for TEVs.

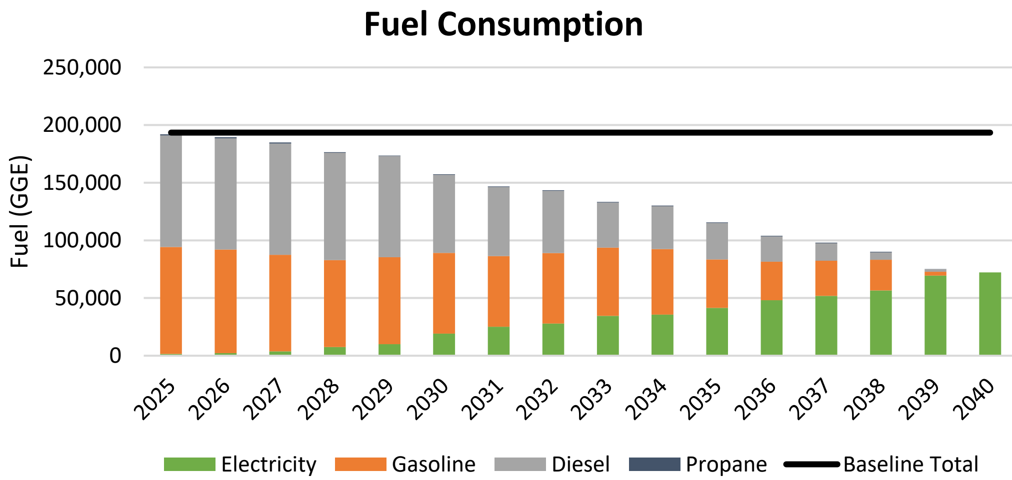


Figure 4: Fuel Consumption in Gasoline Gallon Equivalents (GGE) in the transition vs. the baseline scenario

1.4.3 Reduction in Emissions

Electric vehicles do not have the same traditional emissions as ICE vehicles. Santa Rosa purchases 100% renewable energy through Sonoma Clean Power's EverGreen tariff. In other words, the City's EV charging can be considered emission-free. Cumulatively by 2040, and based on U.S. Energy Information Administration (EIA) estimates of GHG emissions per gallon of fuel used, NV5 estimates that the city will use about 1.3 million fewer gallons of fossil fuel, and avoid approximately 12.6 million kg of GHG emissions by 2040. By 2040, Santa Rosa will achieve a zero-emission fleet, with an emission reduction of 1.7 million kg of CO_2 per year.

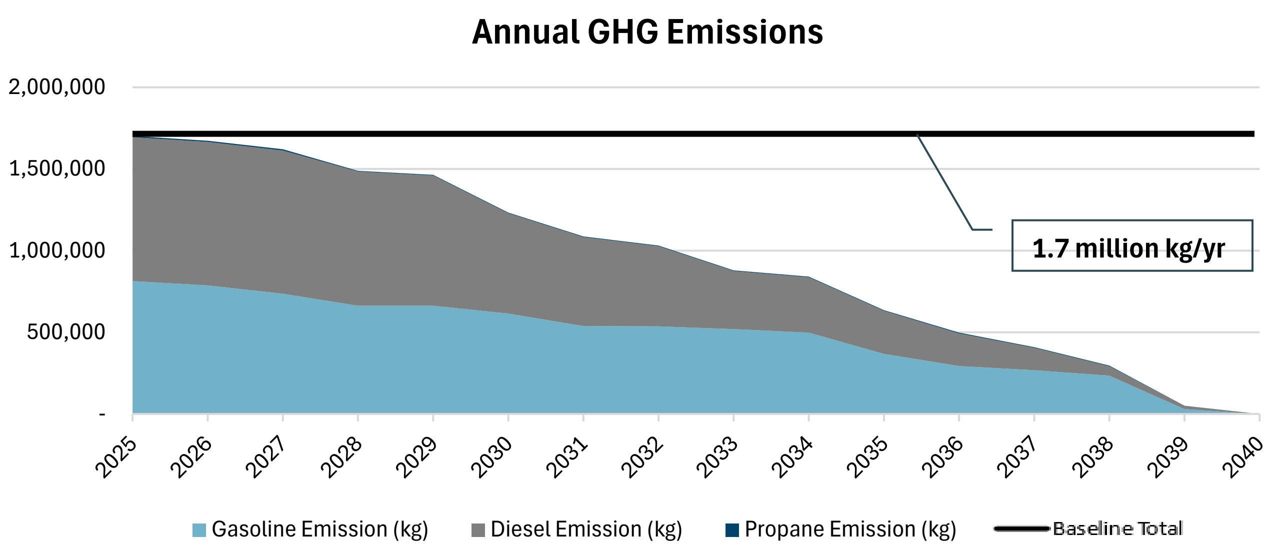


Figure 5: Tailpipe emissions in kg/year in the transition vs. the baseline scenario

1.4.4 Cost Analysis

NV5 estimates that the transition plan will save Santa Rosa $3.3M on fuel over the course of the analyzed time period. However, the capital expenses involved in putting in charging infrastructure make fuel a net cost rather than a net savings, with an estimated $10.1M in incremental costs between 2025-2040.

For infrastructure cost, PG&E will cover all to-the-meter infrastructure cost per Electric Rule 29. "EVSE Ports + Infra" costs in the Phase 1 (2026 and 2027) includes cost to install additional capacity for future chargers in 2030 and 2035. In 2030 and 2035, the "EV Ports + Infra" cost will be much lower, since the only cost needed is to install EVSE pedestals on existing stub-outs and conduits.

Incentives are not included in this analysis, since availability of these funding sources change often. Potential incentive programs and estimated values are described in section 1.4.5.

Table 7. Fleet electrification cost per year comparing Transition and Baseline plans.

	Transition Plan				Baseline Plan				
Year	EVSE Ports + Infra.	EVSE OpEx	ICE Fuel + EV Electricity	Total Cost	EVSE Ports + Infra.	EVSE OpEx	ICE Fuel + EV Electricity	Total Cost	Incremental Cost
2025	-	-	$701	$701	-	-	$706	$1,269	-$4
2026	$2,310	-	$708	$3,018	$181	-	$720	$725	$2,117
2027	$6,930	$53	$716	$7,699	$544	$6	$735	$740	$6,414
2028	-	$53	$695	$748	-	$6	$750	$755	-$8
2029	-	$53	$705	$757	-	$6	$765	$770	-$14
2030	$1,173	$93	$673	$1,939	-	$6	$781	$785	$1,152
2031	-	$93	$646	$739	-	$6	$796	$801	-$63
2032	-	$93	$643	$737	-	$6	$812	$817	-$82
2033	-	$93	$618	$711	-	$6	$829	$833	-$124
2034	-	$93	$624	$717	-	$6	$845	$850	-$134
2035	$2,198	$162	$596	$2,956	-	$6	$863	$867	$2,088
2036	-	$162	$577	$739	-	$6	$880	$884	-$147
2037	-	$162	$565	$727	-	$6	$898	$902	-$176
2038	-	$162	$548	$710	-	$6	$916	$920	-$211
2039	-	$162	$453	$615	-	$6	$934	$939	-$325
2040	-	$162	$443	$605	-	$6	$953	$957	-$353
Total	$12.6M	$1.6M	$9.9M	$24.1M	$0.6M	$0.08M	$13.2M	$13.8M	$10.1M

All numbers are in thousands unless otherwise noted. Positive values are costs, negative values are savings comparing the transition to the baseline scenario.

1.4.5 Grants and Incentives

As of the writing of this memo, the grants and incentives landscape is rapidly changing. Therefore, this represents a snapshot in time for available grants and incentives.

1. **PG&E EV Fleet**

   Estimated Value: $478,000

   Description: The EV Fleet program provides a rebate based on the number of purchased EVs (Class 2 and above) in a five-year period. In disadvantaged communities and bus transit customers, PG&E also provides a rebate for charging stations depending on the charger power level, up to 50% of the charger and infrastructure cost. To be eligible for the program, PG&E requires that at least two medium or heavy-duty vehicles be purchased at a site within a five-year period.
   Estimated Value Calculation Methodology: Off-Road vehicles receive $3,000 per vehicle. Transit buses and Class 8 vehicles receive $9,000 per vehicle. All other vehicle types receive $4,000 per vehicle. Incentives are limited to 25 vehicles per site. There are no EV charger incentives because none of the Santa Rosa addresses are in disadvantaged communities. For all 17 locations that Santa Rosa's vehicles are domiciled, NV5 reviewed the EV procurement plan and calculated the vehicle rebates, capped at 25 vehicles.

   Actions for Santa Rosa: Apply to EV Fleet program well before June 2026, which is the anticipated closing date for the program, however this can change. Conservatively we would recommend targeting all EV Fleet applications be submitted by the end of 2025. Coordinate with Tim O'Neill at PG&E at TKO2@pge.com.

   Useful Link: https://www.pge.com/en/clean-energy/electric-vehicles/ev-fleet-program.html

2. **Federal Inflation Reduction Act - Clean Vehicle Credit**

   Estimated Value: $2,300,000

   Description: Through the 2022 Inflation Reduction Act (IRA), tax-exempt organizations that buy a qualified commercial clean vehicle may qualify for a clean vehicle tax credit under Internal Revenue Code (IRC) Section 45W. Credits are capped at $7,500 for vehicles less than 14,000 lbs, and $40,000 for vehicles more than 14,001 lbs. The credit is further capped by the lesser of 30% for zero-emission vehicle (ZEV) purchase cost, or the incremental cost of the vehicle. The Investment Tax Credit (ITC) is currently available through 2032.

   Estimated Value Calculation Methodology: According to the EV procurement plan, a total of 176 EVs are procured from 2025 until 2032. NV5 evaluated the weight class of the vehicles, incremental cost of the EVs compared to their ICE counterparts, and the cost of the EVs to calculate the maximum tax credit. The calculated credit amounts to an average of $13,000 per EV purchased.

   Actions for Santa Rosa: Coordinate with tax accountants to file for the tax credit for all EVs purchased every year through 2030. There is great uncertainty regarding the future of the ITC due to the new federal administration. The city should monitor proposed changes to the ITC and pursue credits as soon as possible for any past purchases.

   Useful Link: https://www.irs.gov/clean-vehicle-tax-credits

3. **Federal Inflation Reduction Act - Alternative Fuel Vehicle Refueling Property Credit**

   Estimated Value: $108,000

   Description: Through the IRA, installers of EV chargers may receive a tax credit under IRC Section 30C. The credit is equal to 6% of the capital cost, capped at $100,000 for each charger. The credit increases to 30% for projects meeting prevailing wage and apprenticeship requirements. The credit is limited to projects in eligible low-income or non-urban areas.

Estimated Value Calculation Methodology: According to NV5's review, only City Hall, City Hall Annex, Brown Farm, and Laguna Treatment Plant are located in low-income or non-urban areas. For those sites, the cost of the charging infrastructure is multiplied by 30%.

Actions for Santa Rosa: Coordinate with tax accountants to file for the tax credit for EV chargers installed every year through 2032.

Useful Link: https://www.irs.gov/credits-deductions/alternative-fuel-vehicle-refueling-property-credit

4. **Communities in Charge**

Estimated Value: $390,000.

Description: Communities in Charge is funded by the California Energy Commission (CEC) and provides rebates for Level 2 chargers in workplaces and municipal fleets. Rebates are up to $6,500 per Level 2 charging port.

Estimated Value Calculation Methodology: 48 fleet and 12 public L2 charging ports are expected to be installed in the first phase of the project. These 60 charger ports are multiplied by $6,500. This program is not likely to be continued in the long term.

Actions for Santa Rosa: Join mailing list for Communities in Charge to be notified when the next wave of funding is released. Review application and be prepared to submit them as soon as the application window opens as funds are usually claimed quickly.

Useful Link: https://thecommunitiesincharge.org/applicant-journey/

5. **Low Carbon Fuel Standard**

Estimated Value: Less than $100,000 from 2025 to 2030.

Description: Low Carbon Fuel Standard (LCFS) is a cap-and-trade carbon emissions program. CARB has determined a fossil fuel emission benchmark that decreases over time until 2030. Fossil fuel producers must buy credits to meet the benchmark, and credits are generated by clean fuel users (electric vehicles charging sites, sugar cane ethanol producers, etc). One credit is equal to 1 ton of CO2 emission. The LCFS credit historically ranged from $60 to $200 per credit depending on supply and demand. In recent years with the popularity of EVs, credit prices have remained in the $60-80 range. This program is not expected to extend beyond 2030.

Actions for Santa Rosa: To claim LCFS credits, Santa Rosa needs to report its EV charging amount annually for each EV charger installed. Reports are due at a quarterly basis. Santa Rosa can designate a third party such as NV5 to report on its behalf.

Useful Link: https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard

2.0 EV CHARGER INSTALLATIONS BY SANTA ROSA TRANSIT

Santa Rosa Transit (Transit) has installed, and plans to expand, dedicated L3 EV chargers to fuel the City's transit bus fleet. Transit's bus depot is located within the Municipal Services Center (MSC) North parking lot, adjacent to where the City houses a majority of the municipal (non-transit) fleet.

Table 8 outlines Transit's installed and planned L3 charging infrastructure at MSC North:

Table 8: Santa Rosa Transit L3 EV Charger Installation by Phase at MSC North

Phase	Year Installed	Electric CityBus added in Phase	Charger Ports Installed at Each Phase	Max Power per Port when only 1 Port Occupied per Charger (kW)	Power per Port when All Ports Occupied per Charger (kW)	Total Cumulative Power (kW)
1	2022 (Completed)	9 Fixed Route	10 (5 dual)	150	75	1,500
2	2026 (In Progress)	12 Fixed Route	15 (5 triple)	360	130	3,455
3	2030 (Planned)	8 Fixed Route, 12 Paratransit	21 (3 dual, 5 triple)	150	75 (dual) or 50 (triple)	4,655
Total		41	46 Total Ports			

Within the Stony Point Road municipal complex, the City's municipal, non-transit fleet is currently operating 16 EVs which are fueled by 4 dual port L2 chargers provided by Sonoma Clean Power (3 at Utilities Field Operations, 1 at Municipal Services Center North). As outlined in this report, the share of EVs in the municipal fleet is expected to grow considerably over the next decade, with a corresponding need for fueling infrastructure at the various City sites where the vehicles are housed.

In the near-term, Transit has agreed to share its chargers with the growing municipal EV fleet. This will allow time and flexibility for the City to plan and construct charging for the municipal fleet at the various City facilities as outlined in this report.

For cost efficiency, Transit and municipal vehicles should be charged between 9pm and 4pm the following day to take advantage of the lowest electricity costs. The 10 EV charger ports installed under Phase 1 in 2022 have no power draw limitation. However, due to PG&E grid constraints, the EV chargers installed under Phase 2 in 2026 will be restricted to 100kW of power draw in total from 10am to 11pm. PG&E has planned circuit upgrades in the next few years which may remove these restrictions. See Figure 6 for an illustration of charger power limits and electric tariff periods for the Phase 2 Transit chargers.

Transit will have priority to use its chargers for overnight charging, and Transit anticipates procuring enough electric buses to fully utilize its chargers over the upcoming years. Fueling of the municipal fleet will require close coordination with Transit to coordinate the growth of both fleets and to optimize for lower cost charging. The most likely scenario is Transit charging overnight, with morning to early afternoon day-time fueling by the municipal fleet.

