Municipal Clean Fleet Planning Guidance

Driving to Net Zero

Submitted to: Santa Clara County **Submitted by: ICF**	**County of Santa Clara Office of Sustainability**
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1 Introduction

This task of the Santa Clara Driving to Net Zero project is concerned with the development of tools and guidelines to help the partner jurisdictions attain their fleet electrification goals. ICF, the consultant working with the County on this project, initially approached this task by addressing three broad areas, namely:

- Gathering information of clean fleet goals and needs/challenges
- Developing a comparative vehicle lifecycle (or total) cost analysis
- Creating short- and mid-term implementation plans that can include initiatives such as procurement policies, infrastructure planning and other

This approach is visualized in the schematic in Figure 1, which shows how the understanding of clean fleet goals, and fleet needs and challenges, along with the economic analysis of electric vehicle assets vis-à-vis conventional combustion technologies feed into the process of developing implementation plans.

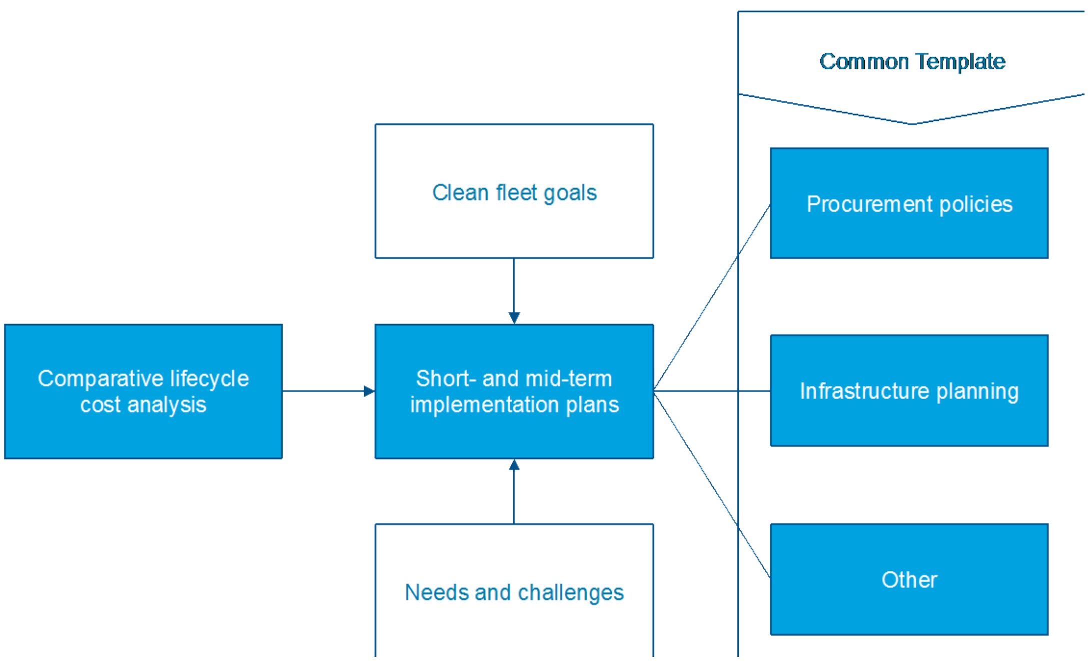

Figure 1. Visualization of the process to develop a fleet electrification plan

Figure 1 clearly suggests that completing this task requires an interdisciplinary approach, combining techno-economic analysis with fleet managers and stakeholders' engagement. Starting with the latter, ICF conducted one-on-one phone conversations with contact points in each of the partner jurisdictions and their respective fleet leads. The conversations had multiple objectives, primarily to understand expectations and to elicit opinions and obtain information on a variety of relevant areas. In the next section, we present an overview of the first round of conversations.

2 Overview of Interviews with DNZ Partner Leads and Fleet Managers

As a first step, ICF worked with the jurisdiction leads to identify their respective fleet contacts and scheduled a round of interviews with each of the jurisdictions. To respect the privacy of these conversations, we summarize here not the individual, but the general takeaways from these interviews as a group. We organize these takeaways into two tables, one collecting information about the general context of fleets and their motivations (Table 1) and one collecting their needs and expectations (Table 2).

Table 1. Initial survey of fleet context and motivations

Category	Highlights
Fleets composition and adoption	▪ Fleet composition is dominated by medium duty vehicles. Passenger cars, which offer the most immediate targets for EV adoption, generally represent a smaller share of the fleets. ▪ Fleets in partner jurisdictions have varying degrees of experience with EVs. Some cities have adopted a few EVs, either battery electric vehicles (BEV) or plug-in hybrid electric vehicles (PHEV).
Drivers and goals	▪ For some cities, the key institutional drivers for the adoption of EVs are their Climate Action Plans. ▪ Some cities have adopted fleet vehicle procurement policies that require to first give consideration to either alternative fuel vehicles, plug-in electric, or most-efficient models. ▪ No partner jurisdiction has yet adopted a formal fleet EV strategy or procurement requirement.

Table 2. Initial survey of fleet needs and expectations

Category	Highlights
User experience	▪ Fleet customers and fleet managers have varying attitudes toward EVs. ▪ The more noticeable areas of concern for users related to EVs have been vehicle range and size. ▪ Drivers are not used to charging vehicles, which leads to suboptimal results. For example, if they forget to charge plug-in hybrid electric vehicles, they are only used in hybrid mode.
Infrastructure	▪ Fleet drivers report that there is not enough charging infrastructure that is accessible to them. ▪ In many instances, stations are available but are being used. ▪ There may be a need for stations that are dedicated to support fleet operations.
EV economics	▪ Fleet managers are still trying to understand the economics of EVs, because vehicles have not been owned long enough and

Category	Highlights
	because the operation of these vehicles by drivers is still suboptimal. ▪ There is a clear need to educate vehicle users.
Need for assistance	▪ There is currently insufficient data available to fleet managers to help them plan the adoption of EVs. ▪ Some fleet managers identified a need for short- and long-term electric vehicle strategies. ▪ Some fleet managers, on the other hand, believe to be already in a good direction toward EV integration. ▪ Some fleet managers expressed a need for information on some of the EV options to replace aging passenger cars.

The information collected during these conversations was used to develop an agenda for a roundtable discussion, with the goal of bringing all partner jurisdictions to discuss as a group, with ICF facilitation, the challenges and priorities toward the electrification of fleets. This group discussion is the focus of the next section.

Roundtable Discussion: The DNZ Fleet Electrification Workshop

Santa Clara County hosted a half-day Municipal Fleet Workshop, as part of the DNZ project. The workshop took place on February 14th, 2017, with the attendance of representatives from Santa Clara County, City of Cupertino, City of Morgan Hill, City of Palo Alto, City of San Jose, and City of Sunnyvale.

The objective of this workshop was to continue the conversation with fleet managers and other staff, this time as a group, and collect their perspectives on the challenges and opportunities for the adoption of EVs by fleets in their jurisdictions. The workshop was organized around the following sessions:

- Introductions and description of the context
- Review of the stakeholder interviews conducted by ICF
- Identifying and prioritizing fleets' needs
- Identifying challenges toward meeting needs
- Discussion of deliverables and next steps

With ICF facilitating the discussion, participants shared their perspectives regarding challenges toward the adoption of EVs and indicated areas where they needed assistance to advance this process. ICF elicited input from DNZ fleet stakeholders on a set of questions, including:

1) The gaps toward meeting existing goals in each jurisdictions
2) Whether the DNZ project should strive to expand upon existing goals
3) The critical steps toward jurisdictions' goals
4) Issues that the project should prioritize
5) Areas of commonality across municipalities
6) Opportunities to integrate jurisdictions' needs into a plan for the region

After a productive group conversation, a number of issues facing fleets toward the adoption of EVs arose. We have organized these issues into several categories in the tables below.

Table 3. Issues that regional fleets currently face with EV deployment

Issue Category	Summary
EV value proposition	▪ The plug-in models currently offered in the market are small and compact passenger cars. This market offering is not well aligned with the needs of fleets, which predominantly need light-duty and medium-duty trucks. ▪ Some participants believe it make take longer than the life of the vehicle for EV to recover the upfront cost
Institutional barriers	▪ Cities need a full plan for the integration of EVs, in addition to a quantitative goal. The integration of EVs cannot be driven just the fleet—it has to be led by the City, including the needed budget allocations. ▪ The city goals/preferences regarding EV adoption are often disconnected from the funding allocated to vehicle procurement. ▪ Fire and police vehicles generally get priority for procurement, and there is limited opportunity for EVs in those fleet segements. ▪ Stronger institutional signals would be the best way to accelerate fleet electrification. An example of such signals could be city councils mandating the purchase of EVs. ▪ Because EVs often have a price premium relative to conventional vehicles, permission is required prior to proceeding with the procurement. This often results in long delays.
Driver barriers	▪ To certain driver groups, the currently EV models are unappealing and they are reluctant to drive them. This is, in great part, a question of image. ▪ It is proving difficult to get driver buy-in. ▪ Ideas were proposed to help with customer acceptance. These included finding drivers who are more willing to use an EV within the group, and then doing a staged or tiered implementation. ▪ In general, a more successful approach may be to introduce EVs into vehicle pools instead of assigning them directly to personnel.
Data barriers	▪ Fleet managers find it difficult to assess fuel costs in the future. They need to understand what is the return on the upfront premium cost of the vehicle (total cost of ownership). ▪ Fleet managers would find it helpful to obtain more data on the total cost of ownership and have modeling done, to make the business case for EV purchases.

Issue Category	Summary
	▪ There is interest in a sustainability assessment of the fleets and in exploring funding sources available to support the assessments. ▪
Other issues	▪ Fleets face a need for funding to install charging infrastructure. ▪ Procurement funds are not enough to cover the price premium of EVs. ▪ There is a need to better understand the impact that EVs will have on the electric bill of the facility. ▪ It is still unclear how EV adoption might affect safety emergency response (such as disaster response).

Following the workshop, ICF took steps to align fleet needs, as identified by the DNZ partner jurisdictions, with the deliverables of the fleet analysis. ICF organized the immediate fleet needs into the mind map below.

