Zero Emission Vehicle Project Initiation Plan

Del Norte Local Transportation Commission

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Executive Summary

This report is subject to, and must be read in conjunction with, the limitations set out in section '*1.2 Scope and Limitations*' and the assumptions and qualifications contained throughout the report.

Del Norte County is California's northernmost coastal county. It contains Crescent City and is home to four federally recognized tribes. The region is inter-connected by the US Highway 101, US Highway 199, Route 197, and Route 169. These highways act as the major access points and throughfares for the Del Norte County. Geographically, the county is home to inland mountain ranges and coastal mountain ranges along with a rugged coastline. The Climate is mild with minimal temperature fluctuation.

Del Norte Local Transportation Commission, or DNLTC, is the Regional Transportation Planning Agency (RTPA) for the area within the county boundaries. The Technical Advisory Committee (TAC) provides technical advice to DNLTC and is made up of representatives and staff from the City of Crescent City, the County of Del Norte, the Crescent City Harbor District, the Yurok Tribe, California Highway Patrol, the California Department of Transportation, and Redwood Coast Transit (RCT). This project developed a ZEV project initiation plan to address the regional needs to meet the Zero Emission Vehicle mandates created by Governor Newsom in 2020. The mandates include an executive order that bans the sale of new gasoline and diesel-powered vehicles by 2035. CARB, or California Air Resources Board, also mandates that all new trucks sold in California need to be ZEVs by 2045.

To address these mandates, GHD and BetterFleet™ have developed a ZEV project initiation plan that showcases the financial, environmental, policy and infrastructure implications of transitioning to ZEVs. The scope of this project is restricted to stakeholders which provided some or all of their fleet data and includes Crescent City Public Works, Del Norte County, Yurok Tribe and RCT. Beyond just fleets, GHD also explored the viability of installation of public chargers on major throughfares of the County to aid both tourists and the local population.

The Initiation Plan consisted of the following four broad tasks:

1) **Fleet Simulation and Sensitivity Analysis**. This task aimed to articulate the background on technically viable and commercially available ZEVs in the California market which would be appropriate for DNLTC stakeholders. To understand the sensitivities of fleet transitioning, three different transition scenarios were explored with varying assumptions.
2) **Fleet Optimization**. This task developed the three scenarios in detail and showed the economic, environmental, and energy requirements of the combined fleet. The idea is to allow DNLTC stakeholders to visualize the scenario best suited for their daily operations and annual budgets and other constraints.
3) **Decarbonization Strategy**. Based on the scenario outputs, this task aims to capture the nuances of fleet transitioning in terms of specific strategies which are – Fleet strategy, infrastructure strategy, sustainment strategy and funding strategy.
4) **Workplan development**. Utilizing the strategies mentioned above, GHD has developed a tentative 3-Phase workplan for DNLTC which allows stakeholders to meet the necessary mandates and establish themselves as an environmentally conscious region in California.

A summary of recommendations as determined through this study are:

1) Before ZEV procurement can take place, DNLTC stakeholders need to establish detailed technical requirements for the new ZEVs and associated charging/fueling infrastructure, with full confidence. To do that, we suggest tracking the vehicle fuel usage and performing full range-models using telematics (such as onboard GPS) data. In addition, interview vehicle operators to understand their issues and constraints and apply those principles to the desired specifications of the ZEVs.

2) Perform electrical capacity assessment at the four (4) public oriented charging infrastructure locations noted in the report through in-person site visits by an electrical engineer and determine the detailed technical and financial constraints for placement of the chargers.
3) Engage in funding applications as appropriate and applicable to help reduce the upfront expense of purchasing ZEVs and the infrastructure. These applications can be competitive, technical, and detailed in nature, so to maximize the region's potential, utilize grant and funding specialists to guide and write the applications on the stakeholders' behalf.
4) Since ZEV transition will be a major change to the way the region operates today, DNLTC should start the change management process pre-emptively and in parallel with the procurement activities to gain 'buy-in' from the fleet operators and other stakeholders.

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Glossary

Acronym	Definition
Amp	Amperes / amps, the base unit of electrical current
BEV	Battery Electric Vehicle
CAPEX	Capital expenses
CO2	Carbon dioxide (a greenhouse gas)
DCFC	Direct current fast charger (Level 3 charger)
EV	Electric vehicle (also battery electric vehicle - BEV)
EVSE	Electric vehicle supply equipment
EVEMS	Electric vehicle energy management systems
FY	Financial year – the representation year for purposes of accounting or budgeting in the County
ICE	Internal combustion engine
kW	Kilowatt, a unit of power
L2	Level 2 charger
L3	Level 3 charger
NOx	Nitrogen oxides (a pollutant)
NPV	Net present value – the spending over period of time discounted to the value of current dollars
OEM	Original Equipment Manufacturer
OPEX	Operating expenses
PM2.5	Particulate matter, 2.5 microns or less in width (a pollutant)
SUV	Sports utility vehicle
TCO	Total cost of ownership
V	Volts, a unit of electromotive force
Y	Refers to the neutral as the center of the Y shaped power source
ZEV	Zero emission vehicle
ZEVO	Zero Emission Vehicle Optimization (GHD's Fleet Assessment tool)

1. Introduction

1.1 Purpose of this report

The California Air Resources Board (CARB) is pushing towards Zero Emission Vehicles (ZEVs) in light-duty asset classes to meet its 2035 goal of selling only zero-emission vehicles. CARB is requiring that counties and organizations develop plans to improve air quality, reduce pollution, and tackle environmental challenges in communities across the state. Stakeholders within the Del Norte region recognize that there are numerous additional challenges associated with reducing carbon emissions and improving air quality from light-duty vehicles, and that a zero-emission vehicle roll-out study will act as a comprehensive guide to reach CARB goals and form a path to clean air for California's northern communities.

The purpose of this report is to provide a holistic analysis of potential Zero Emission Vehicle (ZEV) transition plans for the Del Norte Local Transportation Commission (DNLTC). This report details the methodology, assumptions, and results of the fleet analysis, which covers potential financial, environmental, electrical, and infrastructure implications. This analysis is subdivided into three potential transition scenarios – a "business as usual" scenario where all fleet vehicles are replaced with comparable Internal Combustion Engine (ICE) vehicles, a cost optimizing scenario, and a technology-leading scenario. The data analysis done throughout the project will help in formulating a complete fleet replacement plan while the discussions with DNLTC stakeholders regarding the infrastructure locations will help provide recommendations for a complete decarbonized infrastructure network.

1.2 Scope and limitations

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

- This report has been prepared by GHD and Evenergi for Del Norte Local Transportation Commission and may only be used and relied on by Del Norte Local Transportation Commission and its member agencies for the purpose agreed between GHD and Del Norte Local Transportation Commission as set out in this report.
- GHD has prepared this report on the basis of information provided by Del Norte Local Transportation Commission and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.
- GHD and Evenergi have prepared the ZEVO Fleet Assessment Model ("Model") for, and for the benefit and sole use of, Del Norte Local Transportation Commission and its member agencies to support fleet transition planning and must not be used for any other purpose or by any other person. The Model is a customized model and not intended to be amended in any form or extracted to other software for amending. Any change made to the Model, other than by Evenergi or GHD, is undertaken on the express understanding that neither Evenergi nor GHD is not responsible, and has no liability, for the changed Model including any outputs.
- Cost estimates within this report are projections based on 2023 available data and are subject to market changes, inflation, and site situational requirements for the Del Norte Local Transportation Commission and its member agencies as detailed design progresses. Additional study and design will be required to further evaluation capital costs for the fleet transition.
- GHD otherwise disclaims responsibility to any person other than Del Norte Local Transportation Commission and its member agencies arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

- The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.
- The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring after the date that the report was prepared.

1.3 Assumptions

Since this project involves predicting the fleet transition plan and placement of charging infrastructure, it required several assumptions to be made for a proper analysis to take place. A summary of all assumptions is provided in the table below.

Table 1 – Fleet Assessment and infrastructure assumptions

Assumption	Rationale	Data Source
For the cost-optimized scenario, we limited the transition to roughly 5% of the assets from the total fleet per year.	This was based off the information presented to us during the talk with DNLTC.	DNLTC
For maintenance and service cost, industry standard numbers were used.	This was due to the fact no service/maintenance data was provided so industry standard numbers were used in lieu of fleet specific data	BetterFleet™ database
Gasoline prices were assumed to be $5.20 per gallon.	This was the source recommended to us by the County of Del Norte and DNLTC.	Gas Buddy
A 1:1 vehicle to charger ratio of level 2 chargers is assumed.	A 1:1 vehicle to charger ratio of level 2 chargers is assumed and this is considered in the TCO calculations. We did not assume any use of public chargers for charging the fleets since we envisioned the chargers coming online at all the appropriate facilities and at the appropriate timing alongside the rollout of EVs.	BetterFleet™
Regional stakeholders do not possess a Vehicle Transition Plan and instead drives most vehicles until they are no longer able to operate reliably. This analysis assumes most vehicles need to be replaced after 8 or 9 years which is approximately a 24 month increase from what is typically observed elsewhere.	This is due to the fact that most of the Del Norte County fleet is relatively old and most vehicles are driven past the manufacturer's point of recommended replacement.	BetterFleet™/DNLTC
For EVs, we are making the assumptions that they are responsible for zero tons of CO2 emitted.	Given that this is an early-stage implementation plan, the current analysis assumed that the ZEVs emit 0 emissions, although in reality the number is nearly negligible. This is because most power grids in North America emit CO2 at the source of electricity production. Further analyses with range modelling can indicate an estimated source emission of CO2 from ZEVs.	BetterFleet™
Google Maps satellite imagery was used to observe existing utility infrastructure	As an early-stage study, it was not deemed prudent to require an on-site visit of the proposed charging lots. For subsequent studies, we would	Google Maps

	strongly recommend budgeting in-person site visits.	
Electrical Infrastructure at each site will consist of new utility services either supporting the proposed charging infrastructure, or potentially supporting both the new infrastructure and the existing site load.	Given the magnitude of EV charging, load will be significant and greater than existing load. An entire new service is likely to be required. Where possible, that service will be sized to cover both the new and existing needs to reduce the total number of utility services at a given site.	N/A

2. Sensitivity Analysis & Fleet Simulation

2.1 General background

The Fleet Assessment and Strategy seeks to map the best pathway to a zero-emissions fleet considering the demands and operational context of stakeholders within DNLTC. Through BetterFleet™ modeling, a fleet transition plan has been developed to guide zero-emission vehicle (ZEV) investments over the next five years. Complementing the BetterFleet™ analyses are strategic recommendations to guide ZEV investments across the region's fleets and in consideration of the longer-term mandates outlined in CARB's Climate Action Plan (**Link**).

The BetterFleet™ analysis defines and quantifies opportunities and challenges arising from the transition to ZEVs, articulates pathways toward meeting regional climate goals, and provides context to support other related strategic initiatives (such as electric vehicle [EV] infrastructure development).

2.2 DNLTC market research

The challenge with large and upper large vehicles at the moment is the lack of suitable electric vehicle (EV) equivalents in this part of the market. Small and medium-sized cars have greater options currently.

While similar markets overseas provide many times more vehicle choices per segment, and the technology is now well and truly validated, the electric vehicle market is only slowly increasing in competitiveness. More options are becoming available at lower price points, with growing access to fleet-centric options. There is growing diversity in battery size options trending in the market, with vehicles now available described as 'standard range' and 'extended range' or similar.

The table below describes the existing and anticipated battery capacities in different market segments. This becomes a key consideration in assessing technical feasibility. The specific vehicles identified as suitable EV replacements for the region's current fleets come down to how closely a "match" a particular EV make/model is with each existing fleet vehicle, in terms of vehicle specs and operating requirements.