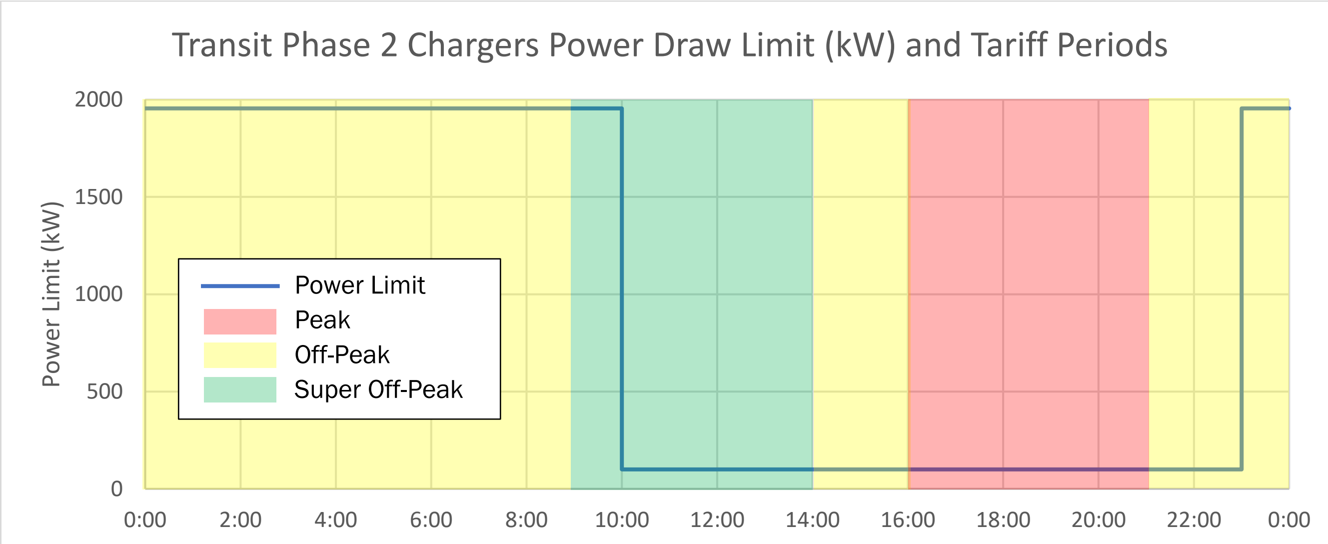


Figure 6. Santa Rosa Transit Phase 2 Chargers Power Draw Limit vs Electric Tariff Rate Periods.

Santa Rosa Transit and the City fleet are coordinating to procure a Charge Management Software (CMS) that can differentiate between which vehicle is charging and bill the appropriate department for the electricity cost. The CMS should also be vetted for its ability to manage fueling costs on the retail electricity tariffs and to support a mixed fleet.

3.0 RECOMMENDATIONS FOR NEXT STEPS

3.1 INITIATE PG&E NEW SERVICE PROCESS (RULE 29 OR EV FLEET PROGRAM)

1. The PG&E EV Fleet program will likely sunset in Summer 2026. After it sunsets, PG&E will likely stop providing incentives. However, the Electric Rule 29 process still exists to cover all to-the-meter infrastructure upgrade costs. PG&E's Fleet Advisory Services may be able to assist with new service application processes.
2. The PG&E new service process typically takes 18 months to complete. This is similar to the design, procurement and construction timeline of the behind-the-meter infrastructure that Santa Rosa is responsible for. Therefore, it is important to behind both processes concurrently. Begin the utility engagement as early as possible to avoid the situation where purchased EVs do not have EV charging stations to use.

3.2 DETERMINE THE PREFERRED PROJECT DELIVERY METHOD

Potential project delivery options include:

1. Traditional Design-Bid-Build: The City will work with a engineering consultant to fully design the systems, put the project out to bid, and hire an installation contractor.
2. Design-Build: The City would develop bridging documents to solicit a design-build contractor to design, permit, and construct the project.
3. Public Private Partnership (P3) or "Charging-as-a-Service" (CaaS): Typically implemented similar to a design-build. However, private capital is used to finance the project, with the City paying a higher operational cost over time. The CaaS entity typically also provides operational services. CaaS arrangements can be structured for the City to eventually own the infrastructure.

3.3 PREPARE FOR PROCUREMENT PROCESS

Depending on the project delivery method, the City will need to consider how to best procure the EVSE projects as well as the subsequent operating agreements. A few key considerations include:

1. Major equipment (in particular, switchgear and possibly the EV chargers) can be procured separately to accelerate the construction schedule and potentially realize some cost efficiency.
2. The CMS is typically an operational, multi-year commitment. Some public entities have procurement hurdles for procuring both capital projects and operational contracts in the same procurement, and the City may have requirements to competitively source the CMS.
3. Similar to the CMS contract, many site owners elect to enter into some level of service agreement (often offered by the EV charger OEM or CMS entity) to maintain the chargers and provide an uptime guarantee.
4. Decide whether to group Phases and/or sites into a single procurement versus separating into individual procurements.

3.4 CHARGE MANAGEMENT SOFTWARE (CMS)

A few key considerations and recommendations for a CMS include:

1. To ensure interoperability of fleet EV chargers and for operational streamlining, a single CMS provider is recommended for the City's EV charger portfolio. To date, Santa Rosa has met with representatives from InCharge, The Mobility House, and EDF Powerflex. Other CMS entities exist on the market.
2. The City should consider selecting a CMS provider during the design process. Most CMS have vetted hardware that has been tested with the software, which will narrow the basis of design for the EVSE. Conversely, if the City has a preferred EVSE hardware, this may narrow the field of CMS providers. A CMS provider can also be brought in to collaborate on the design process and help select hardware.
3. A CMS can be a significant operational expense and the offerings vary widely. The City should carefully consider the software features needed. A core functionality should be the software's ability to mitigate fueling costs on the retail electricity tariff.

4.0 APPENDIX

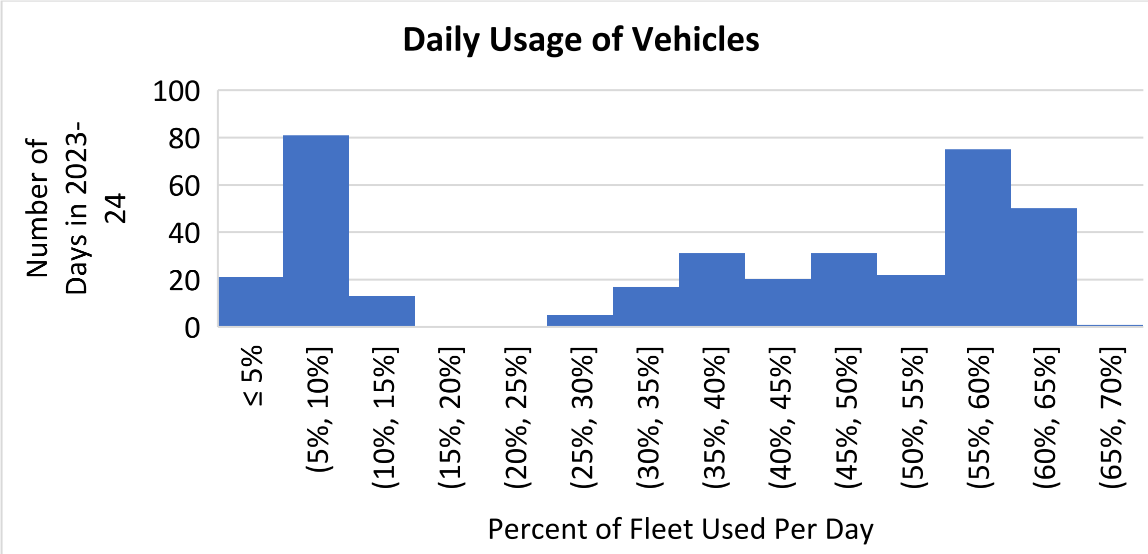


Figure 7: Fleet pullout percentage per day based on daily Geotab data

Table 9: 2040 Energy and Demand Estimates by Location

Location	2040 Annual Energy (kWh)	2040 Unmanaged[11] Peak Demand (kW)	2040 Managed[12] Peak Demand (kW)
City Hall	30,181	80	50
City Hall Annex	1,611	10	10
Bennett Valley Golf Course	866	2	1
Brown Farm	63,456	111	77
Compost Facility	124,907	165	91
Fire Station 10	2,777	10	10
Finley Park	8,699	21	11
Galvin Community Park	164	1	1
Geysers	164	1	1
Howarth Park	3,657	20	19
Laguna Treatment Plant	154,008	353	198
Municipal Services Center North	1,304,308	1,669	1,006
Municipal Services Center South	69,133	187	117
A Place to Play	164	1	1
Rincon Valley Community Park	164	1	1
Steele Lane Recreation Center	7,331	20	10
Utilities Field Operations	634,266	928	585
Total	**2,405,855**	3,579	2,188

[11] Unmanaged peak demand is based on all EV chargers at a site using their full power.
[12] 60% the City's fleet is used during a typical workday according to Geotab data. Therefore, the managed peak demand is based on the City using 60% of the EV chargers. In a perfect scenario where the annual energy needed is divided by 260 work days and 7 hours of charging, the peak demand for all sites would be lower.