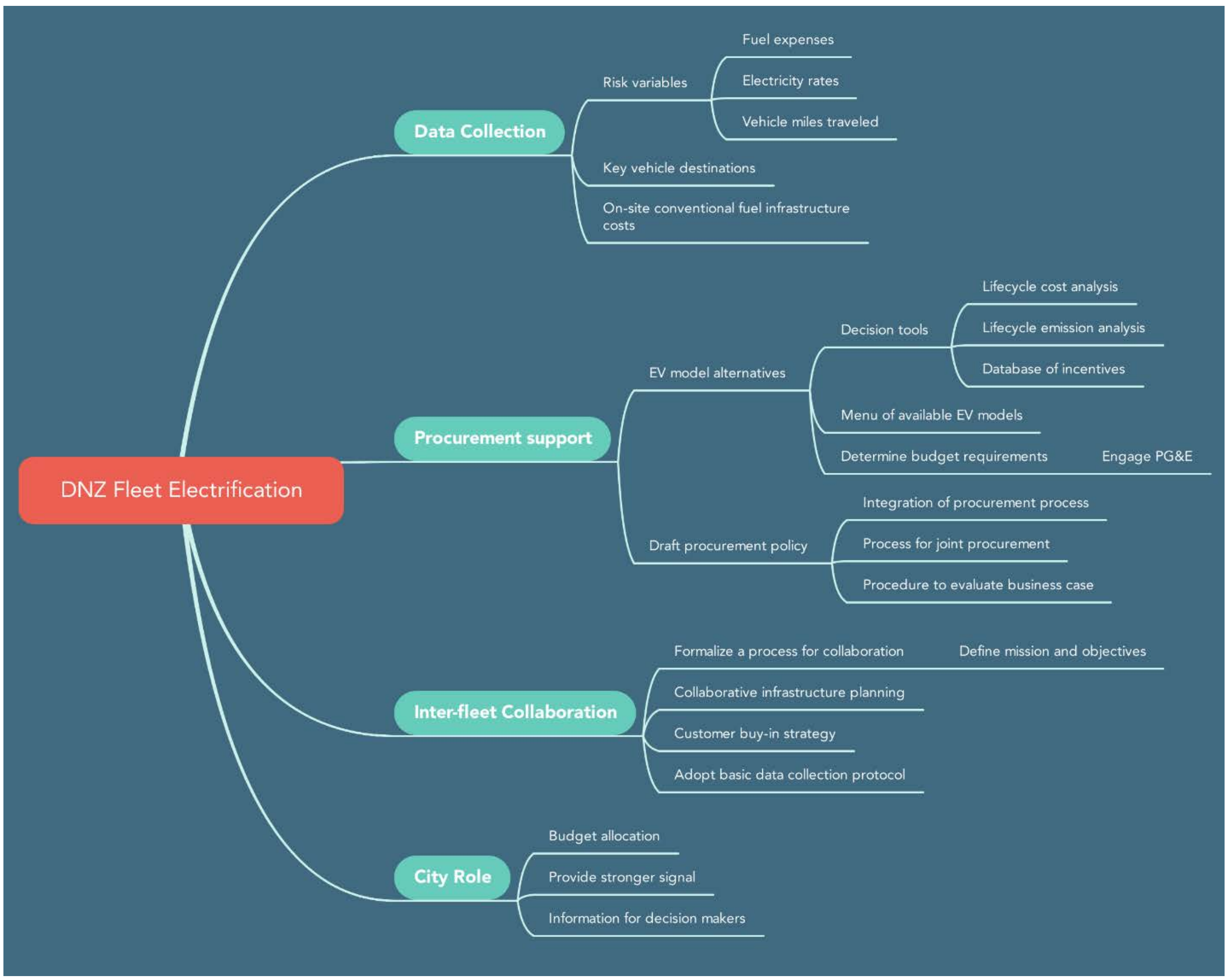

Figure 2. Mind map visualizing the immediate needs identified by DNZ stakeholders related to fleet electrification

3 Total Cost of Ownership

Analytical Background

Individual discussions with fleet managers and group discussions during the Fleet Electrification Workshop, showed that DNZ stakeholders universally believe that a central pillar of an EV fleet strategy is a robust assessment of the vehicle comparative cost of ownership. Over the last few years, multiple calculators have been developed by a range of organizations that yield estimates of cost of ownership. These calculators have various degrees of sophistication and many of them are available online. They all, however, suffer from important limitations. For example, none of these calculators offer the possibility to evaluate uncertainty and risk questions related to the assessment of EV vis-à-vis conventional vehicles, questions that DNZ fleet stakeholders expressed interest in understanding. A study conducted by the University of California at Davis and Logios (Burke, Collantes, Miller, and Zhao, 2015)[1] discussed the limitations of such calculators, which included:

- Ignoring risk and uncertainties;
- Not being adaptable to specific local economic and regulatory contexts;
- Not being comprehensive;
- Not accounting for the effect of time on the key variables;
- Using hypothetical (instead of real) vehicle configurations;
- Not accounting for local conditions (ambient conditions, road grades, typical traffic conditions, etc.);
- Ignoring comparative vehicle depreciation;
- Not designed to be integrated into program development.

ICF carried out an analysis that is responsive to DNZ stakeholder directions to provide fleet managers with results that are more defensible. Giving fleet manager estimates of total cost of ownership (TCO) that account for factors that are important to them in their evaluation gives them more confidence in their procurement proposals and arguments for EV additions to their fleets.

For this analysis, ICF adopted the modeling framework developed in the UC Davis study. That study, with support from the California Energy Commission, developed a TCO tool that is significantly better than earlier calculators. Among the improvements of this tool relative to earlier ones are:

- Allowing for comparisons across different vehicle platforms Accounts for local conditions (topography, driving conditions, etc.) in several areas in Northern California

[1] Burke, Andrew, Gustavo Collantes, Marshall Miller, and Hengbing Zhao (2015) Analytic Tool to Support the Implementation of Electric Vehicle Programs. Institute of Transportation Studies, University of California, Davis, Research Report UCD-ITS-RR-15-08. Available online at https://its.ucdavis.edu/research/publications/?frame=https%3A%2F%2Fitspubs.ucdavis.edu%2Findex.php%2Fresearch%2Fpublications%2Fpublication-detail%2F%3Fpub_id%3D2490

- Providing risk assessments by accounting for future trends on fuel price trends and volatility
- Incorporating estimates of depreciation for the various types of vehicles

For the following TCO analysis, ICF followed the approach taken by the UC Davis team. The model used real-world, GPS driving conditions in various areas of California, to use vehicle performance characteristics that more fairly represent local conditions. ICF choosing from the available duty cycles those that more closely reflect conditions in Santa Clara County. For more information on the characteristics of the model, the reader may refer to Burke, Collantes, Miller, and Zhao (2015).

In addition to the duty cycles, the model allows for the incorporation of other local conditions. For example, trends and variations in fuel prices, local and state taxes, available financial incentives, and other factors can be integrated into the modeling. We discuss some of these in more detail below.

The model uses stochastic modeling to obtain projections of fuel (both gasoline and electricity) prices during the years of ownership of the vehicles. This approach is taken to incorporate the impact of price volatility into the calculations. Price volatility was identified during the fleet workshop as an important factor making it difficult for fleet managers to set expectations about the lifecycle cost of ownership of vehicles that are procured. The trend and volatility of fuels are estimated using historical gasoline prices and electricity rates.

For the case of gasoline, we used prices specific to California, obtained from the California Energy Commission (CEC).[2] The data posted on the CEC website had some errors and missing values, and ICF communicated with CEC technical staff to fix the dataset. This updated dataset was used in the TCO analysis presented in this report. The historical annual prices of gasoline in the state are shown in Figure 3.

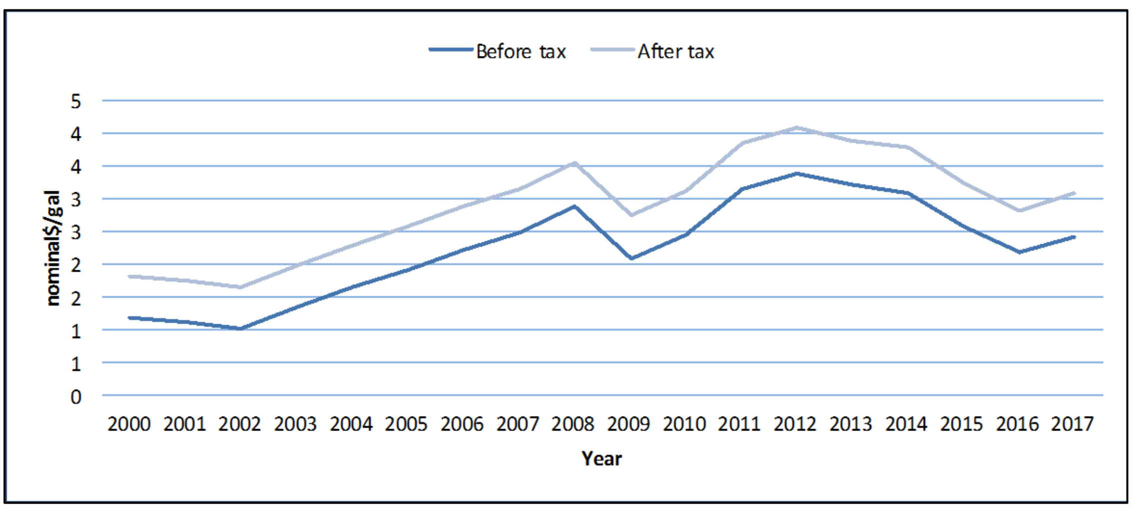

Figure 3. Historical annual gasoline prices in California, with and without applicable gas taxes

[2] Source: http://www.energy.ca.gov/almanac/transportation_data/gasoline/margins/index.php

For the case of electricity, ICF used historical average annual Pacific Gas & Electric rates, for commercial users (A-10).[3] In reality, each of the partner jurisdictions likely faces different rate structures, but the values we use are first approximations. Additionally, these rates do not take into account the opportunities for reduced rates arising from time-of-use (TOU) strategies or from the use of rates specifically designed by electric utilities for plug-in electric vehicles. In general, we consider the rates we use in the analysis to be representative of upper bounds in electricity costs. To expand on this concept: constraining the analysis to the case of TOU rates would give a narrower picture of expected costs, and thus we chose to use the more general case for our analysis (i.e. rates that are not in a TOU plan). By definition, these more general case gives more conservative results than rates designed to encourage charging within specific time windows. In general, conservative results should be more helpful to fleet managers on making a business argument for EVs than having optimistic estimates.

A Note on Gas Taxes

Another way in which the modeling was tailored to local conditions was using values of gasoline taxes applicable to the DNZ jurisdictions. To help with the transparency of our results, we include here a brief discussion of this questions.