Table 2 – Light vehicle class and typical maximum battery sizes

Light Vehicle Class	Sub Class	Make/Model/MSRP	Largest Battery Size in Market
SUV	Large and Upper Large	Tesla Model Y $65,990	87 kWh
SUV	Medium	Volkswagen ID.4 $41,230	76 kWh

SUV	Small	Kia Niro EV $38,112	64 kWh
Passenger	Medium	Ford Mustang Mach-E $61,996	60 kWh
Passenger	Small	Ford Mustang Mach-E $46,595	52 kWh
Passenger	Light	Chevrolet Bolt EV $34,200	45 kWh
Light Commercial	Small Truck	Ford F-150 Lightning $62,976	200 kWh
Light Commercial	Van over 2.5t	Ford E-Transit Cargo $55,690	125 kWh
Light Commercial	Light bus (under 20 seats)	Chevrolet Express $34,745	125 kWh

Majority of the vehicles recommended through this high-level study are Ford built. They provide the Ford Mustang Mach-E, the Ford E-Transit Cargo, and the Ford Lightning F-150, which are ideal vehicles for DNLTC stakeholder's purposes as per the BetterFleet platform.

The closest Ford dealership which offers vehicle servicing and maintenance is at Medford, OR (Crate Lake Ford) which is 110 miles or 2 hr. 20 mins away. The closest California based dealership is located at Yreka, CA (Yreka Motors) which is 160 miles or 3 hours away.

There are limited car dealerships with a servicing department locally within Crescent City. However, there are local businesses such as auto-repair shops and body shops that seem to maintain all makes and models of vehicles. In the future, as EV uptake grows, these local businesses would need to pivot their services and personnel from ICE vehicles to BEV.

ZEV technology and vehicles are being researched and developed even today and will continue in the future. Many car manufacturers are in the process of setting up mass-production units for EVs, including proposed factories in both United States and Canada (**Link**). While this process is on-going, the supply of EVs and EVSE will remain slow, especially in the specialized vehicle categories. To summarize, the following are the primary issues behind ZEV supply management:

1. **Battery Production and Supply -** BEVs rely on advanced lithium-ion batteries, and the production and supply of these batteries (and their components) can be a bottleneck in the production and supply of EVs
2. **Global Semiconductor Shortage -** The automotive industry, including BEV manufacturers, has been impacted by a global shortage of semiconductors which started during the Covid pandemic. These chips are crucial for various vehicle functions, including advanced driver-assistance systems (ADAS), infotainment systems, battery management, smart controls and power management.
3. **Logistics and Shipping Challenges -** Shipping vehicles and components across long distances is subject to logistical challenges. This problem has also been exacerbated by the Russian-Ukrainian war. The conflict has led to geopolitical tensions and the imposition of economic sanctions by various countries. These sanctions and countersanctions have affected trade and logistics, leading to changes in trade patterns, restrictions on certain goods, and the renewed emphasis on domestic production of EVs.

However, the supply chain is continuously improving and production of EVs should pick-up in the next 5 to 10 years.

2.3 Fleet Methodology

The aim of the BetterFleet™ analysis is to help DNLTC stakeholders understand when assets are technically and commercially suitable for electrification. The methodology applied herein is presented below:

1. Map replacement schedule and emissions for business-as-usual like-for-like replacements (lowest total cost of ownership [TCO]).
2. Understand if there are like-for-like ZEV replacements based on duty requirements in the market at each replacement date and the expected market timing for alternatives.
3. Map asset replacement schedules for the forecast period under the devised scenarios, selecting the most appropriate replacement vehicle according to the preferences of given scenarios, delivering economic budgets, and evaluating emissions outcomes.
4. Assemble preliminary emissions and costing information for the forecast period, excluding out-of-scope considerations such as infrastructure deployment.

A like-for-like analysis assumes the functional attributes of the existing vehicles in the fleet are optimized for particular purposes, and the need for a purpose is certain and cannot be replaced. Like-for-like light vehicle replacements are determined by matching existing fleet assets against all options within the same peak-body designated vehicle segment and sub-segment.

A derating factor is applied to the energy consumption rating to account for variability of battery performance in cold and hot weather conditions, and the added relative drain of heating and air conditioning systems. Modeling the peak energy consumed by electric vehicle replacements to existing fleet assets therefore presents worst-case energy consumption.

Hydrogen as an alternative fuel is still in the process of achieving financial and commercial viability in the medium- and heavy-duty classes of vehicles. For that reason, this analysis was restricted to electrification. However, we anticipate Hydrogen technology to evolve quickly given the incentives and grants in this space and the desire of the California state government and the federal government to make Hydrogen mainstream. In the near future (1-2 years), we suggest revising this analysis with updated vehicle makes and models which may include Hydrogen. In addition, a transition to Hydrogen may enable creation of dedicated hydrogen fueling stations which are aimed at long-haul trucking fleets.

Master data is applied to total cost of ownership (TCO) and asset replacement modeling tools, set up to compute results for scenarios according to the assumptions underpinning each scenario. We note that this analysis is built on several assumptions based on a combination of empirical data from other jurisdictions, professional judgement, and data provided by DNLTC. As such, while the nearer-term years of the forecast can be expected to be relatively accurate, the future years provide a framework for analysis and will need to be updated annually as the market matures.

2.4 Data validation

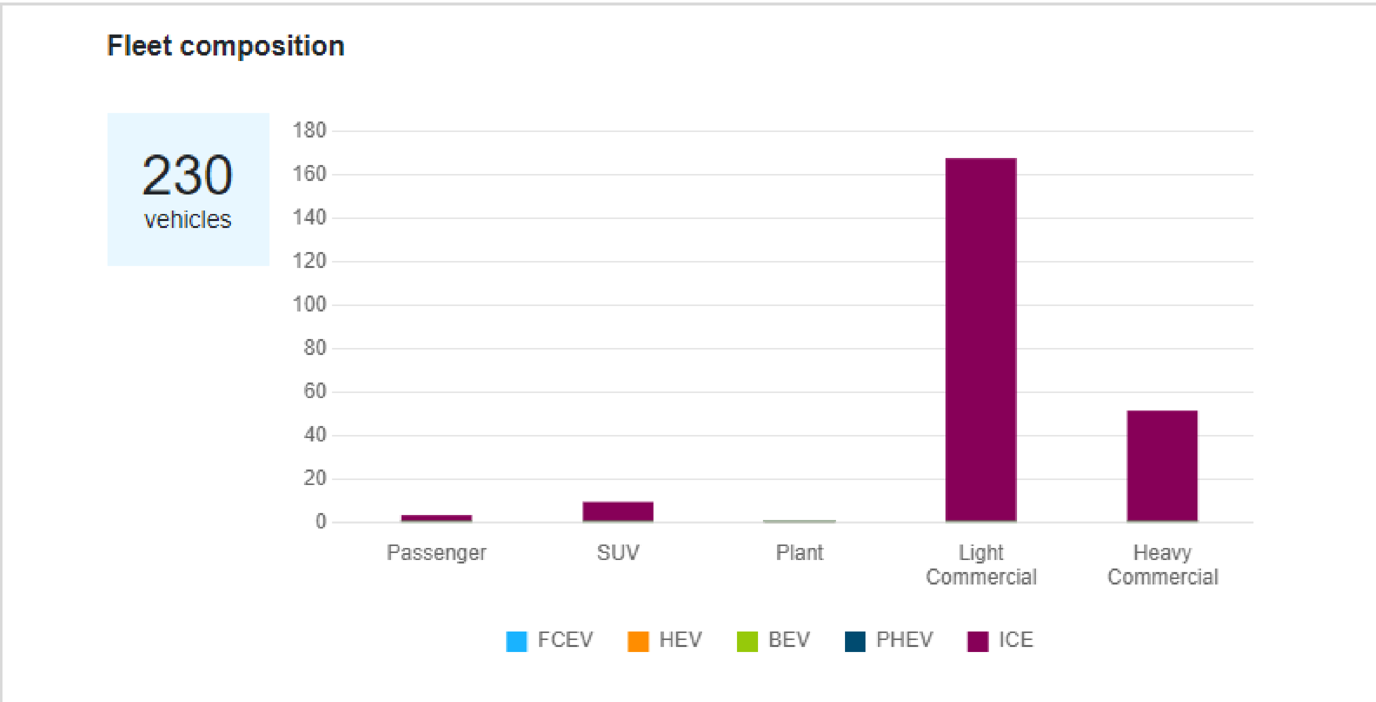
To begin the BetterFleet™ modeling, the combined fleets were divided into light-duty vehicles and heavy-duty vehicles, and the analyses were run separately for each. Light-duty vehicles were defined as any vehicle under 3.5-ton, and heavy-duty vehicles referring to those that are over 3.5-ton. It is important to note, that due to a lack of data this analysis is focused on light-duty vehicles and does not capture heavy-duty vehicles. Future analysis with more robust data will be required to develop a high-duty vehicle transition plan. At this stage, since we are not fully aware of the financial capacity of the various stakeholders, beginning the complete fleet transition process with the easier-to-transition light-duty vehicles is the most pragmatic and responsible solution.

2.4.1 Light-duty vehicle fleet

Pickups trucks make up the largest component of light duty vehicles in the combined fleet, commonly in the form of Ford F-150s and Ford Rangers. Other larger segments include vans over 2.5-ton which are primarily Ford Transits and Ford Transit Connects.

An assortment of passenger vehicle sizes and types exists with larger passenger cars including Dodge Chargers and Honda Accords. There are relatively few small vehicles in either passenger or SUV types. In total, there are 167 light-duty vehicles in the fleet that are all ICE.

Figure 1 – Light vehicle fleet composition

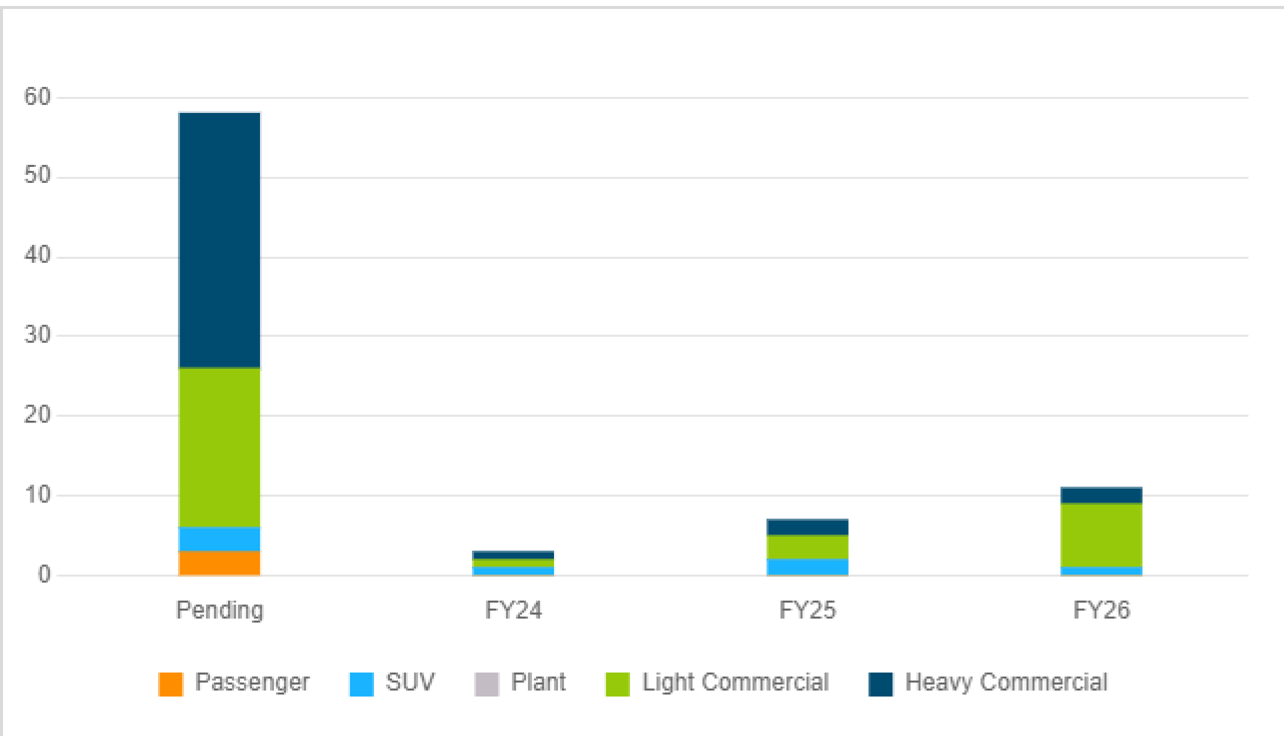


Vehicle Type	Road Yard	Crescent City	Flynn Center	RCT	Sheriff's Office	Yurok Tribe
Passenger		3				
SUV		9				
Plant						
Light Commercial	19	92	5	13	26	12
Heavy Commercial	1	50				

For this analysis we have combined the fleets of the DNLTC stakeholders. The table above shows the breakdown of the vehicles and their respective stakeholders and depots. A portion of the Del Norte County fleet, including the three depots (Sheriff's Office, Road Yard and Flynn Center) makes up most of this analysis since it contains the largest number of vehicles. 'Plant' in this case refers to non-traditional vehicles such as ATVs and Forklifts which were not part of the scope of work.