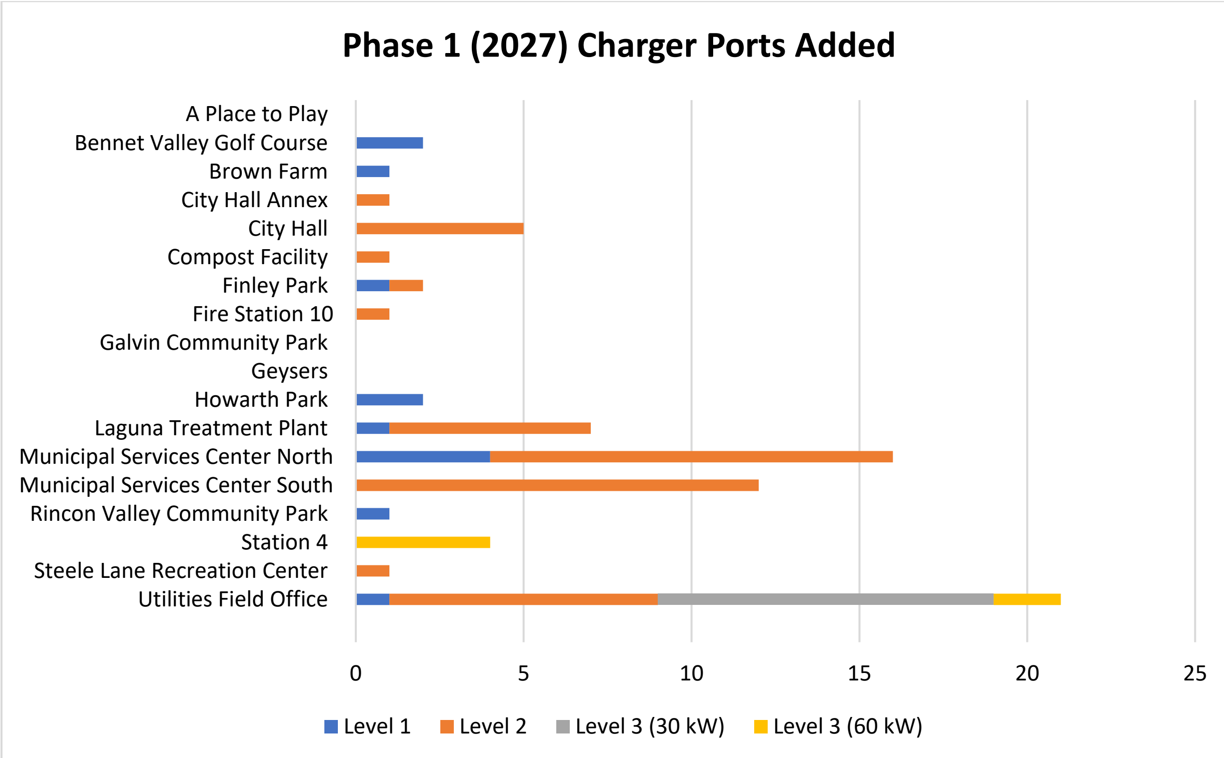


Figure 8. Phase 1 quantity of EV charger ports added by site

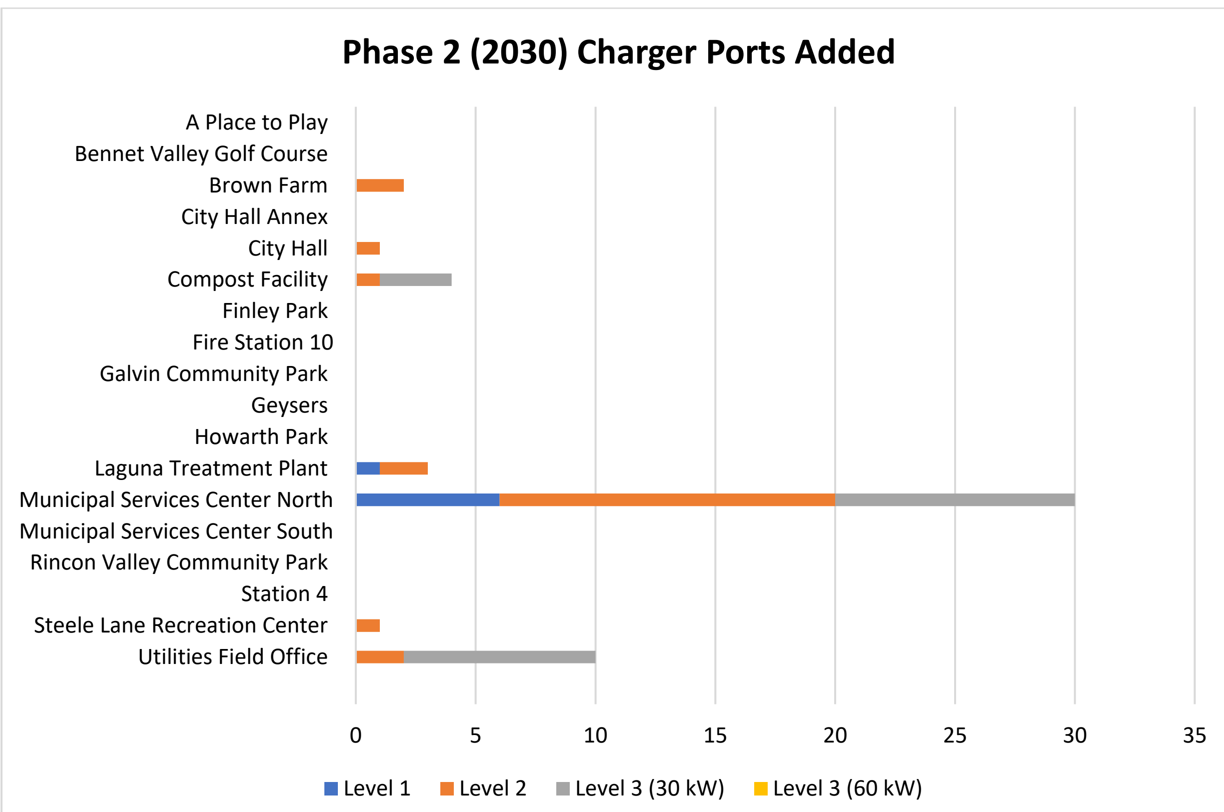


Figure 9. Phase 2 quantity of EV charger ports added by site

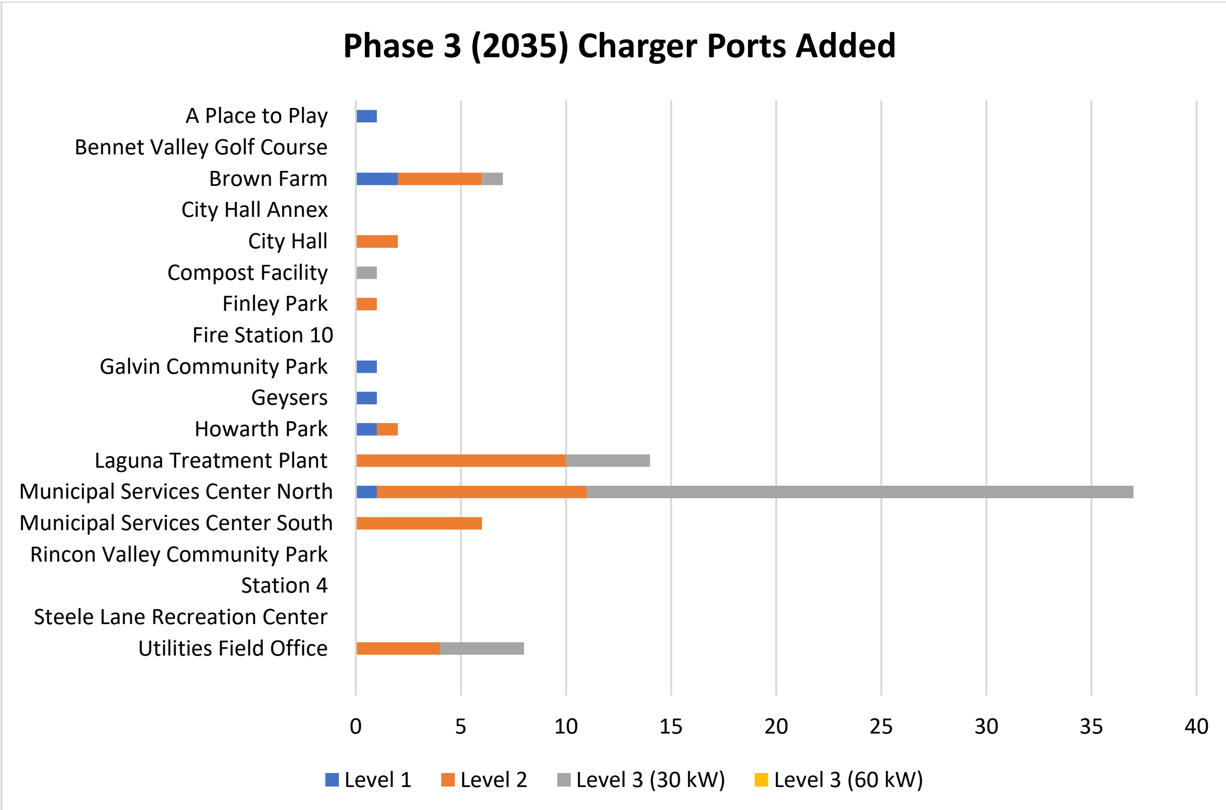


Figure 10. Phase 3 quantity of EV charger ports added by site

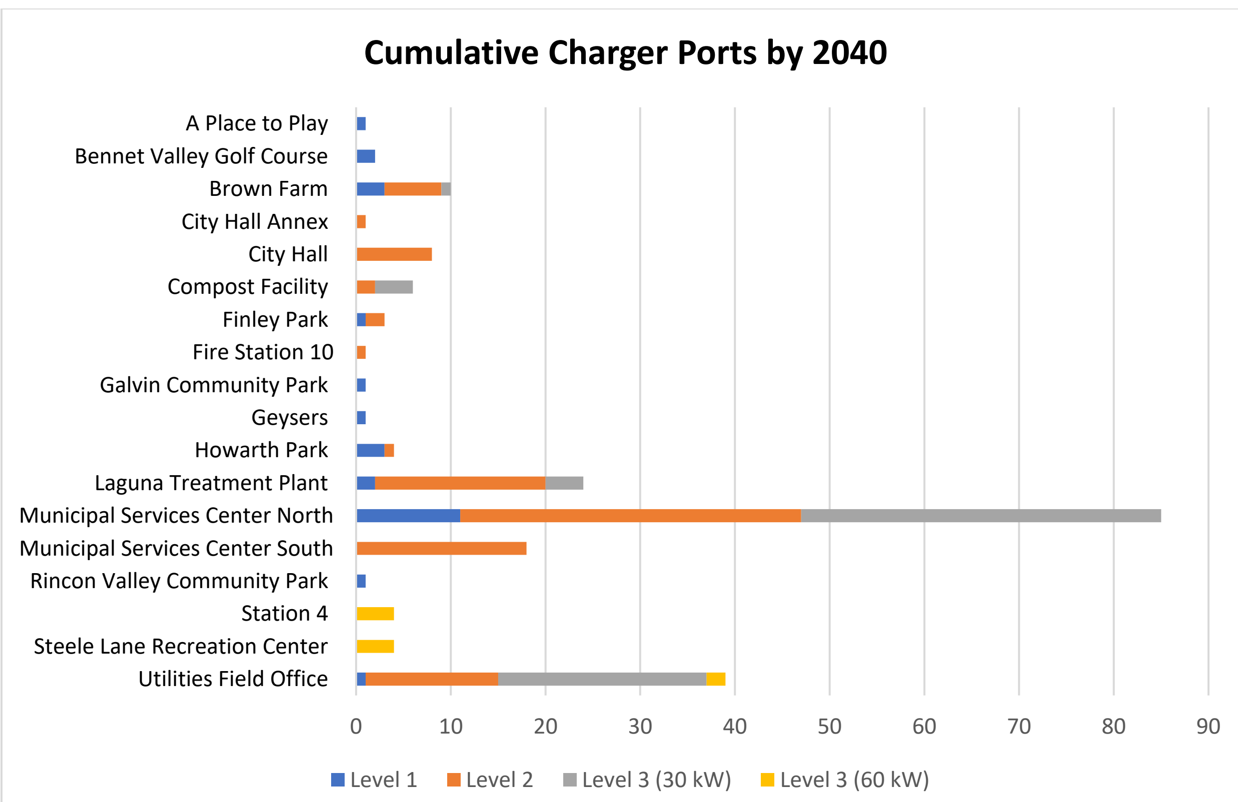


Figure 11. Cumulative quantity of EV charger ports needed for a fully electrified fleet by site.

Appendix A.6

Microgrid Resiliency Assessment Memo

June 2025

Prepared For:

City of Santa Rosa

Prepared By:

NV5

NV5

101 Lucas Valley Road, #302
San Rafael, CA 94903

NV5 PROJECT 5980824-2304101

EXECUTIVE SUMMARY

The City of Santa Rosa has engaged NV5 to evaluate the financial feasibility of implementing microgrids at six city sites. These microgrids, comprising solar photovoltaic (PV) systems, battery energy storage systems (BESS), and diesel fuel generators, aim to provide resiliency for electric vehicle (EV) charging in the city's transition to an all-electric vehicle fleet by 2040. The microgrids will generate and store electricity on-site and provide backup power during power outages.

The analysis covers the following sites:

- Brown Farm
- City Hall
- Laguna Treatment Plant
- Municipal Services Center North
- Utilities Field Operations
- Station 4

For each site, NV5 evaluated the financial feasibility of a complete microgrid system (PV, BESS, generators) versus a generator only option. Financial feasibility was assessed under two financing options: Cash Purchase and Power Purchase Agreement (PPA).

To summarize the finding of this study:

- Neither financing option (cash purchase or PPA) is expected to yield positive net savings over 25 years, for both resiliency options (complete microgrid or generator-only).
- High upfront costs and low export value of solar energy contribute to the negative financial outlook.
- Generators are recommended as the most cost-effective resiliency solution.

PROJECT OVERVIEW

City of Santa Rosa EV Infrastructure Masterplan contracted NV5 to assess the financial feasibility of microgrids consisting of solar photovoltaic (PV), battery energy storage system (BESS), and conventional fuel generator (genset) at 6 City sites. These microgrids will support the City's transition to all electric vehicles by 2040 by generating and storing electricity on-site and providing resiliency to grid power outages.

Site Locations	1. Brown Farm 2. City Hall 3. Laguna Treatment Plant 4. Municipal Services Center North 5. Utilities Field Operations 6. Station 4
Electric Utility	Pacific Gas & Electric
Site Description	Electric vehicles overnight charging depots

This financial analysis reviews the performance of the conceptual solar PV, BESS, and natural gas genset microgrids at each site under either a Cash Purchase or Power Purchase Agreement (PPA) financing options.

Due to the high concentration of the City's vehicles parking in the Stony Point Road municipal office complex, two independent microgrids were evaluated to provide backup charging during an outage:

- At Municipal Services Center (MSC) North, Santa Rosa's Transit agency CityBus has preliminary plans to build a solar PV canopy on top of their chargers. This site would be the backup charging site for vehicles domiciled at MSC North, Finley Park, and Transit.

- At Utilities Field Operations (UFO), its microgrid would serve as the backup charging site for vehicles domiciled at UFO and MSC South.

During everyday operations, the microgrids at the two sites above would only serve the vehicles typically domiciled there.

Note that for Station 4, the design is subject to change as this site has a future planned remodel. Timing and sizing of the PV, BESS, or generator installation for the EV chargers should be considered in concert with the proposed improvements for the buildings.

MICROGRID CONCEPTUAL SIZING

For system sizing, NV5 used the estimated energy consumption in 2040 for the fully electrified fleet scenario, as shown in Table 6 in Appendix 2.

The conceptual solar PV is sized to offset roughly 80% of the EV charging load in a year, capped by the available space in the vehicle depot. For example, at MSC North the PV canopy space is restricted to the space above the charging stalls and offsets approximately 40% of the CityBus's annual expected energy consumption.

For BESS, NV5 modeled the size to be large enough to minimize PV export to the grid, but not larger than the outage needs. The EVs are expected to charge predominantly overnight. The solar PV system will charge the BESS during the day, and the BESS will discharge overnight to charge EVs. The BESS is therefore able to support energy cost arbitrage and can provide resiliency for shorter grid outages.

Lastly, the generator is sized at the expected peak demand and would be used to meet longer grid outages once the BESS is fully discharged. Santa Rosa stated resiliency needs are listed in the Appendix 1.

Table 1. Microgrid System Sizes by Technology

	Brown Farm	City Hall	LTP	MSC North[1]	UFO	Station 4
Solar PV	36 kW-DC	17 kW-DC	71 kW-DC	240 kW-DC	223 kW-DC	62 kW-DC
BESS	100kW 203 kWh	50kW 203 kWh	200kW 406kWh	550kW 1,218 kWh	450kW 1,015 kWh	100kW 406 kWh
Diesel Genset	80 kW	30 kW	200 kW	750 kW	750 kW	100 kW

[1]A 240kW-DC solar canopy covers CityBus' PG&E EV Fleet Phase 2 EV charger installations.

During prolonged outages, the BESS would support a portion of the outage while the diesel genset serves the remainder of the outage, as shown in Figure 2 for a 1-day outage scenario. The duration in which the BESS can serve the EVs without the genset depends on the BESS state-of-charge at the time of the outage, the EV charging load, and the duration of the outage. The diesel genset's operation is only limited by fuel supply.

Note that in terms of conceptually phasing the implementation of PV and BESS systems incrementally, NV5 reviewed the feasibility and arrived at the following conclusion: for PV, NV5 recommends installing the full system all at once, because the PV systems are relatively small, and initiating multiple construction projects would be costly due to economies of scale. Whereas for BESS systems, Santa Rosa may choose to install the batteries incrementally or at the same time as the PV installation. The Net Present Value does not vary significantly between the two options, because the capital costs of the batteries are much higher than potential savings. If the BESS are implemented at a later date, the initial project should include make-ready aspects of including the BESS, such as capacity in the switchgear, spare conduits, reserved BESS footprint, etc.

GENERATOR CONSIDERATIONS

The City of Santa Rosa is regulated by the Bay Area Air Quality Management District (BAAQMD) for air pollution. Conventionally fueled emergency backup generators will need to be permitted by BAAQMD. Generator vendors and installers can assist the City with applications for those permits.

Since December 2, 2024, BAAQMD has required all diesel-fueled emergency backup generators to be subject to Tier 4 emission standards.[1] These standards apply to engines larger than 50 brake horsepower (equal to 37kW). To achieve Tier 4 emission standards, generators are required to install Diesel Particulate Filters (DPF) and Selective Catalytic Reduction (SCR). For this study, NV5 has used diesel generators with DPF and SCR included in our cost analysis.

As an alternative, natural gas generators require less exhaust gas treatment, since the exhaust gas is cleaner. However, to use natural gas generators, the City will need to install a natural gas pipeline leading from an existing gas meter to the generator. If there is no existing gas service at a site, PG&E may cover the cost of installing a natural gas line to establish a new meter at the location where the natural gas generator would be situated.

In terms of resiliency, a diesel generator is typically accompanied by a 24-hour fuel tank. For the City's needs, that will be sufficient for 3 days of EV charging - since overnight charging is about 7 hours. As long as the diesel fuel tank gets refilled, the generator can operate for an indefinite period. In comparison, a natural gas generator does not need a fuel tank, since natural gas can be piped in. However, during a natural disaster such as an earthquake, the pipe may be damaged and unable to supply fuel for the generator. The City can store natural gas on site via a tank at an added cost, however stored natural gas is still typically reliant on pipe delivery to refuel. Given these considerations, diesel generators remain the recommended alternative for resiliency during extended outages where natural gas supplies may be interrupted.

[1] https://www.baaqmd.gov/permits/apply-for-a-permit/engine-permits

FINANCIAL OVERVIEW

Table 2. Financial Analysis Assumptions

Assumptions	Value
Utility Tariff	BEV-2-S
Microgrid Controls Cost Adder, % on top of PV, BESS, Genset Component Cost	30%
Investment Tax Credit (ITC), Cash Purchase[1]	25.5%
Net Present Value (NPV) Discount Rate (DR), %	2.0%
Annual Utility Cost Escalator, % [2]	3%
Annual Diesel Cost Escalator, % [3]	2%
Est. Cost Increase Due to Tariffs, % [4]	15%
Soft Costs and Contingencies, % [4]	4.25%
1-Day Outages Per Year	3
7-Day Outages Per Year	0.25 (once every 4 years)
Cost of Diesel, $/gal [5]	$3.73
Daily Charging Window Length	7 hours

[1] Assumed 30% base ITC with 15% reduction (25.5% ITC) if Santa Rosa uses tax-exempt funding.
[2] The annual utility cost escalator was estimated to be 3% based on historic PG&E averages. Should Utility rates escalate a different rate, project savings could differ from the numbers given in this report.
[3] Annual Consumer Price Index increases approximated to be 2%.
[4] Applied to upfront PV, BESS and Genset costs
[5] Santa Rosa Fuel Transaction Summary Report 7/1/2023-6/30/2024

For detailed PV, BESS and Genset pricing, and assumed PPA rates, refer to Table 9.

NV5 modeled the solar PV and BESS systems over a 25-year life. The results of that analysis are shown in Table 3. For the microgrid option, NV5 modeled the Cash Purchase and PPA option. For the generator-only option, NV5 modeled the Cash Purchase option only, as there are no PPAs for generators.

Generator capital costs were provided by Peterson Cat, which Santa Rosa currently uses to provide and maintain generators. Generator maintenance costs were estimated by NV5.