The excise tax on gasoline is composed of the federal base of 18.4 cents plus the state tax. The state excise tax on gasoline is estimated as composed by the base rate of 18 cents, plus the 17.3 cents imposed in 2010 adjusted to the 2017 value of 11.7 cents, resulting from the application of the Fuel Tax Swap sales and use tax provisions. As described in Cal. Rev. & Tax. Code § 7360, starting on July 1, 2019, this adjustment will cease and the tax rate will return to the original value. Per Senate Bill 1 (passed on April 7, 2017) and codified in Cal. Rev. & Tax. Code § 7360, an additional tax of 12 cents will be applied each gallon of gasoline, starting on November 1st, 2017. We include this upcoming tax in the total excise tax.

The local sales tax on gasoline is calculated starting with the statewide tax rate of 7.25%, which includes a 6% state portion, a 1% city portion, and a 0.25% county portion. With the elimination of state portion following the Tax Swap, the sales tax rate is 1.25%. Most local jurisdictions in the state, however, have adopted additional district taxes. For San Jose, for example, this rate is 9.25%, while for the rest of the DNZ partner municipalities is 9%. Once district taxes are included, the sales tax is 3.25% for San Jose and 3% for the rest of the partner municipalities. To summarize, the local gasoline sales tax rates are calculated as the local sales tax rates minus 6%. Following Regulation 1598, the sales tax is applied to the price inclusive of (federal and state) excise taxation.

The model also accounts for a wide variety of input parameters, such as the manufacturer suggested retail price (MSRP), vehicle depreciation with time, the owner federal tax appetite, the cost of charging equipment, road tolls, paid parking events, and others. The model does not account for the costs associated with the infrastructure to dispense conventional fossil fuels. Fleet managers have identified these costs as possibly significant, but we were unable to obtain reliable data. Table 4 shows some of the key parameters used in the modeling for each of the vehicle types. These parameters do not change across scenarios. Many TCO calculators assume parametric values for other factors, such as fuel price. As discussed, our approach accounts for risk and volatility in fuel prices and thus we cannot report a single value for them.

[3] Source: https://www.pge.com/tariffs/electric.shtml#RESELEC

Table 4. Values used for a sample of the parameters that are included in the total cost of ownership model

Parameter	BEV	PHEV	Conventional ICE
Charging/refueling equipment	$565	$565	$0
Charging/refueling equipment installation process	$500	$500	$0
MSRP	$28,800	$34,999	$22,380
Most similar commercial model	Nissan LEAF	Chevy Volt	Chevy Cruze
Maximum federal tax credit	Up to $7,500	Up to $7,500	N/A
California Vehicle Rebate Project	$2,500	$1,500	N/A
Public Fleet Pilot Project	$10,000	$5,250	N/A

Simulations were conducted to estimate the total cost of ownership of a battery electric vehicle (BEV) similar to the Nissan LEAF, a plug-in hybrid electric vehicle (PHEV) similar to the Chevy Volt, and a conventional gasoline internal combustion engine (ICE) similar to the Chevy Cruze, under a variety of conditions. We use MSRPs of $28,800, $34,999, and $22,380, respectively. In particular, for the BEV we run two separate simulations for each scenario: one for the case in which the owner can claim the federal income tax credit in full, and one for the case in which no tax credit can be claimed. For the PHEV, we assume that all the savings from the federal tax credit are passed on to the fleet. Local governments do not file income tax, which is the reason why the case with no federal tax benefit is more appropriate when vehicle purchase is considered. When a vehicle lease is considered instead, the car dealer will typically work with the financing arm of the manufacturer to bundle the tax credit into a competitive lease offer. Our simulation reflects the optimistic case in which the lease offer passes the savings from the tax credit in full on to the leasee.

To calculate vehicle efficiency, we use a duty cycle representative of driving conditions between the peninsula and central Solano County, using a mix of street and highway conditions. Most of the duty cycle that we used is on highway conditions, which in general are less favorable to EVs, and in this sense it should be considered a conservative duty cycle. Fleet managers sometimes refer to trips to Sacramento as an example of longer distance trips which may be more challenging for EVs, and thus the route selected seems adequate. This TCO tool feeds the driving cycle into a model of vehicle dynamics to estimate the average fuel efficiency of each of the vehicle types considered. These are more representative of real-world efficiencies than the sticker efficiencies, as they account for local prevalent speeds, accelerations, and topography.[4]

[4] Burke, A, Collantes, G, Miller, M, and Zhao, H (2013) Analytic Tool to Support the Implementation of Electric Vehicle Programs. Available at https://itspubs.ucdavis.edu/wp-content/themes/ucdavis/pubs/download_pdf.php?id=2455 ; Collantes, G (2015) Accounting for risk shows

ICF estimated the total cost of ownership for five scenarios. The baseline scenario is defined by fleet vehicles that is a) owned for seven years, b) driven 12,000 miles per year, c) can claim the full extent of the federal tax credit, and d) can claim a rebate under the Clean Vehicle Rebate Program (CVRP). The last two conditions apply only to electric vehicles. We define the four additional scenarios varying the annual mileage (scenario 1), duration of ownership (scenario 2), the type of state rebate utilized (scenario 3), and the tax appetite to claim the federal tax credit (scenario 4). These scenarios are summarized in Table 5 below. Each of these scenarios is meant to describe the effect of varying one of the key factors in the TCO of the various vehicle types. In other words, these scenarios help answer the following questions:

- **Scenario 1**: How do the respective TCOs change when vehicles see lower utilization per year?
- **Scenario 2**: How do the respective TCOs change if they are owned fewer years? Or equivalently, what is the impact of variable cost factors, as opposed to capital expenditures, (CAPEX) on the progression of TCO?
- **Scenario 3**: What is the impact of replacing the CVRP with the PFPP on TCO?
- **Scenario 4**: How does the TCO of EV change when the buyer is not able to claim the federal tax credit?

Scenario 3 considers the case in which fleets are awarded the Public Fleet Pilot Program (PFPP). This rebate is available to fleets in pollution-burdened areas of the state. In Figure 9, we include a map of disadvantaged communities in the DNZ region, which helps identify which DNZ jurisdictions may qualify for PFPP. The map shows that San Jose, Santa Clara, and Morgan Hill may be eligible to apply for this rebate, which would enable fleets to own the EV and receive a rebate comparable to the combination of the federal tax credit and the state CVRP. Both the CVRP and PFPP are described in more detail below, in the section dedicated to financial incentives for vehicle electrification.

Table 5. Summary of the scenarios evaluated to estimate vehicle total cost of ownership

	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Duration of ownership	7 years	7 years	3 years	7 years	7 years
Annual vehicle mileage	12,000	6,000	12,000	12,000	12,000
State rebate	CVRP	CVRP	CVRP	PFPP	CVRP
Federal tax credit	$7,500	$7,500	$7,500	$7,500	$0

Analysis Results

The following section presents the results for each of the scenarios.

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plug-in vehicles are a smarter investment. Available at https://phev.ucdavis.edu/wp-content/uploads/2017/01/Collantes-vehicle-cost-of-ownership2.pdf

A Note on How to Read TCO Results

We present the results separately for each of the scenarios, in each case starting with the definition of the scenario, i.e. the value assumed for duration of ownership, annual vehicle mileage, and the applicable state rebate.

In the TCO models of which we are aware assume a single value for the cost of fuel (gasoline and electricity) and yield a single value for the estimate of cost of ownership. Because fuel prices change over time with a high degree of uncertainty, these results have little meaning and are of very limited value in informing fleet investments. The model we use accounts instead for such uncertainties, simulates many possible future conditions, and obtains a results for each of the simulations. The TCO is thus presented not as a single value, but as a *range* of possible values—technically, the results are probability distributions. To describe these ranges of possible values of TCO, we include in the tables below:

- The expected value: This is essentially the mean of results of all the simulations
- The extremes (min and max): These are the lowest and highest value obtained by the simulations. They are typically considered extremes because they are possible, but least likely
- The standard deviation: This gives a sense of the range of values. A small standard deviation indicates that values tend to be closer to the mean, while a larger standard deviation indicates that there is a wide spread of values.

The expected value, the extremes, and the standard deviation are shown in the first table in the results of each scenario and for each vehicle model. Each scenario shows a chart (histograms) that visualize these results. The histograms shows, in a visual way and for each of the models analyzed, how frequently our simulations yielded the TCO in the horizontal axis. For example, the peaks of the histograms correspond to the TCO values that were yielded more times in our simulations, and thus represent the TCO values that are more likely. The low part of the histograms, in contrast, show TCO values that are less likely. These less likely values are nevertheless important—they represent "extreme" events, for example big spikes in fuel prices which while unlikely, are possible.

Baseline Scenario

The Baseline Scenario is defined by the following parameter values:

- Duration of ownership: 7 years
- Vehicle miles driven: 12,000 miles per year
- State incentive: CVRP
- Federal tax credit appetite: $7,500

Running the model with these values yields the results in Table 6. The distributions of possible values of TCO for each vehicle type, as given by the model, are shown in Figure 4.

Table 6. Total cost of ownership results for the Baseline Scenario

	Chevy Cruze (ICE)	Chevy Volt (PHEV)	Nissan Leaf (BEV)
Expected	$45,786	$49,365	$40,460
Std Dev	$1,817	$332	$271
Min	$42,067	$48,459	$39,684
Max	$56,256	$50,632	$41,381

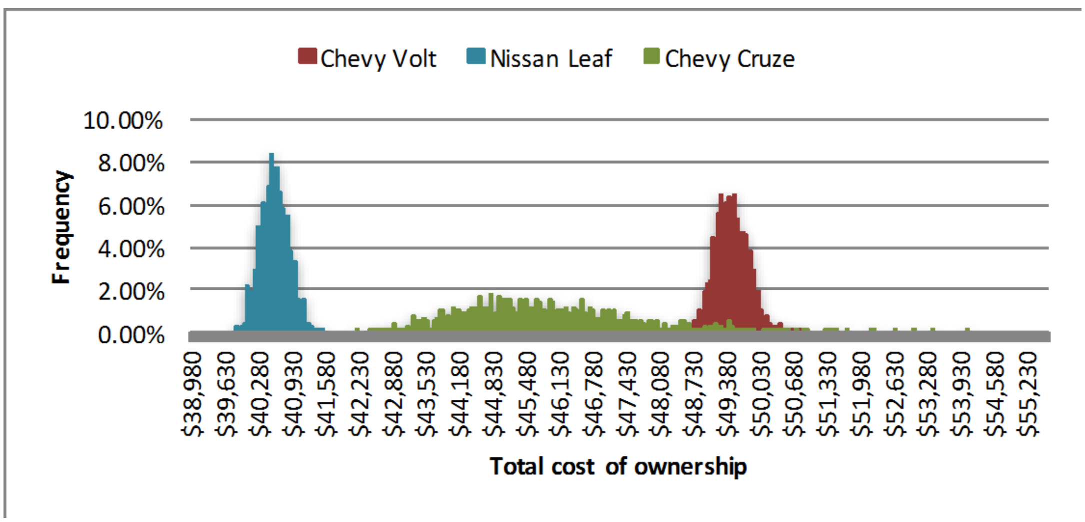

Figure 4. Histogram of the possible values of total cost of ownership under the Baseline Scenario

Key findings for the Baseline Scenario:

- The TCO of electric vehicles is more predictable (smaller standard deviation).
- The estimates of TCO of the conventional ICE vehicle is in contrast and are much more dispersed as a consequence of the volatility of gasoline prices.
- If fleets can capture the full extent of the federal tax credit (via an advantageous lease agreement), then the battery electric vehicle is, financially, almost certainly a better investment than the gasoline vehicle.