The age profile is important for determining which vehicles are coming up for replacement in the next few years. Majority of the older vehicles are the light commercial vehicles, and a number of the larger passenger vehicles are 6 years old. A considerable number of vehicles are also due for replacement in financial year 2026 (FY26).

Figure 2 – Light vehicle age profile



2.5 Scenario comparison

The following pathways have been used as the core framework for the analysis of future scenarios for the Del Norte region's fleets.

Table 3 – Description of modelled scenarios

Scenario name	Scenario description
Business-as-usual (BAU) scenario	The lowest TCO vehicle equivalent is procured. Procurement of ZEVs is excluded under this scenario regardless of TCO outcome to outline a consistent baseline from which the ZEV transition scenarios can be compared. The intention of BAU is that it is the "do nothing" scenario, i.e., it is reflective of how DNLTC stakeholders would continue to procure vehicles if there were no mandates or initiatives related to emissions reduction or fleet electrification. In the BAU, hybrid and plug-in hybrid examples might be procured where lowest TCO is demonstrated.
Cost-optimized scenario	The cost-optimized scenario seeks to meet your emissions and fleet electrification targets in the most cost-optimized manner. In this scenario, generally the lowest TCO vehicle example is procured, however, ZEVs may be selected even if the TCO is not the lowest if they are required to meet your climate objectives and policies, so long as there is a viable alternative that can meet the needs of region. This scenario generally results in higher costs than for BAU as a result of the 'green premium' of purchasing ZEVs. Notably, the cost-optimized scenario works within each organization's procurement cap whereby a maximum of 5% of the total value of the fleet is transitioned per year.
Technology leadership scenario	The technology leadership scenario seeks to position the Del Norte region as an industry leader in fleet electrification. Whereas in the cost-optimized scenario we are only electrifying the fleet as much as necessary to meet your objectives, in the technology leadership scenario we are generally halting all purchases of internal combustion engine (ICE) vehicles provided there is a suitable ZEV alternative. This results in a faster transition of your fleet to ZEVs but also results in the highest TCO out of the scenarios. Notably, the technology leadership scenario illustrates a scenario unconstrained by organizations'' annual procurement caps of 5% of the total value of the fleet. That is, it illustrates what is technologically possible today, although may not be a viable implementation strategy for stakeholders.

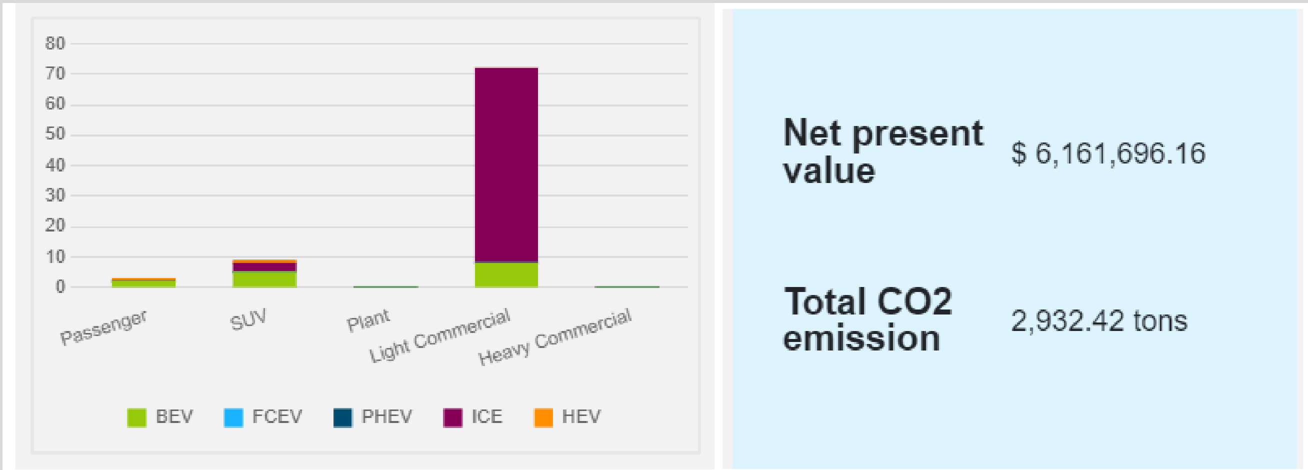
3. Fleet Optimization

3.1 Economic Analysis

The cost-optimized scenario looks for comparable vehicles and considers total cost of operation (TCO) and emissions for the existing fossil fuel fleet. When a vehicle reaches its retirement year, if it has a viable battery electric vehicle (BEV) option that has a lower TCO than its internal combustion engine (ICE) counterpart, the cost-optimized scenario recommends the BEV, otherwise the model will recommend the cheaper ICE option. For the Del Norte region, a large portion of the light commercial vehicles remains ICE because of this very metric. The currently available BEV options are slightly more expensive than their ICE counterparts. SUVs currently don't have this concern so a larger portion of them are available to transition to BEVs.

Overall, the net present value (NPV) of the transition over the course of 11 years is $6.2M. Total CO_2 emissions over the same time-period in the cost-optimized scenario amount to 2,932 tons compared to 3,187 tons in the BAU scenario, resulting in an 8% decrease. The transition of EVs under the cost-optimized scenario is shown below.

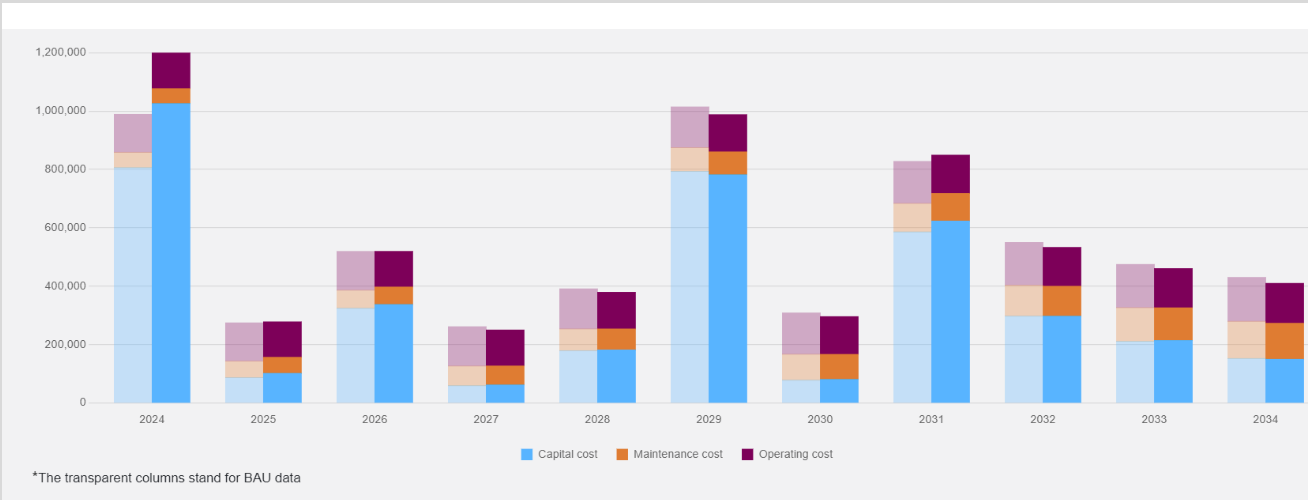
Figure 3 – Light vehicle transition results - cost-optimized transition by type



Due to the limited data provided for this study, the gaps required external market research and assumptions to perform the fleet assessment. In order to develop a more in-depth and comprehensive understanding of the financial impacts of a ZEV fleet transition, a more data-centric approach from the fleet owners is needed. For example, the BetterFleet™ model requires fuel usage data to capture energy consumption and estimate the fuel economy of potential ZEVs. For this project, the relevant fuel information was collected through research. Additionally, research was performed to understand the feasibility of different ZEV equivalents. as well as understand the feasibility of different ZEV equivalents. Moreover, installing trackers on a sample of different vehicle types and rotating the trackers through the fleet can gather telematics data about vehicle usage and duty cycles; a sample of this type of data can be used in the BetterFleet™ model to predict operating range and fuel economy. Given the existing data, we focused on exploring feasible ZEV alternatives for the region's light-duty fleets and developed a framework for a fleet transition/replacement plan based on the mandates put in place by the State of California. Using the vehicle costs and operating costs, we were able to estimate life cycle costs, as shown below.

Under the BAU scenario, the spending is generally between less than $500,000 per year with notable points of greater spending in FY24, 29 and FY31 (see Figure 4). The variable part of the spend is the capital expenditure for vehicles which varies in line with peaks and valleys in vehicle replacements. The operating costs and maintenance costs remain relatively constant over the same period. This scenario forms the baseline against which the cost-optimized and technology leadership scenarios will be compared.

Figure 4 – Light vehicle transition cost profile – BAU and cost optimized

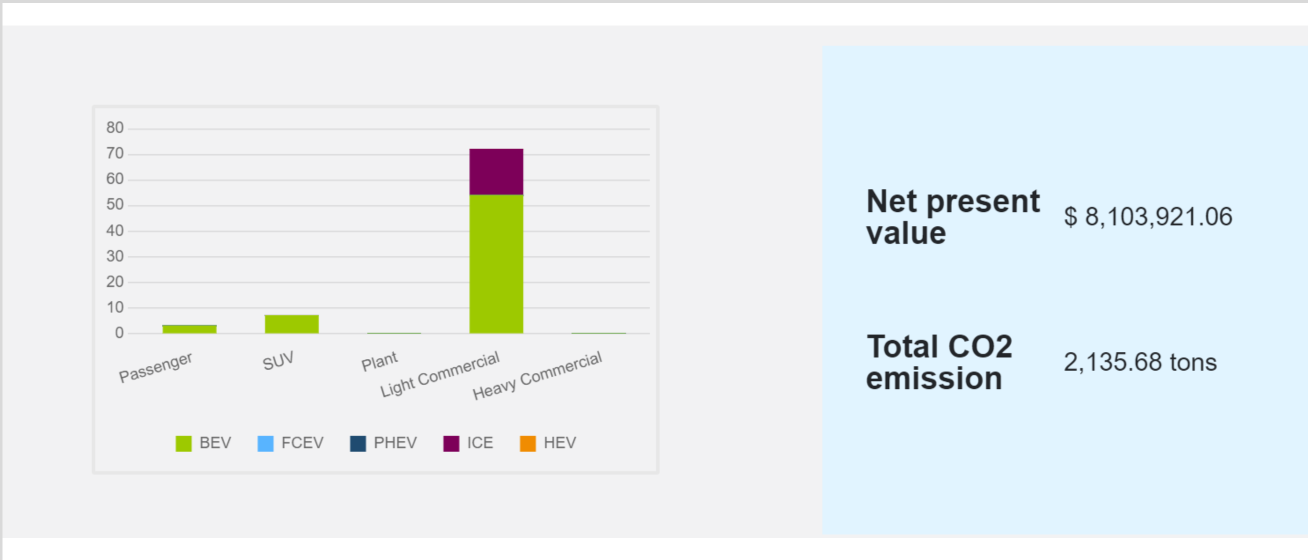


In the cost-optimized transition, slightly greater capital spending occurs in FY24 and FY31 when EVs are added to the fleet. In addition, a number of hybrids are added in other years which also leads to slightly higher capital spending compared to the BAU. Small cost savings in operating costs and maintenance costs materialize following implementation of the first BEVs in FY24. From FY30 some vehicles may be cheaper to acquire as EVs than ICE.