Figure 1 below illustrates the microgrid operations at Laguna Treatment Plant during a typical day on July 31st. For all Santa Rosa sites, EVs are expected to charge from 9pm to 4am the following day, for a total of 7 hours. On this day (July 31st) the solar PV is generating power from 7am to 9pm. The BESS is charging from the PV for the majority of that period. Any excess power that can't be stored was exported to the grid. Then from 9pm, the EVs charge from the BESS. Once the BESS energy is depleted, the EVs charge from the grid.

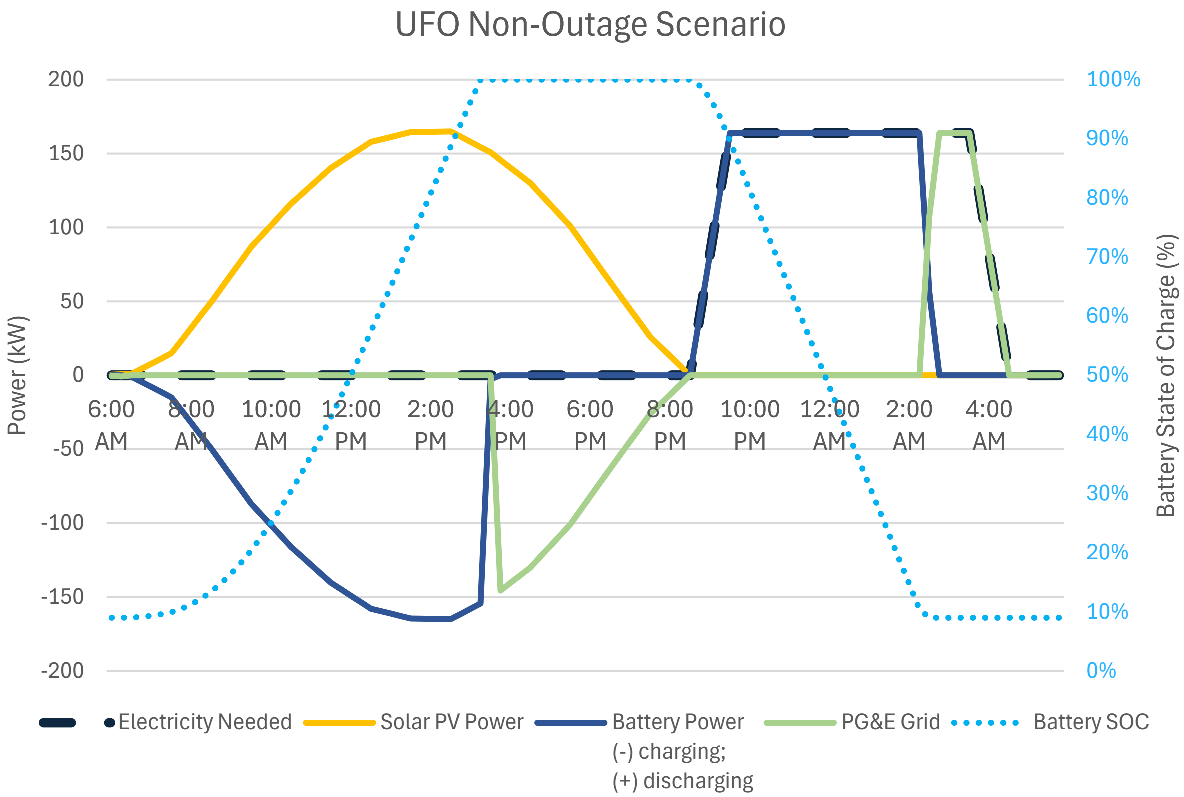


Figure 1. UFO energy resource operations during non-outage day on 7/31/2025 (simulated).

On the other hand, during a power outage, once the energy stored in the BESS runs out, the generators will turn on and supply power to the EV chargers.

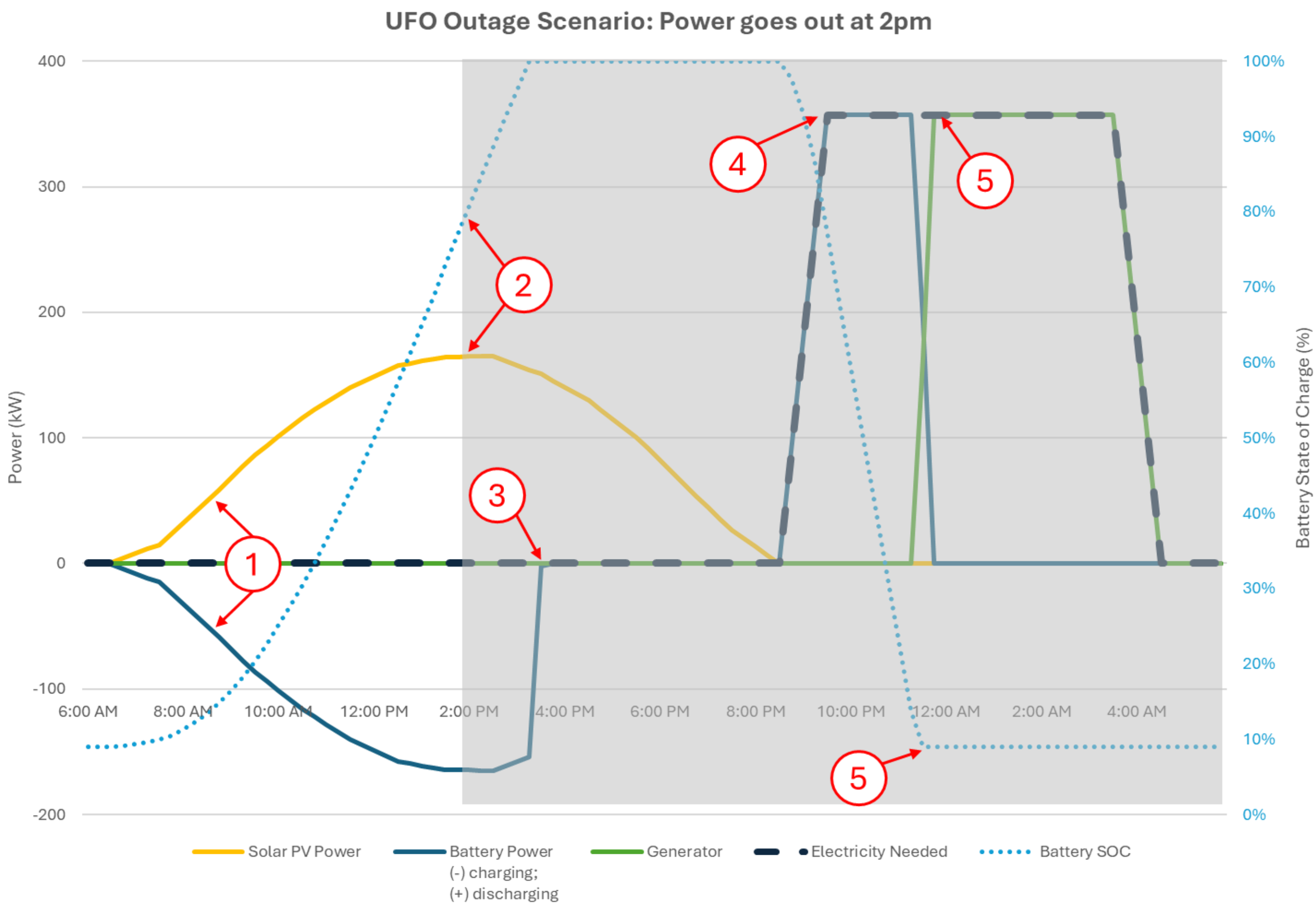


Figure 2. Outage scenario at Utilities Field Operations simulated on 7/31/2025 (simulated)

NOTES IN FIGURE 2:

1. Solar PV system is charging the battery (BESS).
2. 2:00 PM: Power outage occurs. PV system continues charging BESS during outage.
3. 3:30 PM: BESS is fully charged. Solar does not export excess energy because grid is offline.
4. 9:00 PM: Vehicles initiate charging sessions while grid is still offline; BESS begins discharging.
5. 11:45 PM: BESS depleted; generator turns on to finish vehicle charging

NV5 modeled the solar PV and BESS microgrid concept under two different financing scenarios over a 25-year system lifetime: 1) Cash Purchase and 2) Power Purchase Agreement (PPA). CapEx costs and PPA rates are based on NV5's recent procurements for commercial solar PV and BESS projects across the United States.

Table 3. 25-Year Financial Analysis Overview Results: Cash Purchase

Metric	Brown Farm	City Hall	LTP	SR Transit at MSC North	Station 4	UFO
Capital Costs						
Generator-only	$305,000	$72,000	$414,000	$732,000	$307,000	$732,000
Microgrid	$1,384,000	$800,000	$1,755,000	$4,748,000	$1,890,000	$3,994,000
25-Yr Savings Analysis (NPV at 2% Discount Rate)						
Generator-only	-$408,000	-$167,000	-$522,000	-$951,000	-$415,000	-$965,000
Microgrid	-$1,228,000	-$790,000	-$1,449,000	-$3,500,000	-$1,813,000	-$3,011,000

Based on the lifetime financial analysis, the key metrics which the cash model is most sensitive to include installed system cost, BESS replacement costs, annual operations & maintenance costs, annual utility (PG&E/SCP) cost escalator, and soft costs & contingencies.

Table 4. 25-Year Financial Analysis Overview Results: Power Purchase Agreement (PPA)

Metric	Brown Farm	City Hall	LTP	SR Transit at MSC North	Station 4	UFO
25-Yr Savings Analysis (NPV at 2% Discount Rate)						
GenSet-Only	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Microgrid	-$1,829,000	-$1,345,000	-$2,365,000	-$4,688,000	-$2,269,000	-$4,730,000

Based on the lifetime financial analysis, the key metrics which the model is most sensitive to include BESS capacity payment cost, PPA base price, and annual utility (PG&E/SCP) cost escalator.

GREENHOUSE GAS EMISSION

Table 5. Greenhouse Gas Emission Calculations for Six Sites for each Resiliency Option.

Metric	Brown Farm	City Hall	LTP	SR Transit at MSC North	Station 4	UFO
Diesel Fuel Consumption per Year						
Genset Only (gal)	200	70	470	1,689	237	1,849
Microgrid (gal)	69	19	257	1,037	63	1,261
Greenhouse Gas Emission per Year						
Genset Only (kg)	2,038	714	4,790	17,213	2,412	18,844
Microgrid (kg)	705	197	2,623	10,567	640	12,854
25-Year Summary (Assume Cash Purchase)						
Emission Savings (kgCO2e, Genset vs Genset+PV+BESS)	33,314	12,922	54,162	166,162	44,295	149,750
NPV Difference ($, Genset vs Genset+PV+BESS)	$820,000	$623,000	$927,000	$2,549,000	$1,398,000	$2,046,000
Emission Mitigation Cost ($/MTCO2e)	24,675	48,211	17,115	15,340	31,561	13,663

NV5's preliminary analysis shows that while the microgrid option with PV and BESS will reduce GHG emissions overall, the cost faced by the City to mitigate that emission is high. Depending on the site, the carbon mitigation cost ranges from $13,663 to $48,221 per ton of GHG emission saved. For reference, the California Cap-and-Trade prices have not exceeded $41.76/ton since its inception in 2018.[2] This suggests that it may be more cost effective to purchase carbon offsets than invest in PV+BESS systems for EV charging resiliency.

POTENTIAL GRANTS AND INCENTIVES

1. **Federal Inflation Reduction Act – Investment Tax Credit (Included in Results)**

   Estimated Value: $2,220,000

   Description: Through the 2022 Inflation Reduction Act (IRA), tax-exempt organizations that invest in clean energy projects are eligible for tax incentives under Internal Revenue Code (IRC) Section 48. Clean energy projects include solar and wind power, energy storage, microgrids, and others.[3] Investment Tax Credits are 30% of the project cost for projects less than 1MWac[4], and 25.5% for projects greater than or equal to 1MWac. The Investment Tax

[2] https://ww2.arb.ca.gov/sites/default/files/2020-08/results_summary.pdf
[3] https://www.epa.gov/green-power-markets/summary-inflation-reduction-act-provisions-related-renewable-energy
[4] Solar PV systems have 2 power ratings. "MWdc" refers to the direct current power rating of each PV panel in the system added together. The direct current power goes into inverters, which converts the power into

Credit (ITC) is currently available through 2032, however a much nearer term sunsetting is being negotiated in the US Congress. If tax exempt bonds are used to finance the project, there is a 15% tax credit reduction (from 30% to 25.5% for example).

Estimated Value Calculation Methodology: According to the concept designs, initial capital cost of the PV and BESS system for all sites are approximately $8 million. Assuming Santa Rosa uses tax exempt bonds to finance the projects, the potential ITC credit is $2,220,000.

Actions for Santa Rosa: Coordinate with tax accountants to file for the tax credit for all clean energy projects installed to date. There is currently significant uncertainty regarding the future of the ITC under the current federal administration. Current federal legislation being negotiated in the Senate includes a provision for the ITC to be sunset as early as 2025. The City should monitor proposed changes to the ITC and should consider project economics with and without the ITC. The City should also consider an ITC deadlines when planning projects and for projects that do move forward, pursue credits as soon as possible.

Useful Link: https://www.irs.gov/credits-deductions/clean-electricity-investment-credit

2. **Self-Generation Incentive Program (Not Included in Results. Funding may run out.)**

Estimated Value: $621,000 if ITC is claimed. $863,000 if ITC is not claimed.

Description: The Self-Generation Incentive Program (SGIP) offers rebates for installing energy storage technology at residential or non-residential facilities that can be used during a power outage. SGIP participants must enroll in demand response programs. Demand response programs allow the utility to control the battery. For example, when the utility detects a need for more electricity in your area, it may discharge your battery to supply power to the grid. Additionally, 50% of the incentives for your project is given out in the first year, and 50% of the incentives will be spread out over the first 5 years as a performance-based incentive, based on meeting the 104 battery charge-discharge cycles per year requirement.

The program in PG&E territory is currently in step 5, which is the last step before incentives are exhausted. If funding is exhausted, the City will need to wait until CPUC renews funding to the program again.

Estimated Value Calculation Methodology: In the current rebate step, CPUC provides $0.18/Wh of battery storage capacity if the project is claiming the Federal ITC above. However, if the project is not claiming the ITC, the rebate is $0.25/Wh. For the estimated value, the rebate values are multiplied by the total battery storage sizes for all 6 sites.

Actions for Santa Rosa: Contact a battery installer to navigate the application process.

Useful Link: https://www.selfgenca.com/home/program_metrics/

---

alternating current. “MWac” refers to the alternating current rated nameplate power of each inverter in the system added together. Typically the ratio of “MWdc” to “MWac” is about 1.25 MWdc to 1 MWac.