Scenario 1 – Lower Annual Mileage

Scenario 1 is defined by the following parameter values described. We use bold and italic font to indicate the parameter value that changed relative to the Baseline Scenario.

- Duration of ownership: 7 years
- Vehicle miles driven: ***6,000 miles per year***
- State incentive: CVRP
- Federal tax credit appetite: $7,500

Feeding these values to the model yields the estimates of TCO shown in Table 7. Figure 5 illustrates the distributions of possible values of TCO for each vehicle type, as given by the model.

Table 7. Total cost of ownership results for Scenario 1

	Chevy Cruze (ICE)	Chevy Volt (PHEV)	Nissan Leaf (BEV)
Expected	$42,163	$46,682	$38,093
Std Dev	$898	$163	$132
Min	$40,366	$46,235	$37,706
Max	$45,855	$47,250	$38,511

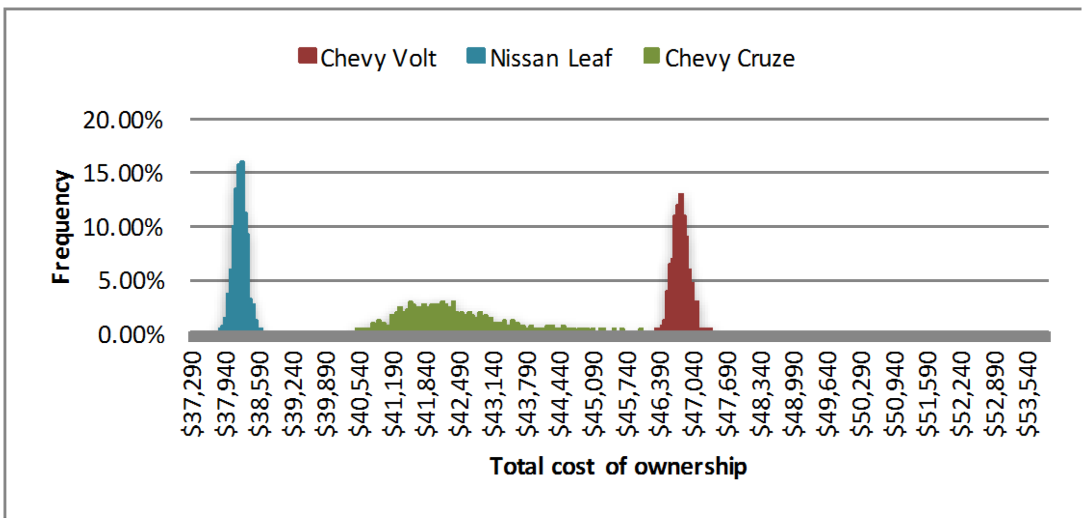

Figure 5. Histogram of the possible values of total cost of ownership under Scenario 1

Key findings for Scenario 1:

- Using a lower annual mileage reduces the spread of the results. The TCO of the EVs are still more predictable than that of the conventional ICE vehicle.
- At the same time, if fleets can capture the full extent of the federal tax credit (e.g. via an advantageous lease agreement), then the TCO of battery electric vehicle is even better than that of the gasoline ICE vehicle, when compared with the baseline scenario.

Scenario 2 – Shorter ownership term

Scenario 2 is defined by the following parameter values. As indicated with bold and italic font, the parameter value that changed relative to the Baseline Scenario is the duration of ownership, which in this case is three years shorter.

- Duration of ownership: ***3 years***
- Vehicle miles driven: 12,000 miles per year
- State incentive: CVRP
- Federal tax credit appetite: $7,500

Using these values in the model gives the estimates of TCO shown in Table 8. Figure 6 then illustrates the distributions taken by the possible values of TCO for each vehicle type, as given by the model.

Table 8. Total cost of ownership results for Scenario 2

	Chevy Cruze (ICE)	Chevy Volt (PHEV)	Nissan Leaf (BEV)
Expected	$26,131	$28,256	$20,358
Std Dev	$399	$79	$68
Min	$25,156	$28,030	$20,133
Max	$28,076	$28,507	$20,559

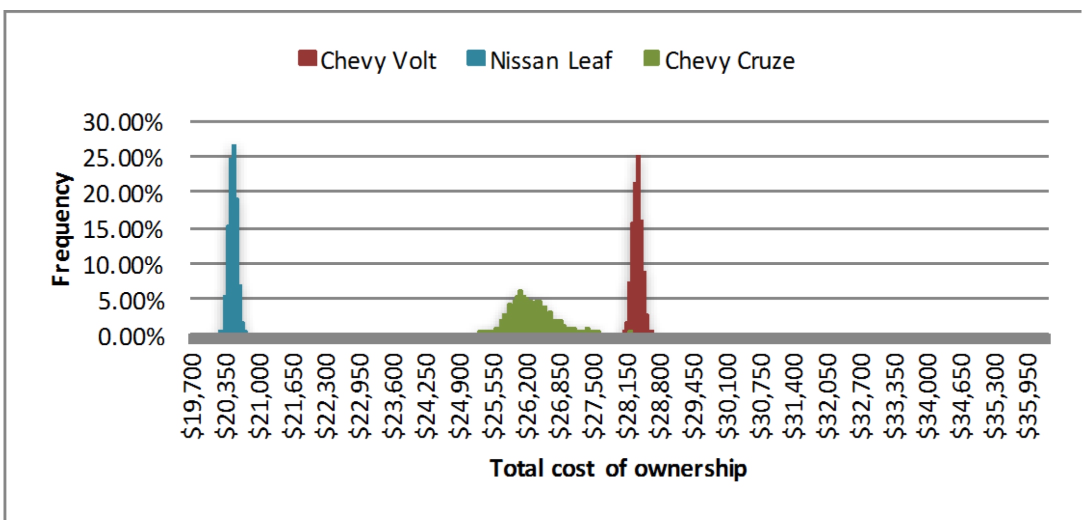

Figure 6. Histogram of the possible values of total cost of ownership under Scenario 2

Key findings for Scenario 2:

- Owning the vehicles for a shorter period of time (fewer years of ownership) reduces further the spread of the results. The TCO of the electric vehicles remains significantly more predictable than that of the conventional vehicle.
- The chart shows that the gap in TCO between the BEV with tax credit and the conventional ICE vehicle is wider. This is due to annual effects, such as asset depreciation.

Scenario 3—Disadvantaged communities

Scenario 3 is defined by the parameter values below. As indicated with bold and italic font, this scenario involves changes in the values of two parameters, relative to their values in the Baseline Scenario: the state incentive and the appetite for federal tax credit.

- Duration of ownership: 7 years
- Vehicle miles driven: 12,000 miles per year
- State incentive: ***PFPP***
- Federal tax credit appetite: ***$0***

With these values, we run the model and obtain the estimates of TCO shown in Table 9. The distributions of possible values of TCO for each vehicle type, as given by the model, are illustrated in Figure 7.

Table 9. Total cost of ownership results for Scenario 3

	Chevy Cruze (ICE)	Chevy Volt (PHEV)	Nissan Leaf (BEV)
Expected	$45,680	$45,617	$32,974
Std Dev	$1,799	$330	$267
Min	$42,119	$44,526	$32,174
Max	$54,017	$46,814	$33,752

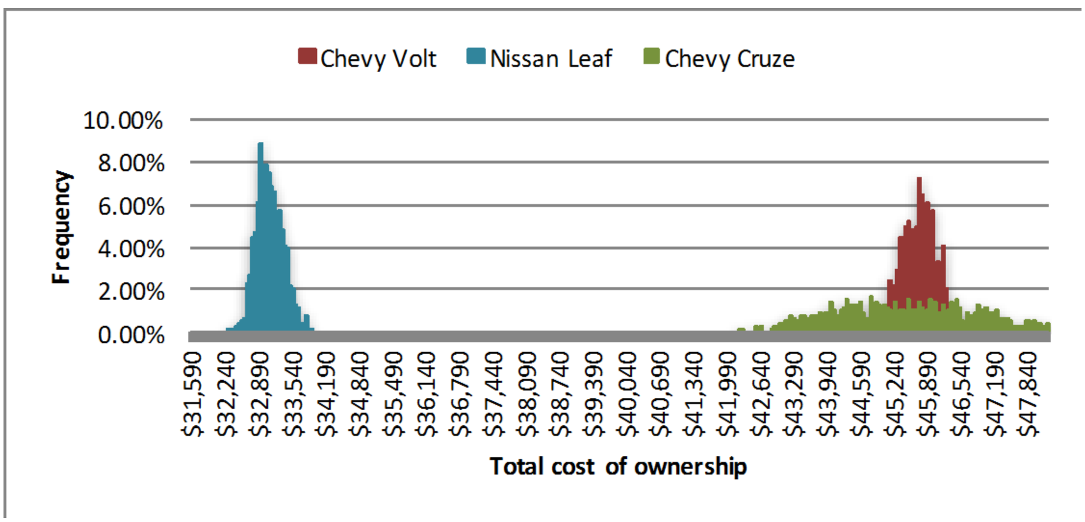

Figure 7. Histogram of the possible values of total cost of ownership under Scenario 3

Key findings for Scenario 3:

- For the BEV with federal tax credit and for the conventional ICE vehicle, these results are similar to those of the baseline scenario.
- The results show that qualifying fleets could purchase (instead of lease) a BEV and still claim savings similar in magnitude to the full extent of the federal tax credit.

- The purchase of a PHEV would qualify for a lower rebate and therefore it would attain savings lower than the full extent of the federal tax credit.