In total, we are estimating a net increase in spending in the cost-optimized transition (compared to business-as-usual [BAU]) of $123,000 over the next 11 years (FY24-FY35), on a discounted cash flows basis. It is noted that the increase in spending is $280,000 on the capital expenditures side (which is partially offset by operations and maintenance cost savings) on a discounted cash flows basis, and it is also noted that these amounts are exclusive of other infrastructure-related costs which would materialize in the cost-optimized transition but not the business-as-usual.

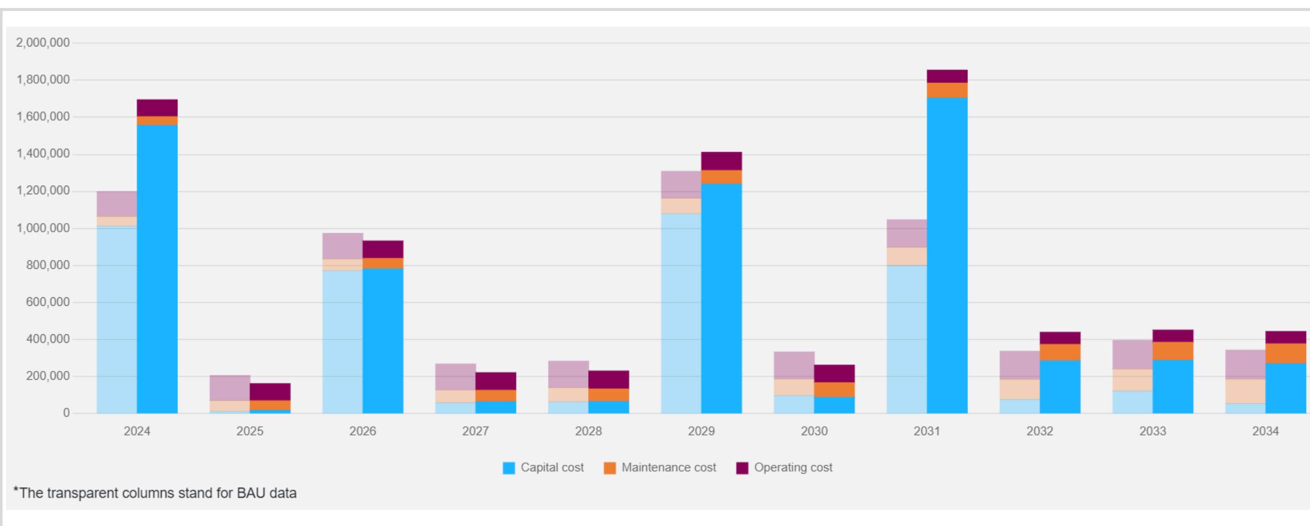
The technology leadership scenario looks for comparable vehicles and, unlike the cost-optimized model, it does not take into account TCO and emissions of the existing fleet. Instead, when a vehicle reaches its retirement year, if it has a viable BEV option the technology leadership scenario recommends the BEV. Overall, the NPV of the transition over the course of 13 years is $8.1M (Figure 5). Total CO_2 emissions in the technology leadership scenario is 2,136 tons compared to 3,187 tons in the BAU scenario, resulting in a 33% decrease.

Figure 5 – Light vehicle transition cost profile - technology leadership transition



In the technology leadership transition, greater capital spending occurs in FY24, FY29 and FY31 when EVs are added to the fleet (Figure 6). Small cost savings in operating costs and maintenance costs are seen beginning in FY24. From FY30 some vehicles may be cheaper to acquire as EVs than ICE. In total, we are estimating a net increase in spending in the technology leadership transition (compared to BAU) of $1.41M over the next 13 years (FY23-FY35), on a discounted cash flows basis, with incremental capital costs of $2.21M.

Figure 6 – Light vehicle transition cost profile – BAU and technology leadership



It is important that using GHD's previous municipal and county clients as a baseline, the cost estimation was done assuming a 1:1, charger to vehicle ratio assuming a Level 2 charger for all vehicles. The level 2 charger costs anywhere between $1k to $5k including hardware and installation. It can provide power up to 22 kW which can fully charge an EV SUV in ~3 hours.

The reason for assuming 1:1 was to ensure that the fleet assets have a reliable place to power-up during off-time. Typically, fleet assets leave the depot in the morning (~6 AM) and come back to the depot in the evening (~6 PM), which provides a 12-hour window to charge the entire fleet and get it ready for service for the next day. A 1:1 ratio also ensures that the fleet operator will not have to assign personnel after hours to move vehicles around the yard or depot to swap fully charged EVs with EVs that require a charge.

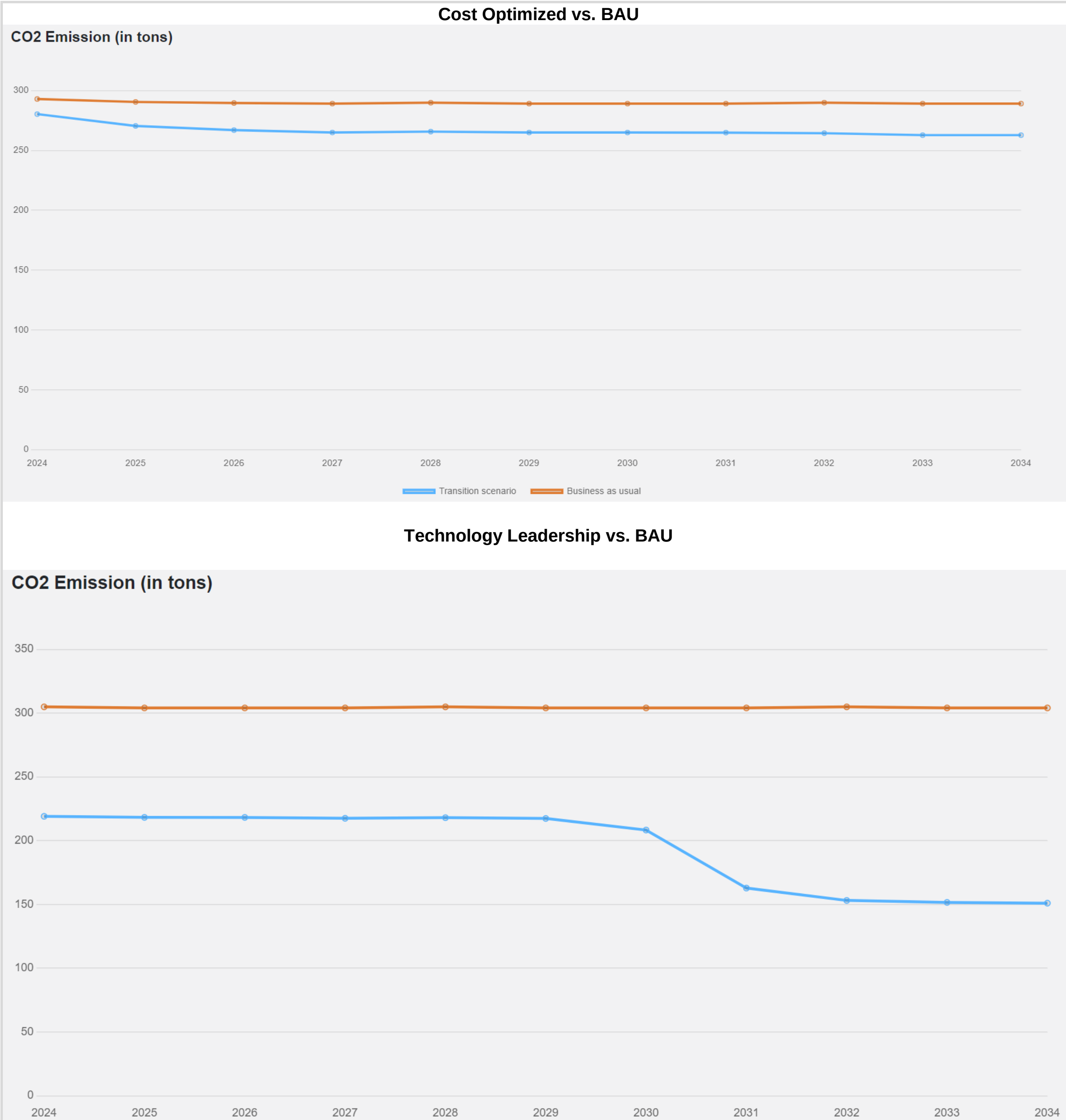
A 1:1 ratio is sometimes not possible if there are space or parking constraints within the yard, in which instance a charging strategy needs to be developed which optimizes charger availability based on the predicted usage by the EVs. GHD has a proprietary Monte Carlo simulator within its ZEVO platform that allows these types of simulations to take place and would be eager to engage with the DNLTC stakeholders as required. This type of simulation and estimation is a necessary next step for DNLTC stakeholders prior to committing themselves towards EVs and making the initial capital investments.

3.2 Emissions Analysis

The emissions profiles for light-duty vehicles, shown below, show the impact the transition to EVs has on CO_2 emissions. Under the cost-optimized transition, emissions fall to ~265 tons per year by FY30, while the BAU continues to emit ~290 tons of CO_2 per year (top chart in Figure 7). The remaining emissions in the cost-optimized scenario are the result of the fleet not reaching 100% BEV due to the cost and procurement restraints built into the model. By the end of the cost-optimized transition, there is a 9% decrease in total emissions.

For the technology leadership scenario (bottom chart in Figure 7), we see a much more drastic change in carbon emissions. By FY30, emission tons per year are around 208 tons (a 31% decrease) and by FY34 emissions are projected to be at 151 tons per year (a 50% decrease). Emissions are calculated from an operations-only standpoint. Throughout these analyses, we look at how many miles each type of vehicle is expected to drive which provides an estimate as to how much fuel it will consume, given that fuel efficiency is available by the manufacturer. For EVs we are making the assumptions that they are responsible for zero tons of CO2 emitted, which is compared against the CO2 from the tailpipe of the fossil fuel vehicles. Power grid CO2 emissions to source the fuel and battery charge are not considered in this analysis.

Figure 7 – Transition emissions profiles



4. Decarbonization Strategy

4.1 Infrastructure review

When reviewing infrastructure, it is important to consider the population, demographics, and existing infrastructure in the area. To properly assess the state of the current infrastructure network, GHD conducted an infrastructure workshop held on May 3, 2023 to engage with members of DNLTC and determine key areas for charging lots based on existing layout and presence of current EV charging infrastructure, parking availability, and through-traffic of the region. Within the entirety of the county, GHD ran analyses to assess equity levels between areas by using traffic parameters to derive Environmental Justice (EJ) scores. A low EJ score is better, so for instance -4.30 implies the region has better EJ compared to a region with a EJ score of +4.65. The resulting maps in Figure 8 and Figure 9 show the outcomes of the analyses. With the areas around Crescent City and northwards along Highway 101 receiving higher traffic volumes compared to the rest of the county, the respective diesel emissions are greater along the routes of that region, which indicates a priority for charging infrastructure consideration in terms of population and air quality. Applying demographic factors such as minority status, household income, and proximity to major transport routes allows us to assign a relative EJ score to each section (Figure 8). This data and the discussions in the workshop are utilized to identify potential charging infrastructure locations.