FINDINGS

1. Neither the Cash Purchase nor the PPA scenario are expected to result in positive net nominal or NPV savings over the 25-year analysis period. This is primarily due to several factors:
    a. Need for PV and BESS to generate large amount of electricity during outage relative to site's daily needs
    b. High Upfront cost of BESS system (and, to a lesser extent, PV system)
    c. Low cost of electricity during the Off-Peak period when EVs will predominantly charge.
    d. Low value for exported energy generation from PG&E's Net Billing Tariff rates. On average, the export value of solar is roughly $0.06/kWh. In comparison, the electric import cost is about $0.18/kWh during Off-Peak periods under the BEV-2-S electric rate.
2. Systems that provide resiliency to grid outages add significant cost. PV and BESS may provide utility energy cost saving during normal grid-connected operation, but the overall capital and maintenance cost of these systems designed to provide resiliency is typically much higher than the cost saving they can achieve.
3. Conventionally fueled internal combustion generators are currently the most cost-effective option to provide EV charging resiliency to the City. However, these generators will emit more greenhouse gas than a microgrid with PV and BESS and will not provide valuable grid services when the grid is operational.
4. PPAs/third-party ownership will lead to higher overall cost to the City. However, a third-party will be responsible for the PV and BESS systems' operation and maintenance under a PPA.
5. The Inflation Reduction Act (IRA) of 2022 includes several beneficial tax provisions; however, as of the writing of this memo, the federal executive and congressional branches of government are pursuing reductions or elimination of federal tax benefits that this project is currently eligible for. At the time of this analysis, the provisions include:
    a. Extension of the 30% Investment Tax Credit (ITC) for PV cost (included in modeling).
    b. Potential 10% ITC Domestic Content Adder (not included in this modeling).
    c. Elective (Direct) Payment option for tax-exempt entities (included in modeling).

NEXT STEPS

1. The City should engage with generator vendors to explore detailed feasibility, regulatory requirements, and costs of installing generators on its EV charging depots.

2. Proceed with the fleet electrification process before making further investments into the PV and BESS systems. As BESS technology and cost improves,[5] more real-life electricity use data becomes available, and more of the fleet transition to EVs, the City should re-evaluate the cost effectiveness of PV and BESS.

3. If the City desires to adopt solar PV and BESS for some sites, build them in phases as funding sources are identified. For example, MSC North's resiliency system, which would be built by Santa Rosa Transit, will start off with a 240kW PV system. As Transit identifies future funding, they may elect to install more solar PV.

4. When the City is ready to adopt solar PV and BESS, engage with a trusted engineering company to develop detailed designs and ensure optimal placement of solar PV, BESS, and generators, and procure

[5] NREL studies show that future battery storage prices are expected to decrease https://atb.nrel.gov/electricity/2024/commercial_battery_storage

Memo Appendix 1: Resiliency Energy Demands

Santa Rosa provided inputs to NV5 regarding its expected energy demands during an outage scenario. Demands are split out by vehicle weight class, outage duration (1 or 7 days), percentage of vehicles to run, and how much those vehicles are driven compared to a typical day. These values are multiplied with site energy data in Appendix 2 to calculate the outage energy needs.

LAGUNA TREATMENT PLANT

	1-Day Outage		7-Day Outage	
Vehicle Class	% Vehicles to run	% Vehicle usage vs typical	% Vehicles to run	% Vehicle usage vs typical
Light	65%	100%	75%	200%
Medium	65%	100%	75%	125%
Heavy				
Construction	50%	100%	75%	100%
Non-Road	50%	100%	50%	125%

BROWN FARM

	1-Day Outage		7-Day Outage	
Vehicle Class	% Vehicles to run	% Vehicle usage vs typical	% Vehicles to run	% Vehicle usage vs typical
Light	50%	100%	75%	150%
Medium				
Heavy	50%	100%	75%	150%
Construction				
Non-Road	50%	100%	75%	150%

MSC NORTH

	1-Day Outage		7-Day Outage	
Vehicle Class	% Vehicles to run	% Vehicle usage vs typical	% Vehicles to run	% Vehicle usage vs typical
Light	50%	100%	75%	150%
Medium	50%	100%	75%	150%
Heavy	75%	100%	75%	150%
Construction	75%	100%	75%	150%
Non-Road	50%	100%	50%	150%

MSC SOUTH

	1-Day Outage		7-Day Outage	
Vehicle Class	% Vehicles to run	% Vehicle usage vs typical	% Vehicles to run	% Vehicle usage vs typical
Light	45%	100%	75%	150%
Medium				
Heavy				
Construction				
Non-Road				

UFO

	1-Day Outage		7-Day Outage	
Vehicle Class	% Vehicles to run	% Vehicle usage vs typical	% Vehicles to run	% Vehicle usage vs typical
Light	100%	100%	100%	200%
Medium	100%	100%	100%	200%
Heavy	85%	100%	100%	200%
Construction				
Non-Road	100%	100%	100%	200%

STATION 4

	1-Day Outage		7-Day Outage	
Vehicle Class	% Vehicles to run	% Vehicle usage vs typical	% Vehicles to run	% Vehicle usage vs typical
Light	3%	100%	3%	200%
Medium	2%	100%	2%	200%
Heavy	6%	100%	6%	200%
Construction	7%	100%	7%	200%
Non-Road	5%	100%	5%	200%

*Note that for Station 4, the "% of vehicles to run" is out of the entire City's fleet. This site is expected to be a central charging location for EVs during an outage.

CITY HALL

	1-Day Outage		7-Day Outage	
Vehicle Class	% Vehicles to run	% Vehicle usage vs typical	% Vehicles to run	% Vehicle usage vs typical
Light	35%	100%	50%	150%
Medium				
Heavy				
Construction				
Non-Road				

Memo Appendix 2: Typical Annual EV Electricity Consumption

Table 6. Estimated EV Electricity Consumption Per Site for Vehicle Fleet (Non-Outage), kWh/yr

Year	Brown Farm	City Hall	Laguna Treatment Plant (LTP)	Santa Rosa Transit	Station 4*	Utilities Field Operations (UFO)
2025	400	6,000	2,000	1,879,000	Minimal	18,000
2026	400	7,000	17,000	1,879,000	Min.	20,000
2027	400	11,000	17,000	1,879,000	Min.	43,000
2028	400	13,000	18,000	1,879,000	Min.	116,000
2029	400	13,000	18,000	1,879,000	Min.	133,000
2030	400	15,000	20,000	1,879,000	Min.	220,000
2031	400	15,000	20,000	1,879,000	Min.	223,000
2032	400	15,000	20,000	1,879,000	Min.	230,000
2033	3,000	17,000	28,000	1,879,000	Min.	272,000
2034	11,000	20,000	36,000	1,879,000	Min.	272,000
2035	39,000	22,000	104,000	1,879,000	Min.	299,000
2036	39,000	30,000	114,000	1,879,000	Min.	319,000
2037	63,000	30,000	117,000	1,879,000	Min.	319,000
2038	63,000	30,000	132,000	1,879,000	Min.	358,000
2039	63,000	30,000	141,000	1,879,000	Min.	358,000
2040	63,000	30,000	141,000	1,879,000	Min.	358,000

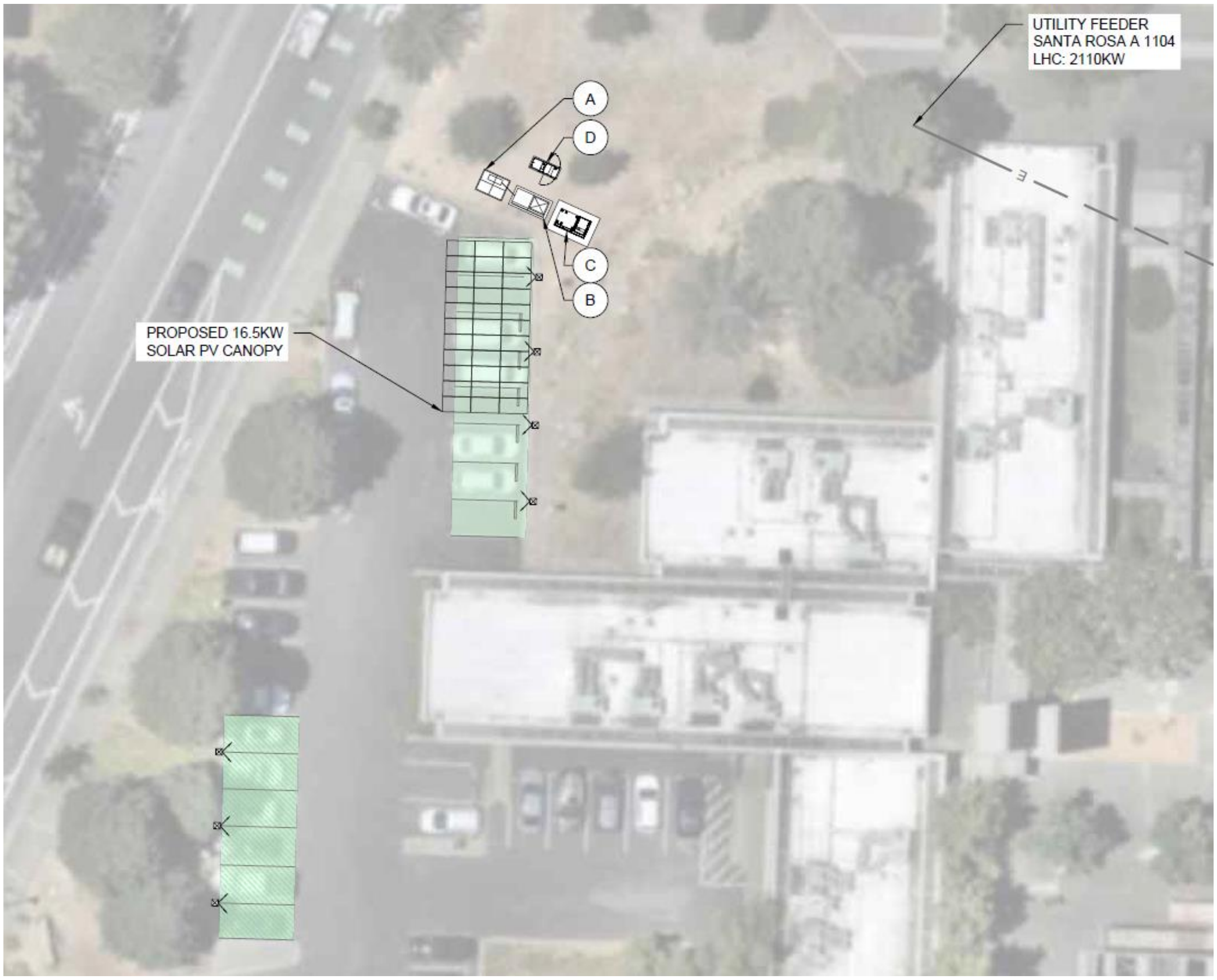
*Station 4 has minimal electricity consumption because no vehicles are stationed there overnight. Any charger use at Station 4 will be due to daytime charging if drivers need to "top up" their vehicles.

Memo Appendix 3: Site Conceptual Layouts

BROWN FARM

A: Existing Transformer
B: New Switchboard
C: New Stepdown Transformer
D: New Subpanel
E: New BESS 100kW/203kWh
F: New Diesel Generator 75kW

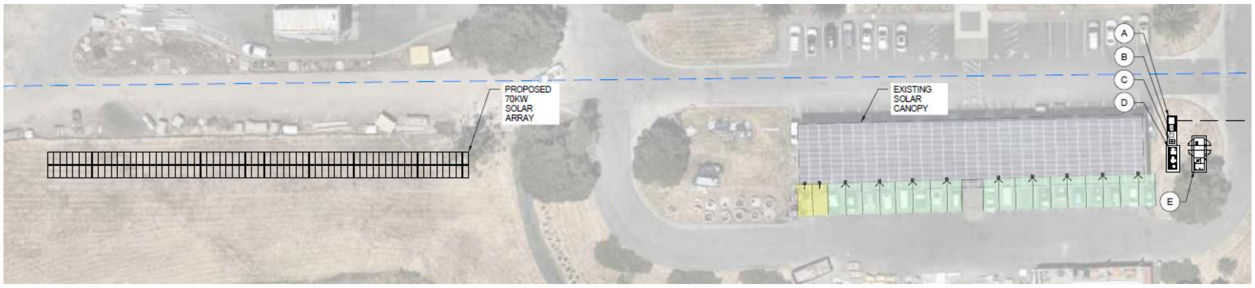
CITY HALL



A: New Transformer
B: New Switchboard
C: New BESS 50kW/203kWh
D: New Diesel Generator 30kW

LAGUNA TREATMENT PLANT

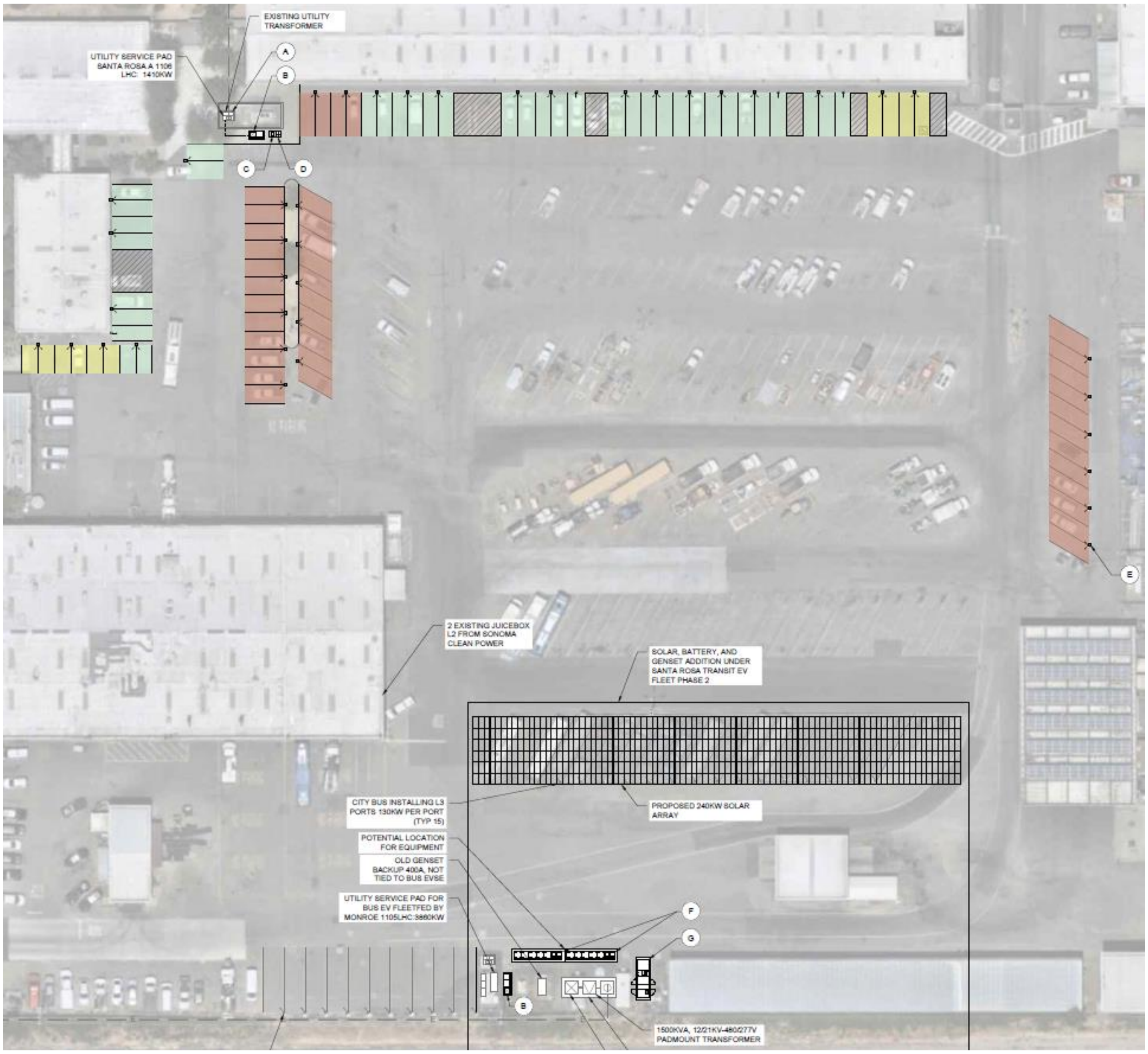
~~~



A: New Switchboard
B: New Stepdown Transformer
C: New Subpanel
D: New BESS 200kW/406kWh
E: New Diesel Generator 200kW

NOTE: A standalone backup electricity system may not be needed if the EV chargers will be connected to site power supply backed up by existing generators. The existing generators need to be verified to have excess capacity to support EV chargers during a power outage.
~~~