Scenario 4 - No federal tax credit appetite

As described below, Scenario 4 is defined by setting to zero the degree to which the fleet can claim the federal tax credit for plug-in vehicles. This was the case in Scenario 3 as well, but in that instance the missing federal tax credit was compensated with the access to the Public Fleet Pilot Program.

- Duration of ownership: 7 years
- Vehicle miles driven: 12,000 miles per year
- State incentive: CVRP
- Federal tax credit appetite: ***$0***

With these values, we run the model and obtain the estimates of TCO shown in Table 10. The distributions of possible values of TCO for each vehicle type, as given by the model, are illustrated in Figure 8.

Table 10. Total cost of ownership results for Scenario 4

	Chevy Cruze (ICE)	Chevy Volt (PHEV)	Nissan Leaf (BEV)
Expected	$45,839	$49,375	$47,964
Std Dev	$1,763	$325	$259
Min	$42,213	$48,590	$47,277
Max	$55,523	$50,621	$48,821

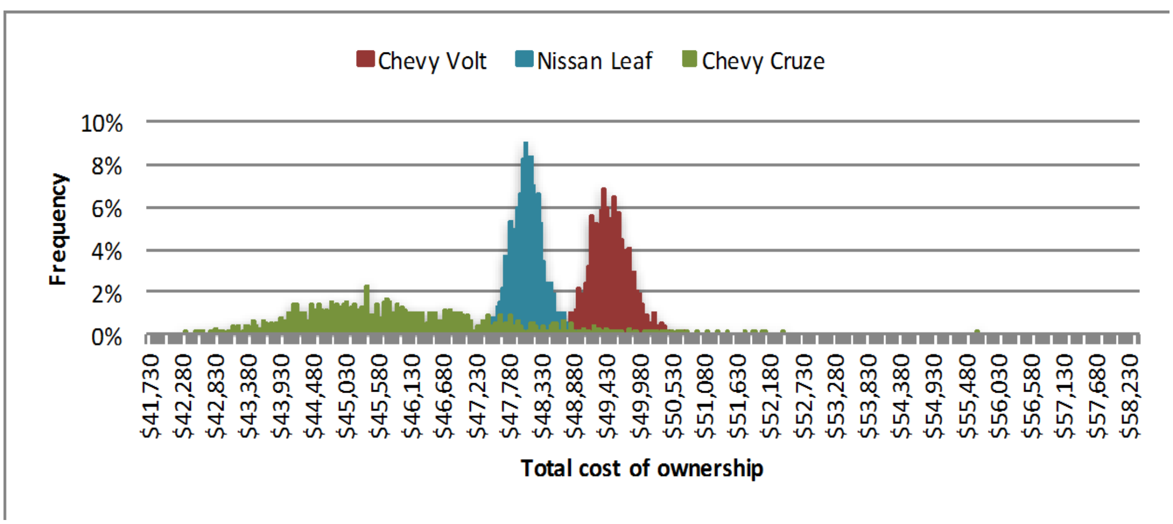

Figure 8. Histogram of the possible values of total cost of ownership under Scenario 4

Key findings for Scenario 4:

- We find that when the federal tax credit cannot be claimed, the conventional ICE vehicle has an 86% probability to have a lower TCO than the BEV.
- The deduction of the federal tax credit negatively affects the PHEV, which still has a higher TCO than the BEV.
- These results correspond to an extreme scenario, and it is expected that fleets will be able to procure electric vehicles under agreements that, in one way or another, incorporate to a certain degree the tax credit benefits.

Highlights of TCO Results

In financial engineering, there are several methods to account for risk on asset valuation. As a rule, risk reduces the net present value of investments. We have used a simulation approach to model risk, to show the range of possible values of the total cost of ownership.

- Conventional vehicles are a significantly riskier investment than electric vehicles, from a financial standpoint.
- The higher the annual mileage of the vehicles, the better the economics of electric vehicles will be, in comparison to conventional vehicles.
- The comparative economics of conventional and electric vehicles are still dependent on the financial incentives on the latter. This simply means that incentives are still important in helping make a compelling economic case for EV. This is particularly important for fleets, which often undergo a procurement process with audits and justification of expenditures.
- Because of the connection between fiscal incentives and the economics of electric vehicles, the terms of the procurement can influence which vehicle platform has a more competitive cost of ownership. This simply means that the federal tax credit is still important to the economic competitiveness of electric vehicles vis-à-vis conventional ICE vehicles. Local governments cannot directly claim the benefits of the federal tax credit, but the law allows intermediary entities to claim this benefit as part of the transaction. Thus, local government fleets, either in direct procurement contracts or using state contracts, should strive to integrate the federal tax credit into the terms of the procurement.

4 Database of Incentives

A wide range of incentives is available to support the purchase of electric vehicles and charging equipment. Some of these incentives apply universally to all persons and organizations, while others target specific segments of the economy or population. For example, some programs in California apply to businesses, to low-income households, or other groups. The goal of this summary is to serve as a reference for DNZ partner jurisdictions as they evaluate opportunities for the procurement of electric vehicles and charging equipment, and therefore we focus on programs that apply to governmental organizations in Santa Clara County.

DNZ partners should note that some incentives are offered on an ongoing basis (we refer to these as *continuing incentive programs*), others are offered regularly, while others are offered as funding opportunities. This summary includes some incentives that fall in the latter category, but these will likely become outdated after the program expiration. DNZ partners will have to dedicate resources to staying updated on such opportunities.

Continuing Incentive Programs

National Federal tax credit

Applicability

Electric Vehicles	✓
Charging Infrastructure	✗

Summary

Beneficiaries can claim a federal tax credit up to $7,500, estimated based on the energy storage capacity of the onboard battery.

<u>Note</u>: Local governments are not affected by income taxes, but under certain arrangements, private entities can claim the tax credit if they retain ownership of the vehicle and lease it to local governments. This way, the tax credit can be integrated into the transaction as a reduced lease.

Eligibility

In essence, all electric light duty vehicle models currently offered by manufacturers are eligible. Eligibility criteria can be summarized more specifically as follows:

- The vehicle must be made by an original equipment manufacturer, and thus it does not benefit vehicle conversion
- The vehicle must be treated as a motor vehicle for purposes of Title II of the United States Clean Air Act
- The vehicle's gross vehicle weight rating (GVWR) cannot exceed 14,000 lbs.
- The vehicle must deliver motive power from an electric motor
- The electric motor must draw electricity from a battery capable of storing at least 4 kilowatt hours of energy and capable of being recharged from an off board source.

Other requirements related to the transaction and use of the vehicle also apply, namely:

- The beneficiary must be the first user of the vehicle
- The beneficiary acquires the vehicle for use or lease, not for resale. (This way, a leasing company may purchase the vehicle, lease it to an end user, and then claim the tax credit.
- The vehicle is to be used mainly in the United States.

Availability

The tax credit gradually phases out for vehicles produced by a manufacturer that has produced more than 200,000 credit-eligible EVs.

Process

To claim the tax credit, beneficiaries fill out Form 8936, Qualified Electric and Plug-in Electric Vehicle Credit for full function EVs.

California Clean Vehicle Rebate Project (CVRP)

Applicability

Electric Vehicles	✓
Charging Infrastructure	✗

Summary

Beneficiaries of the CVRP can claim a rebate of up to $5,000 after the purchase or lease of zero-emission light-duty vehicles.

Funding for the project is specified in an annual funding plan that is developed with public input and approved by CARB. Proceeds from the Cap-and-Trade auction in the amount of $140 million have been recently allocated to the CVRP program. With the approval of these funds, the waiting list that had been established on June 30, 2017 because of limited funds, has been terminated. Applications from all regularly qualified applications, including fleets, are now accepted.

CVRP is administered by the Center for Sustainable Energy (CSE) on behalf of the California Air Resources Board (CARB). All of the information needed to submit a rebate application is available online at https://www.cleanvehiclerebate.org/.

Fleets in vulnerable and pollution-burdened areas

For public agencies in the state's most vulnerable and pollution-burdened areas, CARB offers the ***Public Fleet Pilot Project***, an increased incentive that can be used instead of (and not in addition to) the CVRP rebates. The project offers up to $5,250, $10,000, and $15,000 in rebates for qualified plug-in hybrid electric, battery electric, and hydrogen fuel cell light-duty vehicles, respectively. Each public entity is limited to a maximum of 30 rebates per calendar year. Because of funding constraints, the project currently accepts applications for vehicles located in disadvantaged community census tracts, as identified in the CalEnviroScreen tool. DNZ partners ***Morgan Hill***, ***San Jose***, *and* ***Santa Clara County*** should investigate their eligibility for an immediate application. Eligibility is determined by the address where the vehicle will be domiciled and the area where it will be operated. As of mid-December 2017, there was over $303,000 (10 percent of the total allocated to the fiscal year) remaining to be allocated for rebates.

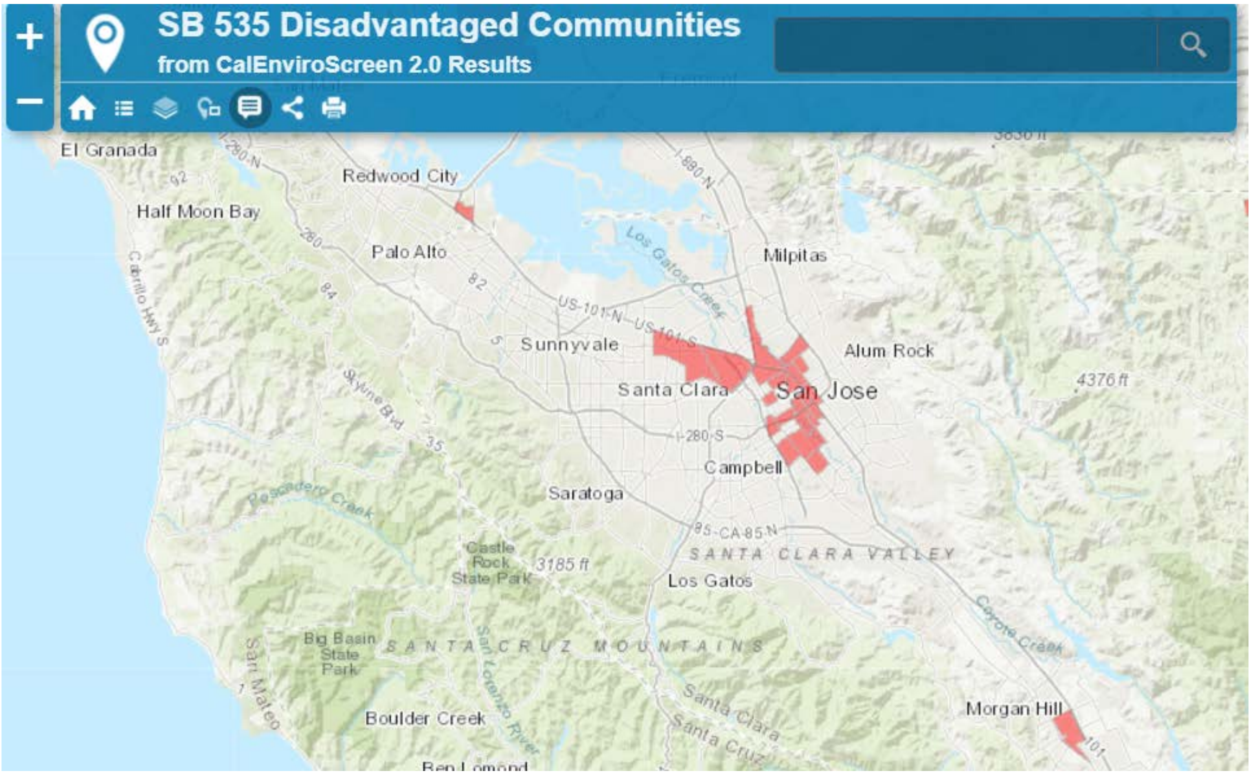

Figure 9. Disadvantaged community census tracts within the jurisdiction of DNZ partners