Figure 8 – Environmental Justice Demographics

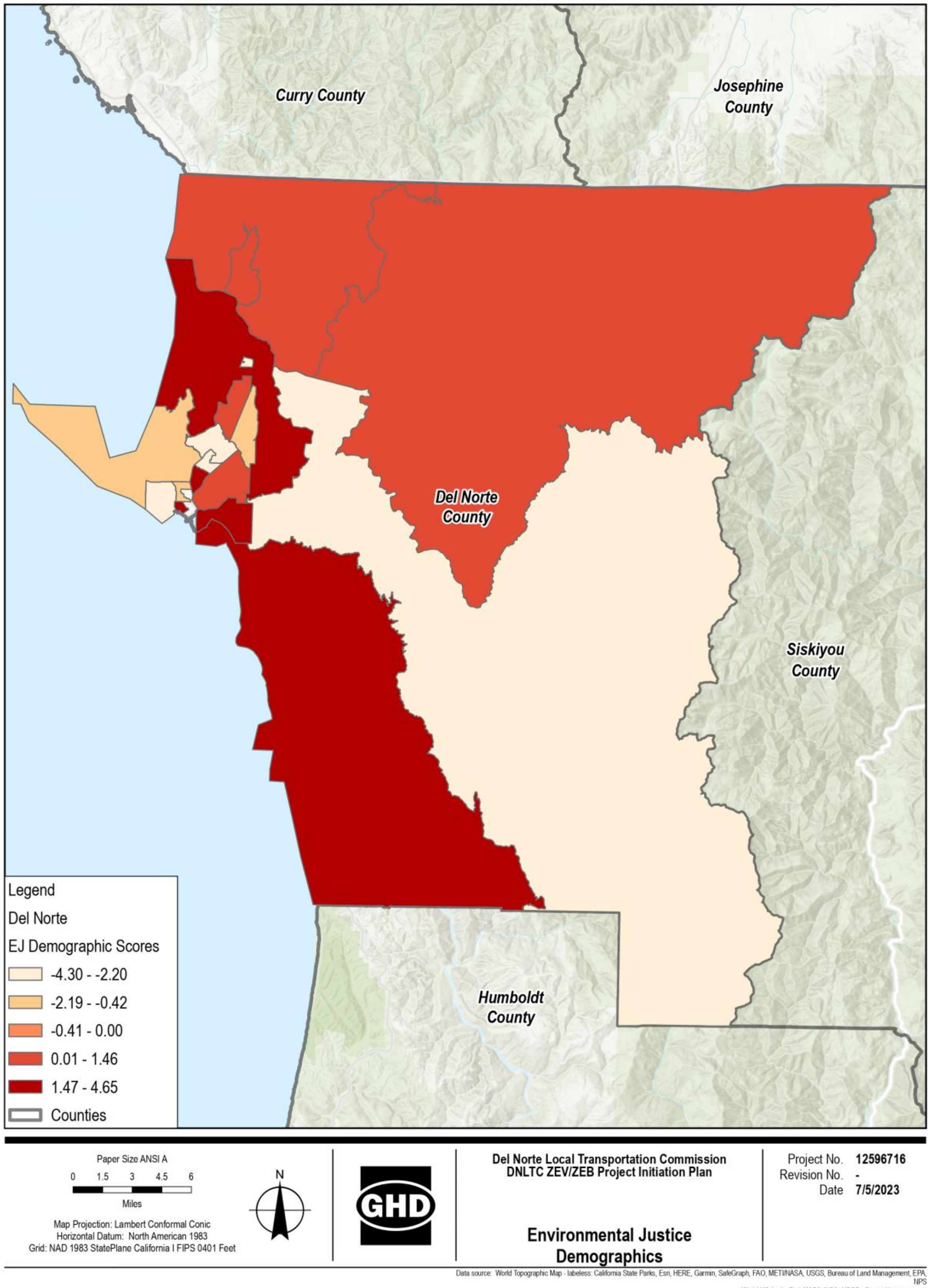
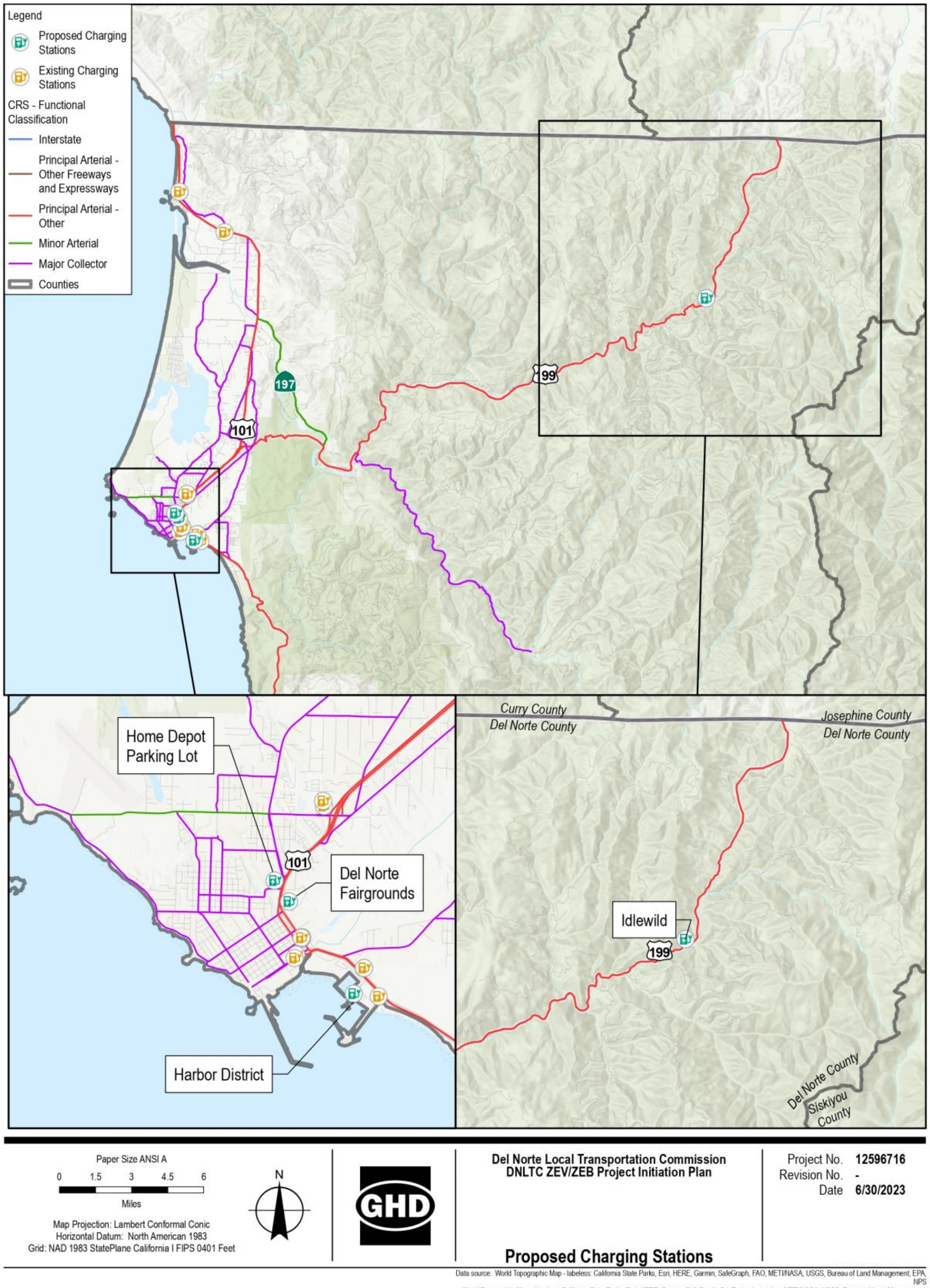


Figure 9 – Prioritized locations for public charging infrastructure



The workshop focused on identifying and prioritizing the 'top 4' locations for placement of charging infrastructure based on a set of parameters. As an initiation plan, the objective was to maximize the benefits of this infrastructure to the local population, and economy. Once these charging lots are developed, the idea is that it will lead to development of other lots as the local population transition further into ZEVs and reduce their dependence on gasoline/diesel. The parameters used to determine the 'top 4' locations are:

- Geographic and topographic location
- Predicted usage by the local population
- Proximity to commercial, industrial, and/or other economic centers
- Situated on major throughfares and arterial roads
- Benefits to commuters
- Resiliency to outages and blackouts
- Impact to local economy
- Benefits to tourists
- Ensuring Public Safety

Google Maps imagery was used to observe the existing utility infrastructure at the sites listed below. Coordination with the local power company (Pacific Power) is needed to confirm the power distribution feeders to each site has capacity for new loads.

Idlewild - Existing electrical infrastructure at this site consists of overhead power distribution that provides power to a Caltrans maintenance facility. A new electrical service is required for new EV infrastructure and would consist of the following upgrades:

- A new intermediate power pole adjacent the current service pole with a new primary riser.
- A new utility pad mount transformer.
- A new 480V 400 Amp outdoor service switchboard with approximately 300kW of capacity.
- Feeders from new switchboard to EV chargers.

Harbor District - Existing electrical infrastructure at this site consists of underground power distribution that provides power to various facilities within and near the harbor. A utility pad mount transformer is located at this site near Highway 101, it is believed that power to the site is derived from this transformer. A new electrical service is required for new EV infrastructure and would consist of the following upgrades:

- A new primary feeder from the existing pad mount transformer to a new transformer and switchboard. If the existing transformer has sufficient capacity, a secondary feeder and no new transformer may be possible.
- A new 480V 400 Amp outdoor service switchboard with approximately 300kW of capacity.
- Feeders from new switchboard to EV chargers.

Fairgrounds - Existing electrical infrastructure at this site consists of a primary riser to a padmount transformer and freestanding service switchboard and ancillary power distribution that provides power to various buildings around the site. The service equipment is located near Highway 101 at Cooper Avenue, and it is believed that power to the entire facility is derived from this transformer. A new electrical service is required for new EV infrastructure and would consist of the following upgrades:

- A new primary feeder from the existing pad mount transformer to a new transformer and switchboard. If the existing transformer has sufficient capacity, a secondary feeder and no new transformer may be possible.
- A new 480V 400 Amp outdoor service switchboard with approximately 300kW of capacity.
- Feeders from new switchboard to EV chargers.
- A potential alternate to increase the future EV capacity would include replacing the existing service transformer and switchboard to significantly increase the service size to accommodate new charging

equipment. Variations of that plan could be explored to optimize costs and minimize downtime. This could retain the single service aspect of the property while allowing a capacity increase.

- RCT's yard is located at the north end of the large Fairgrounds parcel of land, so any electrical upgrades dedicated for the Fairgrounds should be coordinated with RCT. This will hopefully reduce the risk of any 'double work' and ensure that a single upgrade is able to appropriately power both the RCT fleet and public charging infrastructure at the Fairgrounds.

Home Depot parking lot - Existing electrical infrastructure at this site consists of overhead power distribution that provides power to businesses in this area. Based on google imagery, major modifications to the existing utility infrastructure would likely be required for a new service at this site. It is recommended that any efforts to add EV charging stations be redirected to the fairgrounds located across the street. A new service at the fairground is feasible and the larger open area allows for flexibility to add more EV charging stations.

Each parking lot charging station must conform to the California Building Code (5.106.5.3) standard that indicates the number of EV capable spaces based on the total number of parking spaces.

Total Number of Actual Parking Spaces	Number of Required EV Capable Spaces	Number Of EVCS (EV Capable Spaces Provided With EVSE)
0-9	0	0
10-25	4	0
26-50	8	2
51-75	13	3
76-100	17	4
101-150	25	6
151-200	35	9
201 and over	20 percent of total	25 percent of EV capable spaces

In addition to these locations, there are several other strategies that can be utilized to re-purpose traditional fueling infrastructure.

1. **Transition to Electric Vehicle Charging Stations** - Fueling stations can choose to install electric vehicle charging infrastructure, transforming themselves into EV charging stations. This allows them to serve the growing population of EV drivers and capitalize on the increasing demand for charging services.
2. **Diversify into Alternative Fuels** - Another option for fueling stations is to diversify their offerings and include alternative fuels, such as hydrogen fuel cell stations or biofuels. This can provide a transition path for vehicles that are not fully electrified or cater to specific market segments that prefer alternative fuels such as long haul trucking or heavy-duty specialized vehicles.
3. **Repurpose the Space** - If the location and infrastructure of the fueling station are suitable, the property can be repurposed for other purposes. For example, it could be transformed into a retail store, clinic, restaurant, parking facility, or other amenities that cater to the needs of the surrounding community.
4. **Partner with Charging Network Operators** - Existing fueling stations can collaborate with EV charging network operators by leasing space on their premises for installing EV charging stations. This allows them to generate additional revenue streams while leveraging the expertise and network of charging operators.
5. **Convert to Service and Maintenance Centers** - With the increase in electric vehicles, the demand for service and maintenance centers for EVs will grow. Existing fueling stations can consider transitioning into service and maintenance centers that specialize in electric vehicles. This can include routine maintenance, battery inspections, software updates, and other EV-specific services.
6. **Collaborate with Nearby Businesses** - Fueling stations can explore partnerships with nearby businesses, such as shopping centers or restaurants, to share space and resources. For example, a fueling station could

allocate a portion of its property for EV charging stations while collaborating with a nearby restaurant for shared parking spaces or other joint services.