MSC NORTH

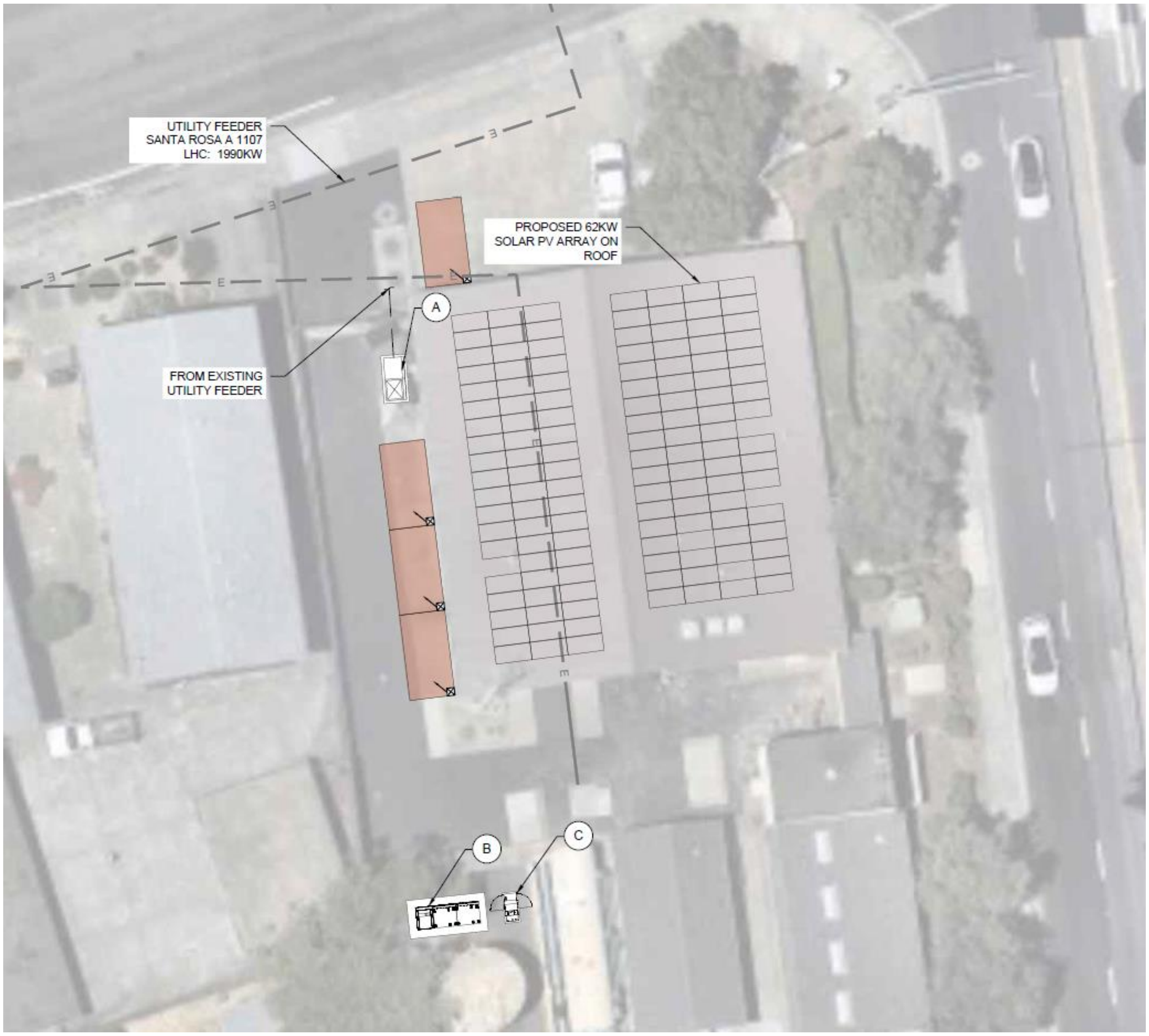


A: Existing Transformer
B: New Switchboard
C: New Stepdown Transformer
D: New Subpanel
E: New Bollards
F: New BESS 500kW/1015kWh
G: New Diesel Generator 750kW

UFO

A: Existing Transformer
B: New Switchboard
C: New Stepdown Transformer
D: New Subpanel
E: New BESS 450kW/1015kWh
F: New Diesel Generator 750kW

STATION 4



A: Existing Transformer
B: New BESS 100kW/406kWh
C: New Diesel Generator 100kW

NOTE: This design is subject to change as this site has a future planned remodel. Timing and sizing of the PV, BESS, or generator installation for the EV chargers should be considered in concert with the proposed improvements for the buildings.

Memo Appendix 4: Financial Summary

CASH PURCHASE

Table 7. 25-Year Cumulative Cashflow – Cash Purchase

Year	Brown Farm	City Hall	LTP	SR Transit at MSC North	UFO	Station 4
0	$(1,384,000)	$(800,000)	$(1,755,000)	$(4,748,000)	$(3,994,000)	$(1,890,000)
1	$(1,116,000)	$(618,000)	$(1,415,000)	$(3,708,000)	$(3,152,000)	$(1,501,000)
2	$(1,117,000)	$(620,000)	$(1,411,000)	$(3,685,000)	$(3,133,000)	$(1,507,000)
3	$(1,117,000)	$(623,000)	$(1,406,000)	$(3,661,000)	$(3,114,000)	$(1,514,000)
4	$(1,117,000)	$(626,000)	$(1,401,000)	$(3,636,000)	$(3,094,000)	$(1,521,000)
5	$(1,117,000)	$(630,000)	$(1,395,000)	$(3,611,000)	$(3,073,000)	$(1,528,000)
6	$(1,117,000)	$(633,000)	$(1,390,000)	$(3,585,000)	$(3,052,000)	$(1,535,000)
7	$(1,117,000)	$(636,000)	$(1,384,000)	$(3,559,000)	$(3,031,000)	$(1,543,000)
8	$(1,117,000)	$(639,000)	$(1,379,000)	$(3,532,000)	$(3,009,000)	$(1,550,000)
9	$(1,117,000)	$(642,000)	$(1,373,000)	$(3,505,000)	$(2,988,000)	$(1,558,000)
10	$(1,118,000)	$(646,000)	$(1,368,000)	$(3,477,000)	$(2,965,000)	$(1,566,000)
11	$(1,118,000)	$(649,000)	$(1,362,000)	$(3,449,000)	$(2,943,000)	$(1,574,000)
12	$(1,263,000)	$(793,000)	$(1,563,000)	$(3,913,000)	$(3,354,000)	$(1,783,000)
13	$(1,262,000)	$(796,000)	$(1,554,000)	$(3,876,000)	$(3,323,000)	$(1,790,000)
14	$(1,261,000)	$(799,000)	$(1,545,000)	$(3,838,000)	$(3,293,000)	$(1,798,000)
15	$(1,260,000)	$(801,000)	$(1,537,000)	$(3,799,000)	$(3,261,000)	$(1,806,000)
16	$(1,259,000)	$(804,000)	$(1,527,000)	$(3,760,000)	$(3,230,000)	$(1,814,000)
17	$(1,258,000)	$(807,000)	$(1,518,000)	$(3,721,000)	$(3,198,000)	$(1,822,000)
18	$(1,257,000)	$(810,000)	$(1,509,000)	$(3,680,000)	$(3,165,000)	$(1,830,000)
19	$(1,256,000)	$(814,000)	$(1,499,000)	$(3,639,000)	$(3,132,000)	$(1,838,000)
20	$(1,255,000)	$(817,000)	$(1,490,000)	$(3,598,000)	$(3,098,000)	$(1,847,000)
21	$(1,254,000)	$(820,000)	$(1,480,000)	$(3,555,000)	$(3,063,000)	$(1,856,000)
22	$(1,253,000)	$(823,000)	$(1,470,000)	$(3,512,000)	$(3,029,000)	$(1,865,000)
23	$(1,252,000)	$(827,000)	$(1,460,000)	$(3,468,000)	$(2,993,000)	$(1,874,000)
24	$(1,251,000)	$(830,000)	$(1,450,000)	$(3,424,000)	$(2,957,000)	$(1,884,000)
25	$(1,250,000)	$(834,000)	$(1,439,000)	$(3,378,000)	$(2,920,000)	$(1,893,000)

POWER PURCHASE AGREEMENT (PPA)

Table 8. 20-Year Cumulative Cashflow – PPA

Year	Brown Farm	City Hall	LTP	SR Transit at MSC North	UFO	Station 4
0[1]	$(412,000)	$(134,000)	$(518,000)	$(968,000)	$(950,000)	$(442,000)
1	$(501,000)	$(209,000)	$(637,000)	$(1,213,000)	$(1,196,000)	$(556,000)
2	$(590,000)	$(284,000)	$(755,000)	$(1,457,000)	$(1,440,000)	$(669,000)
3	$(678,000)	$(359,000)	$(872,000)	$(1,699,000)	$(1,684,000)	$(783,000)
4	$(767,000)	$(433,000)	$(988,000)	$(1,939,000)	$(1,925,000)	$(896,000)
5	$(855,000)	$(508,000)	$(1,105,000)	$(2,177,000)	$(2,164,000)	$(1,009,000)
6	$(942,000)	$(582,000)	$(1,220,000)	$(2,413,000)	$(2,403,000)	$(1,121,000)
7	$(1,030,000)	$(657,000)	$(1,335,000)	$(2,648,000)	$(2,640,000)	$(1,234,000)
8	$(1,117,000)	$(731,000)	$(1,450,000)	$(2,880,000)	$(2,875,000)	$(1,346,000)
9	$(1,204,000)	$(805,000)	$(1,564,000)	$(3,111,000)	$(3,109,000)	$(1,458,000)
10	$(1,291,000)	$(879,000)	$(1,677,000)	$(3,341,000)	$(3,342,000)	$(1,569,000)
11	$(1,378,000)	$(953,000)	$(1,790,000)	$(3,568,000)	$(3,573,000)	$(1,681,000)
12	$(1,464,000)	$(1,027,000)	$(1,903,000)	$(3,794,000)	$(3,803,000)	$(1,792,000)
13	$(1,550,000)	$(1,101,000)	$(2,013,000)	$(4,012,000)	$(4,027,000)	$(1,903,000)
14	$(1,635,000)	$(1,174,000)	$(2,123,000)	$(4,229,000)	$(4,249,000)	$(2,014,000)
15	$(1,720,000)	$(1,248,000)	$(2,232,000)	$(4,444,000)	$(4,470,000)	$(2,124,000)
16	$(1,805,000)	$(1,321,000)	$(2,340,000)	$(4,657,000)	$(4,689,000)	$(2,235,000)
17	$(1,890,000)	$(1,394,000)	$(2,448,000)	$(4,868,000)	$(4,907,000)	$(2,345,000)
18	$(1,974,000)	$(1,467,000)	$(2,556,000)	$(5,077,000)	$(5,123,000)	$(2,455,000)
19	$(2,058,000)	$(1,540,000)	$(2,663,000)	$(5,284,000)	$(5,337,000)	$(2,565,000)
20	$(2,142,000)	$(1,613,000)	$(2,769,000)	$(5,489,000)	$(5,550,000)	$(2,674,000)

[1]Year 0 in the PPA agreement still includes the cash purchase of diesel genset equipment.

Table 9. Detailed Cost Breakdown for Cash and PPA Options

Metric	Brown Farm	City Hall	LTP	MSC North at SR Transit	Station 4	UFO
Site Specifications						
Solar PV System Size (kWp-DC)	35.9	16.5	70.6	240.1	62.2	222.5
BESS Size (kW / kWh)	100 / 203	50 / 203	200 / 406	550 / 1,218	100 / 406	450 / 1,015
GenSet Size (kW)	80	30	200	750	100	750
Yr-1 Solar PV Production (kWh)	53,000	24,000	111,000	352,000	84,000	318,000
Yr-1 Site Electricity Consumption Offset by PV	12,174%	341%	646%	19%	n/a	1,571%
Yr-14 Site Electricity Consumption Offset by PV	75%	73%	72%	17%	n/a	80%
Cash Proposal Costs						
PV Unit Cost ($/W)	$10.12	$11.39	$5.64	$5.84	$9.84	$5.66
Base Yr-0 Purchase Cost, PV	$363,000	$188,000	$398,000	$1,686,000	$612,000	$1,259,000
BESS Unit Cost ($/kWh)	$1,547	$1,515	$1,093	$854	$1,062	$900
Base Yr-0 Purchase Cost, BESS	$314,000	$308,000	$444,000	$1,040,000	$431,000	$914,000
Genset Purchase Cost	$305,000	$72,000	$397,000	$732,000	$307,000	$732,000
Microgrid Controller Cost	$295,000	$170,000	$377,000	$1,037,000	$405,000	$872,000
Total Yr-0 Purchase Cost (inc. soft costs & contingencies)	$1,384,000	$800,000	$1,755,000	$4,748,000	$1,890,000	$3,994,000
ITC Incentive	$193,000	$142,000	$238,000	$752,000	$293,000	$602,000
PPA Proposal Costs						
PV PPA Rate ($/kWh)	$0.3788	$0.4167	$0.3190	$0.2863	$0.3578	$0.2457
BESS PPA Capacity Payment ($/kW-mo)	$60.46	$107.75	$39.38	$28.78	$69.94	$38.03
Genset Purchase Cost	$305,000	$72,000	$397,000	$732,000	$307,000	$732,000
Yr-1 PPA PV Payment	$20,000	$10,000	$35,000	$101,000	$30,000	$78,000
Yr-1 PPA BESS Payment	$73,000	$65,000	$95,000	$190,000	$84,000	$205,000

Appendix A.7

Private Investment in Public EV Parking Spaces Policy Memo

October 2025

Prepared For:

City of Santa Rosa

Prepared By:

NV5

Source: Santa Rosa Downtown District

NV5

Sofia Kyle, AICP
Arthur Tseng, PE
James Clavelli, PP, AICP

NV5 PROJECT 5980824-2304101

EXECUTIVE SUMMARY

The City of Santa Rosa has engaged NV5 to evaluate mechanisms to further the City's goal of facilitating private investment of public facing electric vehicle (EV) charging infrastructure located in the public right-of-way. This memorandum recommends strategies to further this goal. While the memorandum's findings are focused on curbside EV chargers, these findings are generally equally applicable to other siting options, such as City-owned parking lots and garages.

This memorandum first provides a brief overview of the City's background including projected population growth and the growth of multifamily housing stock between now and 2050 (the planning period of the City's recently adopted General Plan). This section also examines recent policy relating to parking requirements in new multifamily and mixed-use developments.

This is followed by the methodology used to determine suitable recommendations, including the strategies that were identified and evaluated, the policy basis for the recommendations, and brief summaries of three informational interviews held by the team. The three interviews included two private companies that supply curbside EV charging units, and representatives from the City of San Francisco that implemented a curbside EV charging pilot program, and Santa Rosa's Parking Division.

The memorandum then provides four recommendations, including:

1. A framework for impact fees
2. Recommendations relating to facilitating private agreements between private providers and private property owners
3. Developer agreements
4. Zoning recommendations

The memorandum ends with a brief discussion regarding public chargers on municipally owned properties and two general recommendations that are applicable to any of the strategies included herein: public engagement and incentivizing clean energy usage.