Rebates under the Public Fleet Pilot Project apply to the purchase of vehicles, not to leases. This distinction is important for public entities that could benefit from the federal tax credit only through lease arrangements.

Regular Incentive Programs

Summary: Local Grant. Up to $500,000 available per project for public charging stations

Bay Area Air Quality Management District Charge! Program

Applicability

Electric Vehicles	✘
Charging Infrastructure	✔

The Bay Area Air Quality Management District (BAAQMD) runs the Charge! Program, which offers funding to help offset part of the cost of procuring, installing, and operating publicly accessible electric vehicle charging stations at qualifying sites within BAAQMD's jurisdiction. The ultimate objective of the program is to foster the adoption of electric vehicles by expanding the network of charging sites available to electric vehicle drivers. The region has a goal of 110,000 and 247,000 electric vehicles deployed in the region by 2020 and 2025, respectively.

BAAQMD has extended the deadline for the 2017 Charge! Program from July 28 to March 9 and is currently accepting applications.[5] Public entities, such as the DNZ partner jurisdictions are eligible to apply. Workplace facilities, including fleets, are explicitly considered eligible for funding. For the 2017 program cycle, BAAQMD allocated $5 million. Awards of up to are made on a first-come, first-served basis.[6] There is no information as of December 2017 on the 2018 program.

Applicants are expected to attend at least one of the pre-application workshops prior to submitting their application. These workshops provide information about the program requirements, the application process, the application evaluation, and administrative requirements. Additional requirements include:

- Applicant must own the property where the station/s will be installed, or alternative provide evidence, such as lease agreement, that documents that the owner allows the installation and operation of charging equipment in their property
- Application should qualify for a minimum of $10,000 in funding, thus encouraging multiple level 1-2 or one or more DC Fast Charge installations per application
- Installations that are required, for example by regulation, ordinance, or other means, are not eligible
- Funded stations must be in operation for a minimum of three years and their level of use must be correlated to the amount of funding received.

More information is available at the Charge! Program webpage: www.baaqmd.gov/charge.

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[5] This is a new extension, following an earlier extension to November 11. ICF had sent a complete copy of this section to Santa Clara County ahead of this deadline, to allow evaluation of possible applications.

[6] ICF communicated directly with staff in the BAAQMD to discuss this incentive.

Bay Area Air Quality Management District PEV Rebates for Public Agencies

Summary: Local Grant. Not presently available but new cycles may be announced. For FY2016, public agencies were eligible for a maximum of $90,000 in voucher awards each, for the purchase or lease of electric vehicles.

Applicability

Electric Vehicles	✓
Charging Infrastructure	✘

The Bay Area Air Quality Management District (BAAQMD) runs the Plug-in Electric Vehicle Rebates for Public Agencies program. The program has offered funding to help offset part of the cost of purchasing or leasing electric vehicles (including hydrogen fuel cell vehicles) to be used by public agencies in Air District's jurisdiction. In earlier cycles, the program offered vouchers in the following amounts:

- $2,500 for battery electric vehicles and hydrogen fuel cell vehicles
- $1,000 for plug-in hybrid electric vehicles

BAAQMD is not accepting applications at the moment of writing this report. Public entities, such as the DNZ partner jurisdictions are eligible to apply. Typically, vouchers have to be redeemed within 120 days and after the purchase or lease of an eligible vehicle. The vehicles that were procured with assistance of the voucher must be driven within BAAQMD's jurisdiction for at least 15,000 mile and three years.

More information is available at the program's webpage: http://www.baaqmd.gov/grant-funding/public-agencies/pev-rebate.

Pacific Gas & Electric EV Charge Network

Summary: Local Grant. Participants can receive discounts of 25% to 100% on charging equipment to be installed in workplaces and other locations.

Applicability

Electric Vehicles	✘
Charging Infrastructure	✓

Pacific Gas & Electric (PG&E) runs the EV Charge Network program that was approved by the California Public Utilities Commission and is funded by ratepayers. PG&E expects that up to 7,500 EV charging stations will be installed at a variety of sites, including workplaces. Selected sites will receive discounts of up to 100% of the price of the charging equipment (depending on location and type of site host). Installations are planned to start in late 2017 and PG&E is already identifying applicants. At the moment of writing this report, prospective applicants could join a list to be pre-screened for eligibility.[7] PG&E will open an application portal soon.

Selected participants will need to meet the following conditions:

- Sign an easement and site host agreement
- Provide a participation payment, if applicable
- Comply with accessibility requirements of the Americans with Disabilities Act
- Agree to promote the use of EV charging stations installed

Participants will have the ability to choose from a menu of charger packages, preselected by PG&E as suppliers for the program. PG&E will do the installations, including site design, permitting and inspection, and construction.

[7] DNZ partners can do this by filling an online form available at https://www.pge.com/en_US/residential/solar-and-vehicles/options/clean-vehicles/charging-stations/interest-form.page

5 Procurement Strategy

Fleet managers expressed interest in developing the core of an EV procurement strategy, including a procedure to evaluating the business case, the budget allocation approach, the data needs, and such.

ICF conducted conversations with fleet managers in DNZ jurisdictions to learn about the typical EV procurement practices and challenges they faced in that process. ICF also communicated with the Department of General Services of the state, to learn about state contracts for joint procurements. These conversations are kept anonymous. We highlight some of the key findings below:

- Fleet managers personal drive to transition to EV varies across fleets.
- City councils set the vision for the city fleet, generally by ordinance, and fleet managers respond to that vision.
- Charging infrastructure is limited and that creates challenges for the use of EV
- City managers indicate to fleet managers what their vehicle daily needs are (mileage, etc.), which helps determine the type of vehicles that are suitable for the different vocations.
- Longer-distance trips, such as trips to Sacramento, are relatively frequent, which is an obstacle for the use EV, given the limited fast charging infrastructure and the lack of user comfort with the technology.
- For some DNZ fleets, annual vehicle mileage is low (e.g. 2,500 miles), which, as described in the lifecycle cost of ownership analysis, makes EV less competitive.
- Procurement needs to be founded on a good economic case, which will be reviewed by auditors.
- A better understanding of the expected lifecycle cost of ownership, would be very helpful to plan future EV procurement
- Fleets often prefer the Ford Focus EV over other EVs, in part because of its better economics and their Ford trained mechanics.
- Some fleets have applied for Public Fleet Pilot Project rebates.
- Some fleets have benefited from state contracts, looking for competitive bids.
- Fleet customers are not always supportive of green vehicles, which may require fleet managers to address concerns.
- Fleet composition and vocation is often a central challenge to the further adoption of EVs. Even if the economics were favorable, there are not EV models to replace police cars or trucks at competitive costs. This particularly affects smaller fleets.

The information collected through these one-on-one conversations with fleet managers was integrated with our modeling results, and other data to develop a suggested approach to EV integration into DNZ fleets.

Business Case

Our results show that the center of the financial argument in favor of EVs is the lower risk, which hedges costs and supports city financial planning. In addition, an argument around lower total cost can be made. Even for fleets with low annual vehicle mileage, we find that EVs can be competitive whenever favorable lease or purchase deals are negotiated or when the Public Fleet Pilot Project rebates are available. Part of the value of the analyses presented here is that they give procurement officers information that can be used in a deal negotiation. As discussed above, the federal tax credit for electric vehicles is still important in helping their economic competitiveness vis-à-vis conventional ICE vehicles, and fleets should seek procurement terms that incorporate as much of that benefit into the price.

Based upon this information, the evaluation of the business case for EVs can start with the histogram corresponding to Scenario 2 (presented in Figure 10 below). This scenario was characterized by a shorter duration of ownership (three years), which can be thought of as representing the initial period of ownership. In other words, the results of this scenario are representative of the relative TCO of the vehicles at the end of the first three years of ownership. We include this histogram below again for reference.

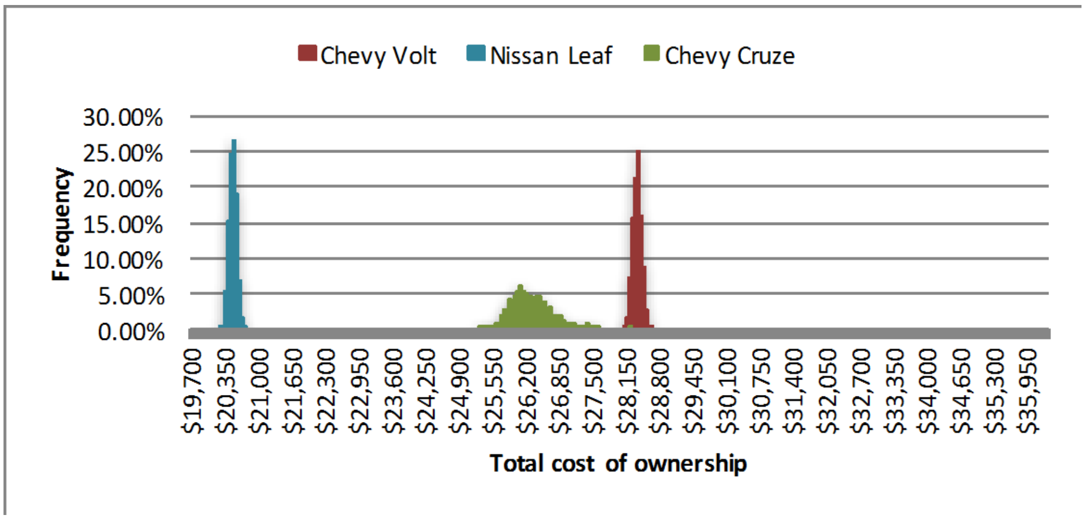

Figure 10. Reproduction of the histogram of the possible values of total cost of ownership under Scenario 2

The early period of ownership allows the impact of the upfront CAPEX to come to the fore, as saving associated with electric vehicles are not fully materialized. The histogram clearly suggests that even on a CAPEX basis, EVs can be competitive. However, this competitiveness depends on the extent of the available public incentives that fleets are able to capture in their procurement deal.[8] This conclusion can certainly vary if we compare different vehicle models. For our analysis we have not used the most inexpensive electric or conventional vehicle models. If we had considered a lower-end Cruze model, for example, the histograms would be identical, except that the histogram for the Cruze would shift to the left.