There are numerous real-life examples of how traditional fuel-suppliers are partnering with upcoming EV start-ups and other companies to re-purpose their existing infrastructure.

- Shell, one of the world's largest oil companies, has collaborated with Ionity, a leading EV charging network in Europe. Through this partnership, Shell has started installing high-power EV charging stations at its fueling stations across Europe, providing fast charging capabilities to EV drivers.
- BP, another major global energy company, acquired Chargemaster, the largest EV charging network in the UK. BP Chargemaster operates charging infrastructure across the country, including installations at existing fueling stations. This initiative enables BP to offer EV charging services alongside traditional fueling.
- EVgo, one of the largest public fast-charging networks in the United States, partnered with Chevron to install EV charging stations at select Chevron fueling stations in California. This collaboration allows Chevron to diversify its offerings and cater to the growing number of EV drivers.
- Circle K, a global convenience store chain, has partnered with Ionity to deploy high-power EV charging stations at Circle K locations across Europe. This initiative allows Circle K to transform its fueling stations into multi-purpose locations that serve both traditional fuel customers and EV drivers.

If Del Norte County or other government agencies in the county decide to implement and maintain their own public charging infrastructure, there are both short-term and long-term tasks that they need to be mindful of:

Short term tasks:

- Identify suitable locations for charging stations based on factors such as proximity to high-traffic areas, population density, existing infrastructure, and accessibility.
- Obtain necessary permits, licenses, and approvals from local authorities and ensure compliance with regulations related to electrical installations, building codes, environmental considerations, and zoning requirements.
- Oversee the installation of charging equipment, including electrical connections, charging stations, signage, and any necessary utility upgrades.
- Establish connectivity for charging stations, enabling real-time monitoring, remote management, and user payment processing. Set up payment systems, such as credit card readers, mobile apps, or membership-based access, to facilitate charging transactions.
- Develop educational materials, user guides, and support channels to assist EV drivers in understanding the charging process, payment methods, and troubleshooting common issues.
- Develop marketing strategies to raise awareness about the charging network, target relevant user segments, and promote the availability and benefits of ZEV charging stations.

Long-Term tasks:

- Continuously monitor the charging network for operational issues, connectivity problems, equipment malfunctions, and perform regular maintenance tasks to ensure reliable and efficient charging services. Assume minor cleaning, inspection tasks every year, and a more detailed inspection every 3-5 years – similar to servicing other electrical switchboards and equipment. The charge cables need to be replaced periodically, but the cost and frequency depend on the exact type and manufacturer of the EVCS. Assume a cable replacement at $1000-$2000 every 5 years, for each station as an estimate.

- Stay updated with advancements in charging technology, software upgrades, and cybersecurity measures to maintain the functionality and security of the charging network.
- Gather data on charging usage, user patterns, and charging station performance to inform operational decisions, optimize infrastructure planning, and provide insights for business and policy purposes.
- Assess the demand for charging infrastructure and plan for network expansion, adding new charging stations based on user needs, emerging technologies, and future market projections.
- Monitor revenue streams, manage billing and payment processing, and assess the financial viability of the charging network, including pricing strategies, operational costs, and potential opportunities for revenue generation.

Implementation of regional ZEV charging station also comes with its own set of problems which require appropriate mitigation measures. We have summarized some common problems associated with owning and operating a charging station:

1. **Unauthorized Parking at Charging Stations:**
    - Problem: Non-electric (such as ICE) vehicles or EVs that are not actively charging occupying the charging spots, preventing EV drivers from accessing the stations.
    - Remedies: Implement clear signage and markings to indicate that the parking spaces are designated for electric vehicles only. Enforce parking regulations through monitoring, ticketing, or towing of vehicles in violation. Encourage reporting of violations by EV drivers or install security cameras to deter unauthorized parking.
2. **Overstaying or Idle Charging:**
    - Problem: EVs occupying charging spots long after the charging session is complete, blocking access to other EV drivers or delaying their charging sessions.
    - Remedies: Set time limits for parking at charging stations and implement penalties for exceeding the allotted time. Utilize charging station monitoring systems to identify idle charging sessions and send notifications to the vehicle owners. Educate EV drivers about the importance of promptly moving their vehicles after charging is complete.
3. **Inoperable or Faulty Charging Stations:**
    - Problem: Charging stations that are out of service or experiencing technical issues, preventing EV drivers from charging their vehicles.
    - Remedies: Implement regular preventive maintenance schedules to ensure charging stations are operational. Have clear reporting mechanisms for EV drivers to notify station operators of any faults or issues. Provide real-time updates on charging station availability and status through mobile apps or websites.
4. **Payment and Billing Problems:**
    - Problem: Issues related to payment processing, billing accuracy, or fraudulent activities at charging stations.
    - Remedies: Ensure secure payment systems are in place, such as encrypted credit card transactions or secure mobile payment platforms. Regularly review billing processes to identify and address any inaccuracies or fraudulent activities. Establish clear mechanisms for EV drivers to report payment-related issues and provide prompt customer support for resolution.
5. **Interoperability and Access Challenges:**

- Problem: Incompatibility between charging networks, restricted access based on membership or specific charging network affiliations, limiting user convenience and access to charging stations.
- Remedies: Encourage interoperability between charging networks to enable seamless roaming and access for EV drivers. Promote open standards for charging protocols and data exchange. Advocate for policies that promote cross-network access and interoperability to ensure a seamless charging experience for EV drivers.

6. **Education and Awareness:**
   - Problem: Lack of awareness among EV drivers or the general public regarding charging station rules, etiquette, or available enforcement mechanisms.
   - Remedies: Conduct public education campaigns to inform EV drivers and the public about charging station regulations, proper usage, and reporting mechanisms for violations. Provide clear guidelines and resources on proper charging etiquette and encourage community involvement in reporting and addressing enforcement issues.

An alternative pathway to these common issues is to outsource the implementation and management of the charging stations to a private enterprise. Private enterprises especially from the energy sector (Shell, Chevron, BP, etc.) have been acquiring charging companies to grow their presence. This can be a cost-effective option when the govt agency does not have the internal resources and wants to outsource the maintenance and sustainment to a private enterprise and use them as a Charging as a Service (CaaS) provider. The pros and cons of privatized charging infrastructure have been summarized below:

Pros	Cons
• Private enterprises can often deploy charging stations more quickly compared to government-led initiatives. Being profit driven, they have the rapid flexibility to respond to market demands and identify strategic locations for charging infrastructure based on customer needs and reviews. • Private enterprises can drive innovation in charging technology, user experience, and business models. Competition among different providers can lead to improved services, pricing options, better experience for customers and technological advancements, benefiting consumers. • Private enterprises have the potential to attract substantial investment and financing from venture capitalists, private equity firms, and other sources. This capital can accelerate the expansion of charging infrastructure and help overcome financial barriers which will be difficult for a govt agency to overcome. • Private companies have a strong financial incentive to provide high-quality customer service to attract and retain customers. They can prioritize user-friendly charging experiences,	• Being financially driven, private enterprises might focus on high-demand areas or urban areas with existing infrastructure, potentially leaving less-populated, disadvantaged or remote areas underserved. This can create an uneven distribution of charging infrastructure and limit accessibility for certain communities especially considering Del Norte County's geography and location. • Charging station providers may have different pricing structures, membership requirements, or subscription models, leading to price variability and potential confusion for users. This could impact affordability and consistency across charging networks. It can lock out individuals from using the infrastructure in case they are not members or subscribers to the specific service provider. • The proliferation of multiple private charging networks could result in fragmentation, with different providers using different charging protocols, memberships, and payment systems. This may create interoperability challenges and inconvenience for EV drivers and especially tourists in the Del Norte region who may not be

reliable infrastructure, and efficient support services. • Private enterprises can explore various business models to generate revenue from charging stations, such as pay-per-use, membership subscriptions, advertising partnerships, or partnerships with fleet operators. This can contribute to the financial sustainability of charging networks.	aware of the specific requirements per charging station. • Private enterprises are subject to market forces and profitability considerations. Economic downturns or changes in market conditions could impact investment, expansion plans, or even lead to the closure of charging stations, potentially disrupting charging services. • Private charging networks may not prioritize serving underserved communities or areas with lower profitability potential. This could result in limited accessibility to charging infrastructure for those who cannot afford private charging services or reside in economically disadvantaged regions.

As a planning exercise, if DNLTC or its stakeholders want to calculate the expected cost of implementation of a charging station, they can do so using this graph provided below (Figure 10).

Our estimates for this graph are based on the presumption (**Link**) of a 350 kW of total peak demand for a single parking lot (implies approx. 12x Level 2 Chargers or 7x Level 3 chargers or a mixture of both). The expenses include the following.

- Construction Documents
- Site work and preparation
- Electrical Distribution Equipment
- Electric installation of the chargers
- Transformer & Primary Cable
- EVSE charging hardware
- And 10% Contingency

We accounted for 'economies of scale' where a parking lot with many chargers should cost less in terms of $/kW than a parking lot with a few chargers. We extrapolated these costs so that DNLTC and its stakeholders can estimate the price per charging site for any number of planned charging stations. Please note, these are high-level planning estimates and will vary by specific requirements of each site. Prior to implementation, the site plan must be validated by a licensed professional electrical engineer and estimated appropriately by a Quantity Surveyor (QS).

To utilize the graph, first, estimate the ‘total peak demand’ for the proposed charging station in kW based on the desired number of Level 2 and Level 3 chargers. Secondly, use the peak demand (kW) to identify the correct ‘cost of Implementation’ ($/kw) from the graph. Finally, multiple the ‘total peak demand’ with the ‘cost of Implementation’ to arrive at the total estimated cost for the charging station.

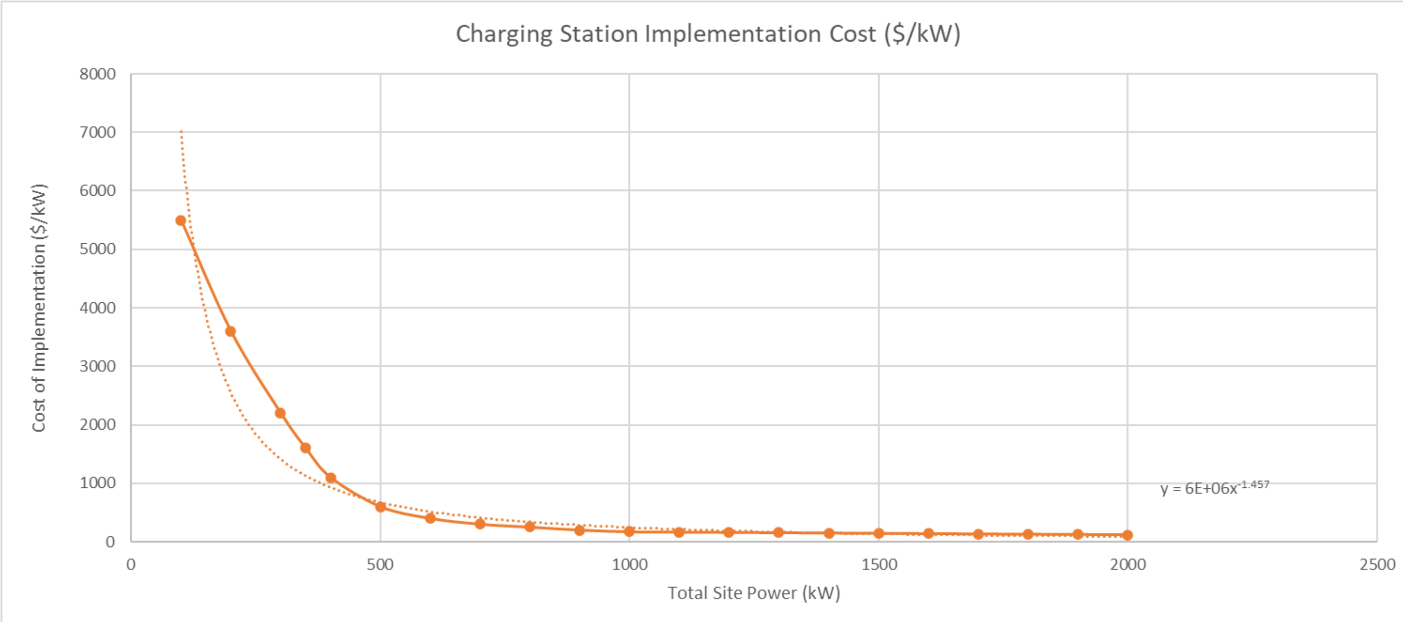


Figure 10 – Formula and graph for estimating Charging Station implementation cost

4.2 Fleet strategy

As noted in the market scan section, several light and heavy-duty fleet vehicles were not considered in the BetterFleet™ analysis as we do not envision them to be candidates for transition in the short-to-medium term, the scope of this assignment. However, over the next five years, as these vehicles begin to reach the end of their lifecycle, we recommend that DNLTC stakeholders revisit their electrification potential, especially as technologies and economies are expected to continue to evolve over the same horizon. In particular, the lack of data availability presented a barrier to producing a more tailored, comprehensive assessment and plan for the region; more robust data collection protocols will be necessary to develop a data-driven strategy and to understand the implications of a ZEV transition.