Source: Santa Rosa, CA Official Website

PLANNING FRAMEWORK

Cities across the U.S. are rapidly preparing for a future where EV charging becomes a standard part of urban life. With surging electric vehicle adoption, municipal leaders are rethinking zoning, infrastructure, and partnerships to ensure equitable and resilient charging access. Fast-paced changes in charging technologies, plug types and cords, and ADA compliance standards mean permitting and regulatory frameworks need to have future thinking updates that allow cities to keep pace. Cities are positioning themselves for flexibility—ready to adapt to the market's evolving needs while supporting long-term growth. This requires strategic planning that balances the need for speed with thoughtful selection, coordination with utilities, and new approaches to accessibility, all while laying the foundation for future resilience as new technologies emerge.

Through the EV Infrastructure Masterplan development process, the City of Santa Rosa identified the need for a plan to encourage private investments in EV charging. The process of positioning the City of Santa Rosa to have both the long-term strategic planning as well as the flexibility to adapt to quick changes in the EV charging market will require the coordination and collaboration of multiple agencies.

Below is a possible structure that the City may follow to enact the recommendations in this memo.

DEVELOP A TASK FORCE

To drive the success of public EV charging in Santa Rosa, the city should establish a dedicated "Public EV Charging Task Force". This group should include representatives from relevant city agencies including, but not limited to, Planning and Economic Development's Planning, Building, and Economic Development divisions, the Parking Division, and Transportation and Public Works, as well as external partners such as utilities and private EV charger providers. The Task Force will serve as the central coordinating body, ensuring all stakeholders share a unified vision and streamlined communications.

DEFINE ROLES

For any cross-departmental initiative—like Santa Rosa's public EV charging rollout—roles should be defined to streamline decision-making, avoid overlap, and ensure accountability. Key areas to address include:

- Project Lead / Coordinator
- Stakeholder and Public Engagement
- Zoning
- Procurement and Contracting
- Permitting
- Legal
- Compliance
- Monitoring and Evaluation
- Environmental Impact and Air Quality Specialist

ENGAGE OTHER AGENCY PARTNERS

The Task Force should engage with other agency stakeholders early in the planning process. These other agencies include, but are not limited to, Sonoma County Transportation Authority (SCTA), Metropolitan Transportation Commission (MTC), Pacific Gas and Electric (PG&E), Sonoma Clean Power, and the County of Sonoma. Engaging other agencies may help to reduce regulatory overlap, preempt technical issues, and to learn from other jurisdictions that may have implemented programs like what Santa Rosa is envisioning.

CREATE A TIMELINE

The Task Force should create a timeline for the development and implementation of methods to encourage private led EV charging. The timeline should include tasks such as:

1. Select planning tools to use
2. Get public input
3. Collaborate to implement a system
4. Evaluate success

BACKGROUND AND CONTEXT

Introduction and Purpose: The City of Santa Rosa has engaged NV5 to evaluate mechanisms to facilitate private investment of public electric vehicle parking spaces located in the street right-of-way. Through discussions with various stakeholders, we identified curbside EV chargers as a viable option for this purpose. The City would like to investigate how to prioritize these efforts in the sections of Santa Rosa that have been developing, or are planning to develop, more multifamily housing, and underserved areas that are also "EV Charging Deserts". The recommended policy options are only recommendations and in no way constitute past, current, or future policy in Santa Rosa.

Project Context: This memorandum is one component of Santa Rosa's Citywide Electric Vehicle Infrastructure Master Plan, which is currently in development. The Electric Vehicle Infrastructure Master Plan is a project with three phases. The first two phases focused on fleet charging for the City's municipal fleet vehicles. This memorandum is part of Phase 3: Private Development Policy.

Community Background: The City of Santa Rosa, located in Sonoma County in the state of California, has experienced substantial growth in the 21st century. Its population increased from 147,532 in 2000[1] to 177,216 in 2023[2], a 20% increase. The population increase outpaces Sonoma County (5.89%), California (15.85%), and the United States as a whole (18.11%) during the same period. The City's most 2023-2031 Housing Element (Housing Element) includes Association of Bay Area Governments (ABAG) projections that the City's population will grow to 204,765 residents in 2030, and 223,060 residents in 2040[3].

The City of Santa Rosa, and the State of California generally, is prioritizing housing development to address the State's housing affordability crisis. The City's General Plan 2050 indicates that in 2019 the City had 75,850 housing units, and the General Plan is designed to facilitate housing growth through land use policy that leads to a projected build-out of 24,090 new units by 2050, for a total of 99,940 units[4]. The City's vision for housing is articulated in the Housing Element:

> *It is the overall housing vision of the City of Santa Rosa to create housing opportunities that enhance affordability, equity, livability and sustainability by remedying discriminatory housing practices and creating a city with a range of housing types, sizes, and costs in close proximity to jobs, transit, amenities, and services. In keeping with a fundamental belief that housing is a human right, the City will work towards ensuring that housing stability and affordability is provided to all residents.*

Development that realizes this vision tends toward higher densities in areas accessible to public transit, therefore increasing the number of housing units and reducing the need to utilize personal automobiles. Furthermore, the City aims to reverse exclusionary practices that have led to some residents benefiting from economic growth and property valuation while others have experienced

[1] Table DP1 of the 2000 Decennial Census, accessed via www.data.census.gov.
[2] Table DP05 of the 2023 ACS 5-Year Estimates Data Profile, accessed via www.data.census.gov.
[3] Table 3-1 located on page 3-2 of the City of Santa Rosa 2023-2031 Housing Element, adopted February 14, 2023, and revised to June 3, 2025.
[4] Table 1-2 located on page 1-16 of the City of Santa Rosa General Plan 2050.

higher cost and declining economic prospects. In short, the City is planning for an increase in housing development, including affordable housing, in a manner that is sustainable.

The City has, since 2019 (the year of record in the 2050 General Plan for existing housing stock), constructed or approved more dense development near public transit. This development strategy is crucial to the City meeting its housing and sustainability goals. An example of this type of development is the approved "The Flats @ 528B" mixed-use development located in Downtown Santa Rosa. Per the development narrative:

> *Parking for the Flats @ 528B is accommodated in the adjacent City owned parking garage structure #1 which is immediately east of and adjacent to the project site. Residents and employees of the ground floor office will have parking passes for the City-owned garage. However, office users and apartment residents along with visitors will be encouraged to walk, bike, and use alternative modes of transportation given proximity to downtown and related services.*

Elevations and Site Plan for The Flats @ 528B

This method of development is intended to reduce the use of automobiles and reserve more of the City for residential and nonresidential development, rather than space reserved for parking, by utilizing existing parking assets and leveraging proximity to public transit[5]. While this is considered good planning and in line with the City's General Plan goals, **it has resulted in the unintended consequence of not promoting publicly and privately available charging locations for electric vehicles.** While the City is succeeding in incentivizing alternatives to automobiles, it may be limiting one tool for reducing pollution and greenhouse gas emissions (GHGs), namely, the adoption of EVs in place of traditional automobiles.

Purpose of Memorandum: The slate of recommendations presented in this memorandum are intended to serve as options to inform policymaking decisions by the City's governing body to facilitate private investment in public, curbside EV charging stations in a manner that is in line with

[5] As of January 1, 2024, and pursuant to §65863.2 of the Government Code of the State of California, *A public agency shall not impose or enforce any minimum automobile parking requirement on a residential, commercial, or other development project if the project is located within one-half mile of public transit.*

the City's vision and goals as articulated in the General Plan 2050 and the 2023 – 2031 Housing Element.

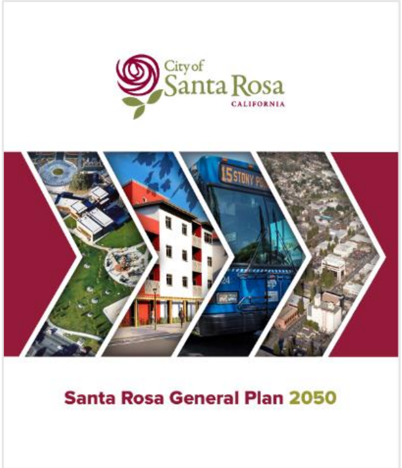
METHODOLOGY

Identifying and Evaluating Strategies: This memorandum recommends the utilization of planning tools available to the City of Santa Rosa that are authorized by the State of California to incentivize private investment in public electric vehicle charging stations for use in the City of Santa Rosa. The planning tools are indicated in the following table:

Table 1: Planning Tools Identified and Evaluated in the Memorandum
Impact / Development Fees
Facilitate private agreements between EV charger providers and private property owners to install publicly accessible EV chargers in the public right-of-way
Developer Agreements
Zoning regulations

Each of these policies will be evaluated to determine feasibility, implementation, and effectiveness.

Policy Basis: While different strategies are presented herein, they all share one commonality, any land use regulation passed by the City must be consistent with the City's General Plan. To that effect, the policy basis for the strategies proposed herein relies on the following sections of the City's General Plan (note that this list is not exhaustive):



1. Community Vision. The Community Vision includes 13 ideals, of which six (6) apply to the proposals herein. These include:

    - **Just** – Social and environmental justice are achieved for everyone. If EV charging stations are planned in an equitable matter that prioritizes Equity Priority Areas, it conforms to this ideal.
    - **Sustainable** – Available EV charging stations makes driving EV vehicles more convenient, increasing likelihood of transitioning from vehicles powered by fossil fuels.
    - **Connected** – Increased adoption of EVs will lead to cleaner air, increased equity, and resiliency against climate change.
    - **Healthy** – Reducing pollution and GHGs makes for healthier communities.
    - **Equitable** – Ensuring equitable distribution of EV infrastructure provides access to meet the energy needs of all residents.
    - **Successful** – Equitable distribution of infrastructure facilities growth throughout the City.

2. Discouraging Travel by Automobile. Policy 2-2.3 states "*Maintain close land use/transportation relationships to promote multi-modal transportation and discourage travel by automobile in all private development, capital improvement projects, and area plans.*"

    - This memo does not recommend including public curbside EV charging stations Downtown or in Transit-Oriented Communities. Furthermore, this policy is part-and-parcel with reducing or eliminating onsite parking requirements and reserving specific spaces for EVs. This memo recognizes that shrinking overall automobile use is a goal of the City, however, to meet sustainability goals, it is recommended that the City facilitate transition to EVs even as the City seeks to shrink the overall number of trips taken by residents in automobiles.

3. Level of Service. Policy 3-4.2 states "*In areas other than downtown, strive to meet intersection LOS D to maintain adequate operation of the street network and minimize cut through traffic on residential streets.*"

    - While the recommendations herein do not further this policy, we take this policy to mean that, outside of Downtown, there is a recognition that automobiles will be in use through the course of the General Plan's life cycle. As such, it is recommended that the City facilitate transition to EVs to the greatest extent possible, including by facilitating private development of public charging infrastructure, to further the goals of the General Plan relating to improving air quality, reducing greenhouse gas emissions, and mitigating noise.

4. Noise. Action 5-7.6 states "*Consider updating the Municipal Code to require new development to provide buffers other than sound walls and allow sound walls only when other techniques would not prevent projected noise levels from exceeding adopted land use compatibility standards.*" Additionally, page 5-53 recognizes that automobiles (including cars, trucks, and buses) are noise generators.

    - EVs are quieter than gas-powered vehicles, and there is evidence that mass adoption of EVs may be as effective in reducing noise-pollution in areas adjacent to roads as sound barriers6. Facilitating a transition to EVs by improving access to charging infrastructure would create an environment more attractive to EV adoption, therefore potentially helping the City meet its General Plan goals relating to noise.

5. The City's Greenhouse Gas Reduction Strategy. The City prepared a Community-Wide Greenhouse Gas Reduction Strategy which was adopted as part of the General Plan as Appendix A. This is an update and replacement of the City's 2012 Community Climate Action Plan (CCAP). Table 13 in the document includes 5 Objectives which are implemented by 17 new Measures, including the following Objective, Measure, and Municipal Program which are relevant to the strategies recommended herein:

[6] *The Traffic Noise Externality: Cost, Incidence and Policy Implications*. Enrico Moretti and Harrison Wheeler. June 2025. Page 3. Accessed via University of California, Berkely Econometrics Laboratory (EML).

Objective: Decrease community-wide vehicles miles traveled (VMT) and increase the use of zero-emission vehicles and equipment.

Measure 5: Accelerate the adoption of zero-emission light-duty and heavy duty-vehicles.

Municipal Program 5.1: Expand installation and operation of electric vehicle charging stations on City properties, including curbside in areas of the community where other options are limited[7]*.*

INTERVIEWS

In preparation of this memorandum the project team, including both NV5 and staff from the City of Santa Rosa, held informational interviews with two private companies that provide electric vehicle charging equipment and one with representatives from the City of San Francisco. The interviews were held with:

1. Voltpost. The project team met with *Voltpost* on July 14, 2025. We met with several members of their team, including both co-founders. The *Voltpost* team described their model and technical specifications.

    a. Model: The Voltpost team indicated that their charging equipment is typically funded through incentives or grants, or are paid for by the City. These funds pay for the equipment and installation, while the City or Agency operates the equipment.

    b. Technical Specifications: These devices are installed on a utility pole from which they draw power. The units have retractable cables which plug into vehicles to charge.

2. It's Electric. The project team met with *It's Electric* on July 15, 2025. We met with Shannon Dulaney (Director of Public Affairs) who described the *It's Electric* model and technical specifications of their equipment.

    a. Model: *It's Electric* partners with private property owners to install public chargers that utilize energy from the property owner to charge electric vehicles. The property owner obtains passive income by providing power to the charger, and *It's Electric* pays for and installs the equipment and facilitates permitting through the appropriate agency(ies).

    b. Technical Specifications: The chargers are similar in size to a parking meter. The charging pedestals do not have charging cables. Instead, drivers can request a cable from the company. Drivers will then store the cable in their vehicle and use it to plug in when using the charger.

---

[7] This proposed community program also references General Plan Action 3-6.37 which states "*Expand installation and operation of electric vehicle charging stations on City properties, including curbside in areas of the community where other options are limited*."

3. The City of San Francisco. The project team met with three representatives from the City of San Francisco on July 22, 2025, including Patrick Rivera from SF Department of Public Works (SFDPW), Nicole Appenzeller from SF Environment (SFE), and Broderick Paulo from SF Municipal Transportation Agency (SFMTA). They provided the following insight into the City's experience with public, curbside EV charging:

    - Developed a curbside charger pilot program, which included developing a map to identify key site criteria.

    - Permit process was developed through the Office of Emerging Technology, which was created to allow for new technology to be implemented in the city for which existing agencies or departments may not have had the capacity to permit.
        - This still involves several City agencies, including SFE, SFMTA, and SFDPW.
        - The City Attorney's Office served as a resource and advisor in the process.
        - The San Francisco Public Utilities Commission (SFPUC) was also involved.
        - The Emerging Technology permit is a short-term solution. To scale the program, another permanent permit process is required.

    - The Emerging Technology Permit prohibits obstruction of transit and bike lanes, and is required to meet accessibility requirements.

    - Accessibility requirements include:
        - One charger at each location must be accessible to drivers with disabilities in accordance with the Americans With Disabilities Act (ADA).
        - Curb ramp access must be within twenty feet of the vehicle and must not be used for active uses like driveways.
        - Vertical obstructions (bike racks, trash cans) are not permitted on the sidewalk.
        - Point of Sale (POS) systems and screens must be accessible.