Budget Allocation Themes

General fleet procurement budgeting practices dissociate the CAPEX with operation and maintenance (O&M) costs. It is important to understand that with the entry of electric vehicles as a market alternative, an effective strategy that seeks the best use of public funds by public fleets needs to revise this traditional approach and integrate both CAPEX and O&M into a

[8] Our analysis is not directly considering the additional discounts in CAPEX that may be attained by mean of joint procurement or using state contract vehicles.

comprehensive financial analysis. The second step in the evaluation of the business case for EVa, discussed next, highlights this principle.

The potential for savings that electric vehicles bring about can be illustrated with the histogram that was obtained in the analysis of Scenario 4, which was defined by annual mileage of 12,000 miles, vehicle ownership duration of 7 years, state rebate at the level of the CVRP, but no access to the federal tax credit. We include it below for reference.

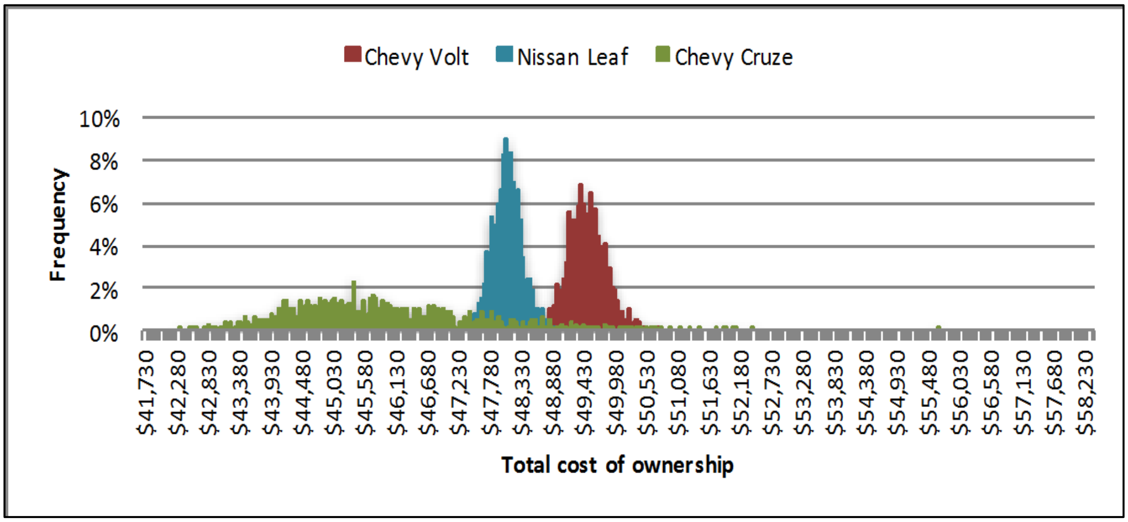

Figure 11. Reproduction of the histogram of the possible values of total cost of ownership under Scenario 4

The effect of risk on the economics of conventional and electric vehicles is clear. The volatility in fuel prices makes it significantly more difficult to predict the total cost of ownership of conventional ICE vehicles. The histogram shows that for a range of less likely but possible future conditions, the TCO of conventional vehicles is on par or higher than battery electric vehicles even without the federal tax credit. This can be seen by looking at the right tail of the histogram of the conventional vehicle in Figure 11, and how it overlaps with or surpasses the histogram of the more expensive EVs.

Longer ownership also brings to the fore the effect of O&M on the TCO, as well as the different rates of depreciation experienced by conventional and electric vehicle platforms. It should be noted that our analysis included the cost of installation of charging equipment for electric vehicles, but it did not include the cost of installation and maintenance of conventional fuel dispensers. The latter has been identified by fleet managers as a tangible cost that is often inadequately recognized in fleet procurement budgeting. We have not included this cost for lack of reliable numbers, but we encourage fleets to quantify these costs and include them in their budgets.

Some of the DNZ jurisdictions already have experience with the use of state contracts for the procurement of electric vehicles, and it is in general an avenue that we recommend all jurisdictions to explore. There is an overarching institutional framework that supports and encourages public fleets to integrate electric vehicles. Executive Order B-16-2012, signed by Governor Brown on March 23, 2012, sets a number of directions for state agencies related to the advancement of zero emission vehicle markets. Pertinent to fleets, EO B-16-2012 sets that

"California's state vehicle fleet increase the number of its zero-emission vehicles through the normal course of fleet replacement so that at least 10 percent of fleet purchases of light-duty vehicles be zero-emission by 2015 and at least 25 percent of fleet purchases of light-duty vehicles be zero-emission by 2020". While EO B-16-2012 applies to state agencies, it has some positive implications for local jurisdictions interested in adopting electric vehicles. To support state agencies' progress toward EO B-16-2012 goals, the Department of General Services (DGS) has adopted an Implementation Plan for zero emission vehicles, which includes adjusting its annual statewide vehicle contracts to include electric vehicle items, as well as EVSE items.[9] DGS provides mechanisms by which local jurisdictions can participate of their leveraged procurement of EV and EVSE.

Public Resources Code Section 25722.5(e) (10) specifies that all state agencies are to report to DGS the annual fuel consumption of their fleets. In addition, per Executive Order B-2-11, state agencies have to provide to the Office of Fleet and Asset Management (OFAM) monthly updates on the utilization of the vehicles in their fleets and information about the fuel used. Such updates have to be provided using OFAM's Fleet Asset Management System (FAMS).

Data Collection to Support EV Strategy

Procurement strategy should also consider the effect of duty cycles on the viability of a given electric vehicle (e.g. electric range) model and platform (BEV vs. PHEV). To this end, we recommend fleets to consider the implementation of effective data collection practices. Fleets should evaluate if they are currently collecting data on the variables needed to determine the extent to which electric vehicles can be integrated. Further, if DNZ jurisdictions wish to develop continued partnerships for the integration of electric vehicles (e.g. joint procurement, sharing of lessons learned, etc.), then a harmonized data collection framework may be helpful. ICF prepared a template for data collection (Appendix B: Fleet Data Request Template) and distributed among DNZ fleet managers. This template was designed with fleet managers' limited time in mind, and the intention was to reduce the number of variables to the minimum, thus reducing the work burden on fleet managers. We do recommend, however, the expansion of this template to add more granularity, and collect data at the level of individual trips.

The evaluation of electric vehicle viability in a given fleet cannot be divorced from a charging infrastructure strategy. Figure 9 below shows the distribution of charging stations in the DNZ partner jurisdictions.

[9] https://www.documents.dgs.ca.gov/ofa/fars/eo-b-16-12ImpPlan.pdf

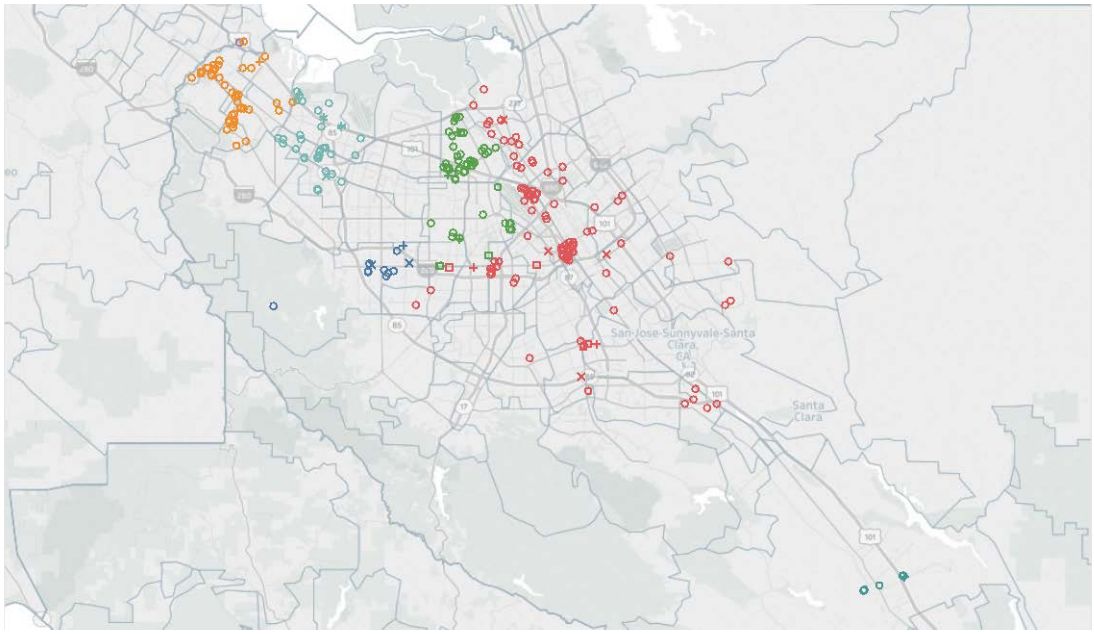

Figure 12. Map with the geographical distribution of public charging stations in the DNZ jurisdictions

Fleet managers have reported that customers often feel that there are not sufficient charging stations available. Information from conversations with fleet managers and data at the annual level suggest that, for the typical operations of passenger cars in DNZ fleets, electric vehicle range should not be a significant concern. To evaluate quantitatively the needs in charging infrastructure investments to support the integration of EVs into DNZ fleets, data on vehicle mobility patterns are needed. The data that ICF was able to obtain from fleets were not sufficiently granular to help fleet managers evaluate the extent of this potential challenge. This may be true for urban duty cycles, but range concerns may be more justified for regional-level travel, such as trips to Sacramento. Supporting such trips requires an available network of DC fast charging equipment, which can charge a BEV in around 15-20 minutes, installed along regional corridors. A strategy for the deployment of regional high-power charging infrastructure is beyond the scope of any one jurisdiction and requires collaboration across county lines and/or participation of the state. The Zero-Emission Vehicle Investment Plan, funded through the 2.0-Liter Consent Decree that requires Volkswagen to invest $800 million on ZEV projects in California is expected to address this problem to a significant degree.[10]

Questions related to perceived and real range limitations can however be addressed by fleets with a strategy for the assignment of vehicles according with the expected duty cycle. In its most rudimentary form, such strategy would assign battery electric vehicles to trips within a given radius, and plug-in hybrid electric vehicles (or conventional vehicles, if PHEV are not available) to trips beyond that radius. With an appropriate system of data collection, fleet managers will be able to develop the information to make increasingly efficient vehicle assignments.