It is important to appreciate that this Fleet Assessment and Strategy is intended to highlight the early action items that DNLTC stakeholders may take to prepare for a ZEV transition; it is not intended to be a comprehensive ZEV Master Plan. Rather than consider each vehicle individually for its electrification potential, it is important to understand how each vehicle fits within a larger fleet electrification program. A more complete master plan will be required not only for planning electrification across the entire region's fleets, but also for considering strategies related to infrastructure rollout, engagement with Pacific Power and other stakeholders, human resources planning, and funding strategies. Each of these initiatives have implications with respect to the actions that DNLTC intends to take with respect to EV rollout.

The core focus of the BetterFleet™ analysis was to evaluate the combined fleets of Del Norte County, Crescent City, the Yurok Tribe and Redwood Coast Transit, identify suitable EV replacements that meet key operational fit-for-purpose requirements, and outline a preliminary strategy to help guide initial fleet transitioning action in the short to medium term.

Key conclusions from the fleet analysis include:

1. The region's fleets contain a large number of vehicles that are overdue for transition, providing plenty of options to be immediately transitioned to an EV fleet.

1.1. The cost-optimized scenario and the technology leadership scenario illustrate two possible pathways to electrification, but they are not the only two possibilities.

1.2. Regardless of the scenario selected, there are short-term opportunities for DNLTC to demonstrate 'quick wins' in electrification, with EVs identified as early as FY24.

1.3. Appropriate budgets should be established, and appropriate funding and grant sources identified, to help guide the implementation. Essential infrastructure to support the EV transition will also need to be considered.

1.4. Fleet transitioning is best approached with a mind of efficiency, where charging infrastructure is phased in over time and not unnecessarily front-end loaded. DNLTC stakeholders should take a pragmatic approach to phase in infrastructure at garaging locations accordingly. Given there are more than four (4) potential fleet depots within the region, fleet owners through DNLTC, should focus on deciding which site to transition first based on criteria like suitability for electric upgrades, vehicle capacity, and operating characteristics.

2. Emphasizing light-duty cab chassis vehicles in the transition is a prudent approach for the short-term.

2.1. Light-duty cab chassis vehicles generally have stronger feasibility for electrification in the short-term as the technology is more established and the TCO gap is more manageable.

2.2. Prioritize learnings through early electrification projects targeting the lowest TCO gap. Take advantage of new and existing sources of data to build a deeper understanding of the duty cycle demands on assets at relatively low cost.

2.3. Over the next five years, DNLTC stakeholders can expect to transition anywhere from 13 to 26 of their vehicles to EV alternatives, and over the next ten years, the combined fleets of the Del Norte region can expect to transition anywhere from 15 to 63 vehicles to EV alternatives. It is appreciated that the number of vehicles to be transitioned that is feasible for stakeholders may be on the lower end of those ranges, due to procurement limitations.

4.3 Sustainment strategy

An important aspect of building a regional decarbonization strategy and workplan is the consideration of a ZEV sustainment strategy. This strategy needs to ensure that the region's sustainment efforts have 'buy-in' from the local stakeholders and produce a long-lasting impact without losing momentum. The 'buy-in' can only happen when DNLTC and its partner organizations create a holistic sustainment strategy which largely meets the goals, aspirations, and desires of the regional players. The plan needs to solve more problems than it creates. Much of this pathway at both the national and state level strategies is rooted in a sustainability goal of Net-Zero Greenhouse Gas Emissions by 2050. While California has established a mandate to this end by banning the sale of new gasoline and diesel-powered vehicles as early as 2035. CARB mandates include all new trucks sold in California emit zero emissions by 2045 and associated Innovative Clean Transit (ICT) regulations for roll out plan Zero Emission Bus (ZEB) purchases scheduled now thru 2040. Decoupling the environmental sustainability aspects of the larger strategy and focusing on the regional decarbonization of personal and fleet vehicles, the Sustainment strategy provided as part of the work plan will:

- Explore sustainment strategies in terms of maintenance requirements for both mobile and fixed assets.
- Characterize specifically on social equity metrics around deployment of ZEVs to ensure that benefits from this roll-out is realized for all residents of the county and the general area.
- Develop an engagement strategy that garners feedback from the regional work group and applies towards the Work Plan.
- Funding model that looks at the various incentives, grants, loans, and rebates available and ensuring that the overall workplan meets the mandates set by the California government CARB and ICT.
- Encourage sustainable modes of transportation through marketing activities and incentivizing users either financially or via other means.
- Further develop neighborhoods around charging lots and create an economic system which leverages this new transportation mode.
- For new civic facilities and buildings, be mindful of building the infrastructure in a manner that is receptive to ZEVs

Articulate, communicate, and initiate specific sustainable transportation ideas via an **Action Implementation Table**, an example of which is provided below. We would suggest to expand this table with any other idea and then get formal quotes for pricing, engage in procurement, and develop their next steps.

Actions	Timeline	Expense	Lead Department	Priority
Develop and implement a Green Fleet Strategy **Example**	Short Term	$$	DNLTC and its stakeholders	High
Develop and implement a new Climate Action Plan that incorporates emerging best practice approaches and innovative technology **Example**	Short Term	$$$	DNLTC	High
Encourage sustainable driving habits through an e-learning civic driver training program **Example**	Medium Term	$$	DNLTC	Medium

Research and evaluate low carbon or renewable fuel options for the various fleets (e.g. piloting biofuel, low emission diesel, hydrogen)	Short Term	$	DNLTC	Medium
Foster community driven climate action projects and initiatives that contribute to community GHG reduction. The general contents include specific projects, their impacts, risks, and financial implications.	Short Term	$$	DNLTC	Medium
Complete an assessment of Environmental Technology Opportunities such as smart sensors, and Catalyst Injection Systems. The general contents of this assessment include market research, results from pilot studies done elsewhere and the business case of implementing it in the local context.	Short Term	$	DNLTC	High
Set guidelines and standards for sustainable procurement of new vehicles across the region	Short Term	$$	DNLTC	Medium
Foster the local population to utilize transit, car-sharing and other modes of transportation which help reduce emissions. This can be done by attracting car-share companies like **Zipcar**, or encouraging active modes of transportation such as walking or cycling in conjunction with transit.	Short Term	$	DNLTC	Low
Develop a Carbon-Offset or Carbon-Credit reserve fund policy that will help allocation funds to high-value GHG emission reduction projects **Example**	Short Term	$	DNLTC	Medium
Develop partnerships with local businesses to gauge their interest in developing charging lots	Short Term	$	DNLTC and its Stakeholders	High
Develop a GHG Tracking solution that encapsulates the fleet, buildings, and public vehicles. This can be real-time or historical data based. The easy option would be to make it a data analytics exercise and predict GHG emissions through attractive Power BI dashboards which can be accessed by various personnel in the region. The more expensive option will be to install emission trackers on the vehicles and utilize that to report on real-time	Long Term	$$$	DNLTC	Medium

emissions which for Del Norte may be unreasonable.				
Continue to discourage idling of fleet vehicles and develop community guidelines around idling and an associated campaign. It continues to be relevant because idling can occur at traffic lights, while parked or while waiting to pick-up or drop-off. An average engine idling for 10 mins produces 700 grams of CO_2. (**Link**)	Short Term	$	DNLTC	Medium

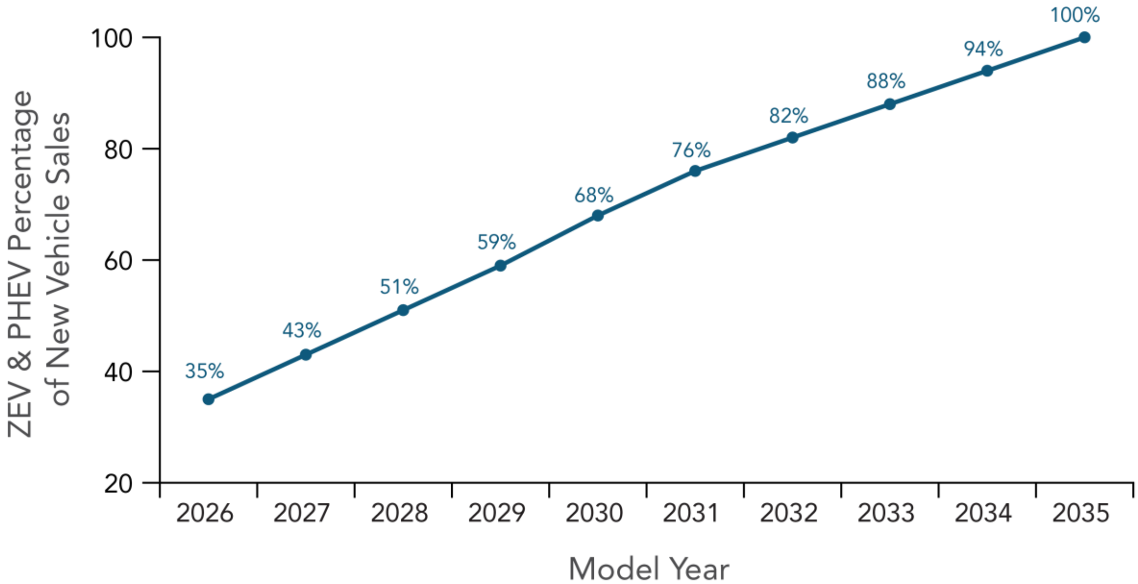
4.4 Emissions targets in the Del Norte County region

The Del Norte County region falls under the jurisdiction of the California Air Resources Board (CARB) policies to achieve 100% zero-emission vehicle purchases by 2035. The goal of these conditions is to provide long-term community benefits in terms of environmental sustainability and air quality, especially to disadvantaged communities such as Indigenous communities, rural regions, or socio-economically underserved communities.

Del Norte County, especially in Crescent City, and neighboring northern counties within the state already boast comparatively low emissions and pollution rates compared to the regions south of San Joaquin County. However, to mitigate the effects of climate change across local and neighboring communities, The Del Norte region has an obligation to decarbonize regional fleets according to the policies and targets outlined in the CARB emissions reductions plans. As California is facing one of the most severe air pollution crises in the country, the National Ambient Air Quality Standard (NAAQS) registered rising rates of PM2.5 and NOx quantities which are tailpipe contaminants detrimental to long-term health. This is why the Government of California proposed a plan to regulate that automakers increase production of zero-emission vehicles beginning in 2026 which will account for 35% of all vehicle sales in the state, reach 68% by 2030, and reach 100% by 2035.