    - Through a charging demand study, the City identified key underserved communities and prepared a zip code level map to use as a guide to increase EV chargers in underserved locations.

4. Santa Rosa Parking Division. The project team met with Santa Rosa's Parking Division, on July 28, 2025. Santa Rosa Parking shared the following insight on EV charging in City-owned parking garages:

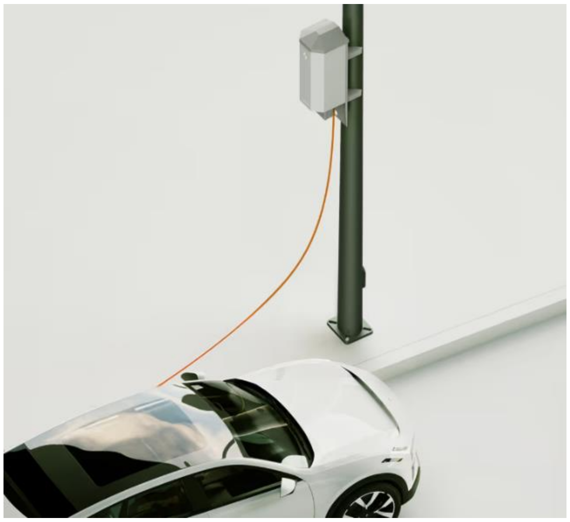
    - Parking previously executed a contract with Tesla for the installation of EV chargers in City-owned garages. However, due to grid infrastructure limitations with PG&E, the project was canceled. Parking staff are actively collaborating with Tesla to identify alternative locations within city limits and are also exploring potential partnerships with the County for sites outside city boundaries.

    - Parking successfully completed a project in coordination with the PG&E EV Fleet Program, resulting in the installation of four Level 2 dual-port chargers at Garage 9. These chargers are now operational and designated for Fleet use.

- Parking is in the process of finalizing a contract with PG&E under the Rule 29 Program. Construction is scheduled to begin this fall at Lot 10 (730 5th Street), with plans to install four Level 2 dual-port chargers and two Level 3 DC fast chargers. These chargers will be publicly accessible upon completion.

- In collaboration with the City's Planning Division and the Metropolitan Transportation Commission (MTC), Parking has participated in the Equitable EV Charging Workgroup and the Charge Smart Cohort. These efforts have led to the city earning a Gold Status Designation, which will be formally awarded in November.

It's Electric EV Charging Station
Source: It's Electric via Car and Driver



Rendering of Voltpost Charger
Source: Voltpost

RECOMMENDATION 1: IMPACT / DEVELOPMENT FEES

One method of facilitating private development of public curbside EV charging stations is through the imposition of impact fees to fund public infrastructure. The California General Code includes statutory requirements for the imposition of impact fees, also referred to as a "Nexus".

This section provides a framework for the imposition of impact fees for funding public curbside EV charging stations.

UTILIZING AN IMPACT FEE

Pursuant to ***§66001 of the California General Code***, the following is required for "*establishing, increasing, or imposing*" an impact or development fee:

1. *Identify the purpose of the fee.*
2. *Identify the use to which the fee is to be put. If the use is financing public facilities, the facilities shall be identified. That identification may, but need not, be made by reference to a capital improvement plan as specified in Section 65403 or 66002, may be made in applicable general or specific plan requirements, or may be made in other public documents that identify the public facilities for which the fee is charged.*
3. *Determine how there is a reasonable relationship between the fee's use and the type of development project on which the fee is imposed.*
4. *Determine how there is a reasonable relationship between the need for the public facility and the type of development project on which the fee is imposed.*

<u>Purpose</u>. The fee will be used to install public, curbside EV charging stations. The fee should be applied pursuant to §66007(c)(2)(a)(ii)(I)(id), which includes the category of public improvement for which the fee may apply:

Roads, sidewalks, or other public improvements or facilities for the transportation of people that serve the development, including the acquisition of all property, easements, and rights-of-way that may be required to carry out the improvements or facilities.

<u>Use</u>. Currently, the use of the fee is not identified in the General Plan. It is recommended that the City develop a Capital Improvement Plan (CIP) as the policy tool for planning the prioritization and distribution of public, curbside EV charging stations.

<u>Reasonable Relationship</u>. It is recommended that the fee be applied to all multifamily, mixed-use, commercial, and industrial development in the City. As indicated in §66001(b), the imposition of the fee is required to:

> *In any action imposing a fee as a condition of approval of a development project by a local agency, the local agency* ***shall determine how there is a reasonable relationship between the amount of the fee and the cost of the public facility or portion of the public facility attributable to the development on which the fee is imposed****.*

Anecdotally, the NV5 team understands that these types of development generate additional automobile traffic, including from electric vehicles. Due to state policy limiting or restricting onsite parking requirements near transit, and the City waiving certain parking requirements for multifamily and mixed-use development, new residents with EVs are unable to charge their vehicles onsite. Additionally, while NV5 does not have data to support this at this time, there is a potential unintended consequence of discouraging broader EV adoption due to a perceived or real lack of EV charging infrastructure. A growing population combined with policies discouraging personal vehicle transportation is resulting in a shortage of EV charging infrastructure. The City may remedy this shortage through the planning and regulatory tools at its disposal, including using impact fees.

Additionally, gas powered automobiles generate noise and greenhouse gas emissions. This infrastructure improvement incentivizes EV usage, reducing auto generated noise and automobile-generated GHG emissions, in line with the City's existing policies as indicated in the Methodology section of this report.

IMPLEMENTATION

Where Should The Fee Apply? Collection of fees should apply to all the designated development types regardless of where in the City they are developed. The installation of the public, curbside EV charging stations should be prioritized. It is recommended that prioritization occur as follows:

1. Equity Priority Areas[8]
2. Priority Development Areas
3. Zones where medium-high density residential and mixed-use development is permitted
4. Areas that overlap one or more of the preceding categories, with priority given to those that overlap with all three categories, or with category 1 and any of the other two (2) categories.
5. The rest of the City where on-street parking is located, excluding:
    a. Downtown – the General Plan states that additional automobile use downtown is discouraged, and furthermore, the City has a program of installing EV charging stations in parking garages, which appears to be a better solution Downtown.
    b. The North Station Area (a Transit-Oriented Community along with the Downtown as defined by the Metropolitan Transportation Commission) where additional automobile use and auto-oriented infrastructure is discouraged.

Tuxhorn Drive in the Amorosa Village Development has roughly 360 feet of frontage on the north side of the street.
Source: LandDesign Construction and Maintenance

[8] The City has defined and mapped "Equity Priority Areas" on pages 2-5 to 2-11 in the City's most recent General Plan.

Downtown and the North Station Area comprise large portions of the City's Priority Development Areas and include large segments of the City's Equity Priority Areas. While it may seem counterintuitive to impose the fee in these areas where the chargers will not be installed, they will receive the benefits of the proliferation of public, curbside EV charging equipment. Benefits include reductions in air pollution, greenhouse gas emissions, and noise throughout the City. Additionally, the City projects population growth through the lifespan of General Plan 2050. As the City continues to grow, new residents that have EV cars may park in certain portions of the City where charging infrastructure exists, but will likely still patronize the Downtown and North Station Areas. The City maintains a goal of growing multimodal transportation, and EV owners are as likely as other residents to utilize a bicycle or walk to reach Downtown. The City is also installing EV charging equipment in parking structures in the Downtown and North Station Area to accommodate EV drivers. By making the City more conducive to EV vehicles overall, it creates more opportunities for more residents to settle in the City, continuing the growth of the City economically. A City that is conducive to EV charging will incentivize new and current residents that continue using personal automobiles to switch to EVs, therefore furthering the City's goals relating to greenhouse gas emissions, air quality, and noise.

It should also be noted that the growth of Downtown and the North Station Area makes the City more attractive to visitors and new residents by creating vibrant, accessible, walkable neighborhoods. To accommodate these new residents and visitors, it is logical that all development in the City support an infrastructure program that will help the City to grow in an environmentally sustainable manner, which includes the proliferation of public, curbside EV charging equipment.

How Should the Fee be Determined? While this memo does not estimate the cost of installation, it does recommend one manner of determining the fee. It is recommended that, through a CIP or other mechanism, the City determines how many curbside EV parking spaces it desires per street based on length of frontage, imposing the fee accordingly based on the amount of street frontage associated with a given development.

As an example, below is a possible equation for calculating the fee:

$$Impact\ Fee = \beta * Desired\ EV\ stalls\ per\ Foot\ (port/ft) * Development\ Frontage\ (ft) * Cost\ of\ Installation(\$/port)$$

Where β is equal to an adjustment factor that reflects the broader economic context influencing curbside EV charging deployment in the City.

How Should the CIP be Structured? It is recommended that the City identify a style of charger and any associated costs with installation, including utility connections, sidewalk repair, and other associated infrastructure improvements that may be associated with the installation, and include those elements in the CIP.

RECOMMENDATION 2: FACILITATE PRIVATE AGREEMENTS BETWEEN EV CHARGER PROVIDERS AND PRIVATE PROPERTY OWNERS

As described in the Methodology section of this report, the project team interviewed two private EV charger providers, *Voltpost* and *It's Electric*, and the City of San Francisco to understand potential public/private partnership models of implementing public, curbside EV charging infrastructure through private investment. This memo elaborates on the It's Electric model for illustrative purposes.

THE IT'S ELECTRIC MODEL

The *It's Electric* business model includes partnering with private property owners that provide electricity for public chargers on the curb along the property frontage. According to *It's Electric's* website, and insight gathered during the informational interview, the company inspects the property owner's building to determine compatibility, then pays for and facilitates permitting and installation of equipment. The charger provides a revenue share for the property owner, and *It's Electric* is responsible for maintaining the equipment.

What Responsibility Does Santa Rosa Have? Implementing this model reduces the work required on behalf of the City, and the City will not own, operate, or maintain the public chargers. It is recommended that the City update its building code and Zoning Ordinance to permit these kinds of projects prior to launching and permitting such a program. It is recommended that the City consider the following prior to implementing this model:

1. Determine where in the City these would be permitted. It is recommended that these are not permitted in the Downtown Area or North Station Area for the same reasons stated in the prior section of this report, e.g. existing high demand for on-street parking - curbside EV chargers would reduce availability of them.

2. Partner with the Provider to determine regulatory changes. Work with a provider to determine what permitting reforms can facilitate implementation and meet the goals and values of the City of Santa Rosa. Examples include:
    a. Determining how chargers can be ADA compliant
    b. Determining how chargers can be compliant with relevant fire code
    c. Creating a streamlined, clear permitting process that aligns with the City's interests while making it clear to install chargers
    d. Determining enforcement mechanisms for maintaining privately owned equipment within the public right-of-way

What are the Downsides to this Model? The downside to this model is that it relies on providers outside of the City's control to facilitate implementation.

Next Steps for Exploring This Model. The City will need to create a regulatory framework that allows private operators to maintain infrastructure on public property. The Task Force should engage the City Attorney's Office to determine a regulatory framework to facilitate this model. Additionally, the

City of Alameda has successfully implemented this model. It is recommended that the City's Task Force contacts the City of Alameda to learn from their experience in implementing this model.

ADDITIONAL MECHANISMS

The previous two mechanisms appear to be the most feasible mechanisms for facilitating private investment in public, curbside EV charging stations. However, the following two mechanisms may also, upon further study, prove viable options to further the City's goal:

1. Zoning regulations
2. Developer agreements

ZONING REGULATIONS

The City may explore making the inclusion of public, curbside EV charging stations a zoning requirement for certain types of development or in certain zones. This is a "hammer approach," and would be more expensive for developers than other right-of-way improvements typically required, like street trees or street furniture.

This approach may result in more chargers being installed than the impact fee approach, but it may also be a considerable expense to developers – rather than spreading the cost throughout the City to fund targeted charger installations, developers would instead be required to install charging infrastructure at their sites. Additionally, this would result in chargers being installed when and where development occurs, rather than in prioritized locations chosen by the City and funded through the impact fee. Finaly, unlike the "It's Electric" model, these chargers would be operated and maintained by the City of Santa Rosa, introducing an additional layer of responsibility to the City.

DEVELOPER AGREEMENTS

Developer Agreements may prove a successful avenue for installing public, curbside EV charging stations. Because these agreements tend to be negotiations between the City and private property owners, there are possibilities that can occur during the negotiation process that may result in installation of chargers.

The downside to this approach is that each agreement is unique, outcomes are not guaranteed, and opportunities are only available when and if there is a willing property owner. This would not be a programmatic approach. If the City considers utilizing this mechanism, it is recommended that it be used as one tool within a toolkit of possible tools for furthering the City's goal.

SITING EV CHARGING EQUIPMENT IN MUNICIPAL GARAGES AND ON MUNICIPAL PROPERTIES

MUNICIPAL GARAGES

While this memorandum focuses on encouraging private EV charging development in the public right of way – i.e. curbside charging, a version of this public-private partnership model is already utilized by Santa Rosa's Parking Division in City-owned garages. For example, parking is actively exploring a partnership with Tesla and Sonoma County to install Level 3 DC fast chargers in City-owned lots and garages for public use. In Garage 9, Parking installed four Level 2 dual-port chargers in collaboration with PG&E, the Metropolitan Transportation Commission (MTC), and Communities in Charge. In Lot 10, construction is set to begin for four Level 2 dual-port chargers and two Level 3 DC fast chargers. This project is designed to support increased demand for EV infrastructure in the area, including the nearby multifamily developments at 420 Mendocino Avenue and 425 Humboldt Street.

Adding EV chargers in City-owned garages and parking lots can address the lack of EV charging opportunities in dense urban areas (charging deserts) where curbside EV charging equipment is discouraged.

MUNICIPAL PROPERTIES

The City may consider installing EV charging equipment in surface or structured parking lots located on municipal properties or along the street frontage of municipally owned properties. This may be especially beneficial if and where municipal properties overlap with Equity Priority Areas.

The use of municipal property frontage may serve as a suitable area to pilot the City's chosen private charging model, such as *It's Electric* or *Voltpost*. Additionally, where curbside chargers are typically level 2 chargers, if the City were to make parking spaces in municipal lots available for public use, the City can explore partnering with companies that provide Level 3 fast chargers to provide a faster and more convenient experience for residents.

Santa Rosa Municipal Garage 9
Source: Google Maps Streetview (May 2024)

GENERAL RECOMMENDATIONS

PUBLIC OUTREACH

It is generally recommended that, if the City embarks on any mechanism of installing public, curbside EV chargers, that the City engage the public, including both residents, business owners and the development community, as part of developing the program.

- Determine demand. The City should determine the demand (location, quantity) for public, EV charging stations prior to implementation of any plan to install chargers. If the demand is sufficient to warrant advancing the program, the City should continue public and stakeholder outreach.

- Involve City staff and stakeholders. Santa Rosa should engage with staff and community stakeholders to create a map where on-street curbside chargers or off-street chargers are more appropriate. Obtaining feedback from residents that may desire these improvements or those that may object should help pave the way for a smoother process and a more targeted approach.

INCENTIVIZE CLEAN ENERGY USAGE

To the extent that it is feasible, it is recommended that the City operate any program or initiative to install public, curbside EV charging stations in tandem with incentives to generate power or obtain power from clean energy sources, such as those provided by the Sonoma Clean Power Authority's EverGreen. EVs will reduce tailpipe air pollution in Santa Rosa. Air pollution will be further reduced if the power generated to charge EVs is from clean sources as well.

Sonoma Clean Power's Advanced Energy Center Storefront Located on 4th Street in Santa Rosa

NV5