[10] For more information on the ZEV Investment Plan, please see https://www.arb.ca.gov/msprog/vw_info/vsi/vw-zevinvest/vw-zevinvest.htm

In addition to user concerns, limitations in charging infrastructure can have an impact on the economics of electric vehicles. To observe this quantitatively, we run the TCO model increasing the average distance that electric vehicles would have to go between charging events. This change will have a more immediate impact on PHEVs, which are more likely to switch to hybrid gasoline mode when trip distances are higher than their real-world electric range. This effect is illustrated in Figure 13, which shows that the histogram corresponding to the example PHEV both shifts to the right and increases its dispersion (standard deviation).

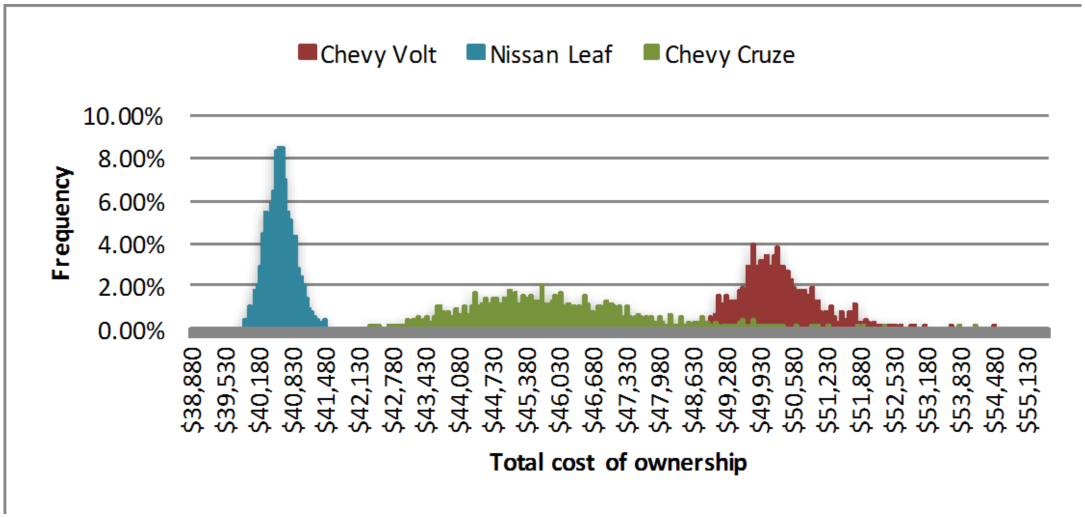

Figure 13. Effect of longer distance between charges on vehicle total cost of ownership

Given the importance of the collection of quality data to inform efficient decisions that maximize the potential of electric vehicle integration, we do not recommend that fleet managers be tasked with the design and implementation of data collection plans. Instead, data collection may be better conducted by third parties with the required technical expertise, and fleet managers can thus focus in using that information to make decisions consistent with their goals.

Educating Drivers

Related but separate from the objective information that data collection can support, there is also a subjective facet of electric vehicle adoption and use, which relates to customer acceptance of the new technology. Fleet managers are typically in the front line of interaction with customers and they need to deal with customer feedback on a regular basis. In practical terms, fleet managers' ability to maximize use of their electric vehicles is limited, if customers are not accustomed to the technology. There is no absolute recipe for how to address customer acceptance, as nobody knows better his/her customers than the fleet manager. There are however a number of guidelines, which include:

- **City directions:** City Councils should provide clear goals regarding both electric vehicle procurement and electric vehicle use. Given these, fleet managers can focus on the best strategies to implement them.

- **Driver/employee education:** Many employees still know little about electric vehicles. Providing them with information about the reasons why the fleet is adopting these vehicles, such as improving the environment and supporting the efficient use of energy, should help with employee acceptance.
- **Driver/employee training:** Different from general education, this is concerned with helping drivers/employees feel comfortable with the use of the new technology. Initial training should include instructions charging of the vehicle, tools for locating of charging station, basics of eco driving, and the interaction with the vehicle dashboard. Beyond these, there is no better way of increasing driver comfort than exposing them to the vehicles.

Appendix A. Fleet Manager Feedback Form

Directions: For each of the prospective deliverables listed below, please check one box to indicate the level of priority that you would assign to it. Preferably, this form will be completed by a fleet manager or representative of the partner jurisdiction in representation of their fleet. Please complete the form by May 25, 2017.

EV model alternatives:

Lifecycle cost analysis

High priority ☐ **Medium priority ☐** **Low priority ☐**

Estimates of lifecycle costs for a variety of vehicle models. These costs will account for risk (fuel price volatility, etc.), CAPEX vs. OPEX, and other pertinent variables. These estimates will incorporate data collected from DNZ fleet managers.

Lifecycle emission analysis

High priority ☐ **Medium priority ☐** **Low priority ☐**

Estimates of lifecycle emissions for a variety of vehicle models. These estimates will incorporate data collected from DNZ fleet managers.

Database of incentives

High priority ☐ **Medium priority ☐** **Low priority ☐**

Prepare a descriptive table with the financial incentives available to fleets for the procurement of plug-in vehicles and charging infrastructure.

Menu of available EV models

High priority ☐ **Medium priority ☐** **Low priority ☐**

Prepare a list of plug-in electric vehicles currently available in the market, organized by vehicle type, including key characteristics.

Draft Procurement Policy

Integration of procurement process

High priority ☐ **Medium priority ☐** **Low priority ☐**

Recommendations to integrate the procurement process across agency groups, to adequately account for differences with conventional vehicles (e.g. discount increased CAPEX with corresponding lower OPEX, etc.)

Process for joint procurement

High priority ☐ **Medium priority ☐** **Low priority ☐**

Recommendation on process to implement joint procurements of plug-in electric vehicles and charging infrastructure.

Procedure to evaluate business case

High priority ☐ **Medium priority ☐** **Low priority ☐**

Proposed protocol to assess the costs of plug-in vehicles for the purpose of procurement evaluation.

Data Collection

Risk variables

High priority ☐ **Medium priority ☐** **Low priority ☐**

Collect information on several variables that are key to evaluate the potential benefits of plug-in vehicles to mitigate financial risks. This information is an input to the lifecycle cost analysis. Information will be collected in the following categories:

- Fuel expenditures by vehicle group
- Electricity rates
- Vehicle miles travelled by vehicle group

Key vehicle destinations

High priority ☐ **Medium priority ☐** **Low priority ☐**

Collect information on key destinations for trips taken by different vehicle groups/categories. This information will help with assessments of travel distances and charging infrastructure needs.

On-site conventional fuel infrastructure costs

High priority ☐ **Medium priority ☐** **Low priority ☐**

Collect information on main costs of owning, operating, and maintaining on-site conventional fuel infrastructure.

City Role

Budget allocation approach

High priority ☐ **Medium priority ☐** **Low priority ☐**

Develop language that DNZ fleets and offices can use to explain the need to review budget allocations consistent with the city goals for fleet electrification and emissions reductions

Provide stronger signal

High priority ☐ Medium priority ☐ Low priority ☐

Develop language that DNA fleets and offices can use to explain the challenges that fleets face with vehicle electrification and the impact that clear directions from decision makers could have to move in that direction.

Information for decision makers

High priority ☐ Medium priority ☐ Low priority ☐

Develop a fact sheet that could be distributed to decision makers, to explain the key characteristics and potential benefits associated with plug-in vehicles.

Inter-fleet Collaboration

Formalize a process for collaboration

High priority ☐ Medium priority ☐ Low priority ☐

Formalize a platform for collaboration across DNZ fleets, including participants list, mission, objectives, and general guidelines for communication.

Customer buy-in plan

High priority ☐ Medium priority ☐ Low priority ☐

Develop a plan to increase customer acceptance and use of plug-in electric vehicles.

Adopt basic data collection protocol

High priority ☐ Medium priority ☐ Low priority ☐

Design a basic protocol to guide the type of data that fleets will collect, to facilitate sharing of experiences and collaborative planning with other DNZ fleets.

Appendix B: Fleet Data Request Template

Fleet Active Assets	Passenger cars
City:	e.g. San Jose

CONVENTIONAL GASOLINE

ASSET NUMBER/ID	YEAR	MAKE	MODEL	CLASS	CLASS DESCRIPTION	MILEAGE	ANNUAL FUEL USE (gallons)	FUELED @ CITY-OWNED FACILITY?
	e.g. 2010	e.g. Ford	e.g. Focus	Passenger car	e.g. Compact	e.g. 45,000	e.g. 450	e.g. Yes

HYBRID GAS ELECTRIC

ASSET NUMBER/ID	YEAR	MAKE	MODEL	CLASS	CLASS DESCRIPTION	MILEAGE	ANNUAL FUEL USE (gallons)	FUELED @ CITY-OWNED FACILITY?

CNG

ASSET NUMBER/ID	YEAR	MAKE	MODEL	CLASS	CLASS DESCRIPTION	MILEAGE	ANNUAL FUEL USE (m3)	FUELED @ CITY-OWNED FACILITY?

ELECTRIC

ASSET NUMBER/ID	YEAR	MAKE	MODEL	CLASS	CLASS DESCRIPTION	MILEAGE	ANNUAL FUEL USE (kilowatt-hour)	FUELED @ CITY-OWNED FACILITY?

DIESEL

ASSET NUMBER/ID	YEAR	MAKE	MODEL	CLASS	CLASS DESCRIPTION	MILEAGE	ANNUAL FUEL USE	FUELED @ CITY-OWNED FACILITY?