California moves to accelerate to 100% new zero-emission vehicle sales by 2035 | California Air Resources Board

Figure 11 – Projection of percentage of ZEV purchases in California until 2035



Alongside CARB targets, the United States Environmental Protection Agency (EPA) has set a net-zero emission goal by 2050 for all sectors across the country, with aggressive targets in place to prevent long-term climate change impacts. The North Coast Unified Air Quality Management District has implemented several incentive programs along with CARB's policies to assist in meeting these quotas with funding sources described in section *4.5 Funding model* of this report. Although the following bullet-point incentives do not apply to the existing vehicles assessed in the BetterFleet™ analyses from the received data, these options may be considered in the region's long-term road to zero-emission vehicles. These are potential funding opportunities to reduce emissions and ensure that DNLTC meets government policies set in California and the United States and can even emerge as a leader in rural emission reduction compliance.

- Carl Moyer Grant Program – *allotted for off-road equipment replacement and infrastructure projects used to fuel or power a covered source*
- VIP Grant Program – *a program for to "…provide funding opportunities for fleets with 3 or fewer vehicles to quickly replace or retrofit their older heavy-duty diesel vehicles...Fleet owners that operate vehicles with 2006 or older model year diesel engines may be eligible for funding towards the purchase of an exhaust retrofit."*
- Rural School Bus Pilot Project (RSBPP) – *any public transportation agencies operating buses in a public school district, a public charter school, the County Office of Education, the Joint Power Authorities (JPA), or the Division of State Special Schools of the State Department of Education.*

4.5 Funding model

Each city or county in California has its own specific approach to funding fleet ZEV charging stations, depending on available resources, local priorities, and partnerships. It's essential for local governments to explore multiple funding sources and leverage state and federal programs to maximize the financial support for ZEV infrastructure development. However, the funds and rebates have their own specific requirements and eligibility criteria. DNLTC stakeholders are suggested to review the fund requirements closely and validate if firstly, they are eligible for the funds and secondly if those funds are appropriate for their use. Common funding models in California include:

1. **Grants and Incentive Programs** - Cities and counties can access grants and incentive programs offered by state and federal agencies to fund ZEV charging infrastructure. Programs like the California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program, the California Air Resources Board's Clean Vehicle Rebate Project, or the Volkswagen Environmental Mitigation Trust Fund provide financial assistance specifically for ZEV infrastructure deployment.
2. **Electrification Funds** - Local governments can allocate funds from their own budgets or establish specific funds dedicated to electric vehicle (EV) infrastructure. These funds may come from a variety of sources, such as general funds, transportation budgets, or utility partnerships. By earmarking funds for ZEV charging stations, cities and counties can support the transition to cleaner transportation within their jurisdictions.
3. **Public-Private Partnerships** - Cities and counties in California often collaborate with private entities to establish fleet ZEV charging stations. Through partnerships, public entities can leverage private investment and expertise to finance and operate the charging infrastructure. Public-private partnerships can include long-term contracts, joint ventures, or concession agreements, with the private entity providing funding or assuming the responsibility for installation, maintenance, and operation.
4. **Utility Programs and Partnerships** - Local governments can work with electric utility companies to access funding or assistance for fleet ZEV charging stations. Utility companies may offer incentives, rebates, or special rates for charging station installations to encourage the adoption of electric fleets. By collaborating with utilities, cities and counties can tap into existing programs and expertise to support charging infrastructure development.
5. **Bond Measures and Financing** - Cities and counties can explore bond measures or financing options to secure funding for ZEV charging stations. These mechanisms involve borrowing funds and repaying them over time through dedicated revenue streams or taxes. Bond measures can be placed on the ballot for voter approval, while financing options allow local governments to access capital upfront for charging infrastructure projects.
6. **Impact Fees and Developer Contributions** - Local governments may require developers to contribute to ZEV charging infrastructure as part of the development process. This can take the form of impact fees or conditions for project approval. Requiring developers to provide or fund charging stations helps expand the charging network and supports the transition to ZEVs within the local community.

As noted in the BetterFleet analysis, the capital expense of transitioning to ZEVs will be one of the largest roadblocks that DNLTC faces. The primary way to mitigate that is by maximizing funds from rebates, grants, and incentives. Both the US Federal Government and California State Government have committed to providing these funds however the challenge is in understanding the nuanced eligibility requirements and application process. In order to simplify that, this report will talk about the four principles behind funding and provide information on the top 3 funds that DNLTC stakeholders would be eligible for. The four principles behind a funding model are:

Nature of Fund	
Understand the purpose and scope of the fund	Verify if the fund is appropriate for DNLTC and its partners
Eligibility Requirements	
Determine specific eligilibty criteria from a technical perspective	Verify the stack-ability rules so as to not be precluded from other funds
Eligible Costs	
Verify which expenses the fund will cover and to what extent	Determine any 'out of scope' items which DNLTC will need to budget for
Application Process	
Validate the steps involved in the application process	Collect 'necessary' and 'supplmentary' documentation

The top 3 rebates for DNLTC to utilize towards it decarbonization future are presented in the following three (3) tables.

Table 4 – California Clean Vehicle Rebate Project (CVRP) (<u>Link</u>)

Nature of the fund	The CVRP fund is aimed at reducing the purchase price of ZEVs including electric, plug-in hybrid and fuel-cell vehicles. It promotes clean vehicle adoption in California by offering rebates for the purchase or lease of new, eligible zero-emission vehicles, including electric, plug-in hybrid electric and fuel cell vehicles. The fund itself is administered by the Centre for Sustainable Energy and is sponsored by the CARB (California Air Resources Board).
Eligibility Requirements	• The vehicles need to be on the list of **<u>Eligible Vehicles</u>** • The vehicle purchased needs to be new (as opposed to used) and registered in California • Odometer reading below 7500 miles at the time of purchase. However, the 'new vehicle' rule overrides this. • MSRP of $60,000 or less for Large Vehicle category which includes minivans, pickups, and SUVs • MSRP of $45,000 or less for the Cars category which includes hatchbacks, sedans, wagons, and two-seaters

Eligible Costs	The rebates are higher for 'Disadvantaged Communities' but as per the **CalEnviroScreen 3.0 tool**, DNLTC falls in the 30-35% percentile and hence would be deemed ineligible for that. The standard rebates are: Hydrogen Fuel Cell Vehicle rebate: $4,500 Battery Electric Vehicle rebate: $2,000 Plug-in Hybrid Electric Vehicle rebate: $1,000
Application Process	• CVRP Application Form submitted online • A complete copy of the executed and signed vehicle lease or purchase agreement • Proof of vehicle registration For more details → **Here**

Table 5 – California Electric Vehicle Infrastructure Project (CALeVIP) (<u>Link</u>)

Nature of the fund	This fund addresses the needs for EV charging infrastructure and includes rebates towards purchase of chargers, upgrades needed towards utility connections. The fund is divided into 1.0 and 2.0: 1) 1.0 is for County-specific rebates, available on a first-come, first-served basis, for L2 and DCFC 2) 2.0 is for pre-planned DC fast charger installations The fund is not disbursed through a standard process for all. Rather, it relies on individual targeted 'projects' which certain counties and communities can apply towards at any given time.
Eligibility Requirements	As per the official website (on June 2023) for 2.0, the first project is called 'Golden State Priority Project' and under that Northern and Southern regions applications have not started yet and the project prioritizes Disadvantaged Communities and Low-Income communities which DNLTC may not be eligible for. However, there will be subsequent projects that DNLTC may be eligible for, and our suggestion would be to sign up for new rebates → **<u>Here</u>** For 1.0 the Northern California Incentive Project application is closed but it did not include Del Norte County. Our recommendation would be to reach out to the fund administrator and get more information on what their anticipated next steps are to include Counties that were missed.
Eligible Costs	For 1.0 DNLTC could get up to $6000 per Level 2 charger and $80,000 per DCFC charger. For 2.0, DNLTC could get up to 50% of the project's total approved costs rebated to a maximum of $100,000 per charger. Other associated expenses are also eligible for rebates and include: • All-inclusive solar EV charging systems • Demand management equipment • Design, engineering, and utility service costs • Electric panels • Electric vehicle supply equipment (EVSE) • Energy storage equipment • Extended warranties • Installation costs (labour and materials) • Network agreements • Planning and engineering design costs • Project signage • Required ADA upgrades to site due to project, but not to include or cover upgrades of existing ADA noncompliance* • Stub-outs • Transformer

	• Utility service orders
Application Process	The application is online through the official portal and full details can be found → **Here**. DNLTC will need to provide the following information: 1) Site Verification Form 2) Evidence of Permit Submittal or if upgrades to the utility service is needed a Utility Service Design document. 3) Installation documents for CSE review

Table 6 – Bus Replacement Grant from CARB (Link)

Nature of the fund	This Grant is fed by the Volkswagen (VW) Environmental Mitigation Trust provides about $423 million for California to mitigate the excess nitrogen oxide (NOx) emissions caused by VW's use of illegal emissions testing defeat devices in certain VW diesel vehicles
Eligibility Requirements	To be eligible for this fund, DNLTC and its member jurisdictions need to show: • Eligible Applicants are owners of transit buses, school buses and shuttle buses • Applicant must scrap a Gas, diesel, CNG or propane powered 2006 or older school bus with a vehicle weight rating greater than 14,001 lbs. to qualify for the grant. • Applicant must scrap a Gas, diesel, CNG or propane powered 2009 or older transit or shuttle bus with a vehicle weight rating greater than 14,001 lbs. to qualify for the grant.
Eligible Costs	You can apply for up to $3,250,000 dollars per Tax ID. However, for each bus the eligible costs are as shown below: **School Buses** • Replacing a compliant old school bus - Up to $400,000 - Requirements - New, Zero-Emissions, Commercially-Available. • Replacing a non-compliant old school bus – Up to $380,000 - Requirements –New, Zero-Emissions, Commercially-Available. **Transit Buses** • Up to $180,000. Requirements – New, Battery-electric bus, Commercially Available • Up to $400,000. Requirements – New, Fuel-cell bus. Commercially Available **Shuttle Buses** • Up to $160,000. Requirements – New, Zero-emission, commercially-available.

Application Process	DNLTC will require the following documentation to apply for this grant. More details can be found → **Here** • Copy of Title • IRS Form W-9 • Dated and itemized dealer quote for the proposed new bus • Authorization of project implementation and signing authority (Board Resolution) • Copy of the current Department of Motor Vehicles Registration for the bus on the application • Copy of proof of current insurance for the bus on the application • Copy of proof of insurance • New bus quote • Copy of bus route (Transit and Shuttle Bus Only) • CARB Executive Order for the engine in the current bus • CARB Executive Order for the engine in the new bus • Photographs of the current engine and bus

5. Workplan Implementation

Zero-emission vehicle technology blends planning activities with day-to-day fleet management, accelerating the need for a higher-level master plan to bring all the pieces together.

Fleet decarbonization must be considered alongside the amount of flexibility desired in the Del Norte region's fleets, recognizing that fluidity of staff and asset allocation to sites required for proper operational functionality must be couched in long-term policies and planning. The lens of fleet decarbonization adds another layer of consideration in that step changes in technology are bringing interruption to standard rollover budget processes. Electric charging infrastructure becomes an inflexible asset and staff/vehicle flexibility cannot be considered as operationally flexible in the event of extreme circumstances. Similarly, the public charging infrastructure and encouraging uptake of ZEVs in the local community needs to be cognizant of the region's aspirations to be developed as a ZEV-friendly place.

Without the proper preparation of a holistic and effective long-term master plan, the path to decarbonization, for both the fleet and public vehicles, may become inflexible and obstructed by constraints.

A DNLTC sponsored ZEV Master Plan affords leadership of the various stakeholders the opportunity to confirm what needs to be delivered and how it can be delivered outside of established system constraints. A master plan should define future ZEV uptake levels and how technology and staff can enable that. The master planning process would remove entrenched inflexibility and redefines performance in a technology agnostic way, and it would allow ZEV rollout to be planned in a stepwise fashion in tandem with the planning and rollout of the appropriate EV charging infrastructure. In order to initiate the ZEV Master Plan, we have put together a high-level 3-Phase ZEV roll-out plan for DNLTC's consideration (Figure 12).

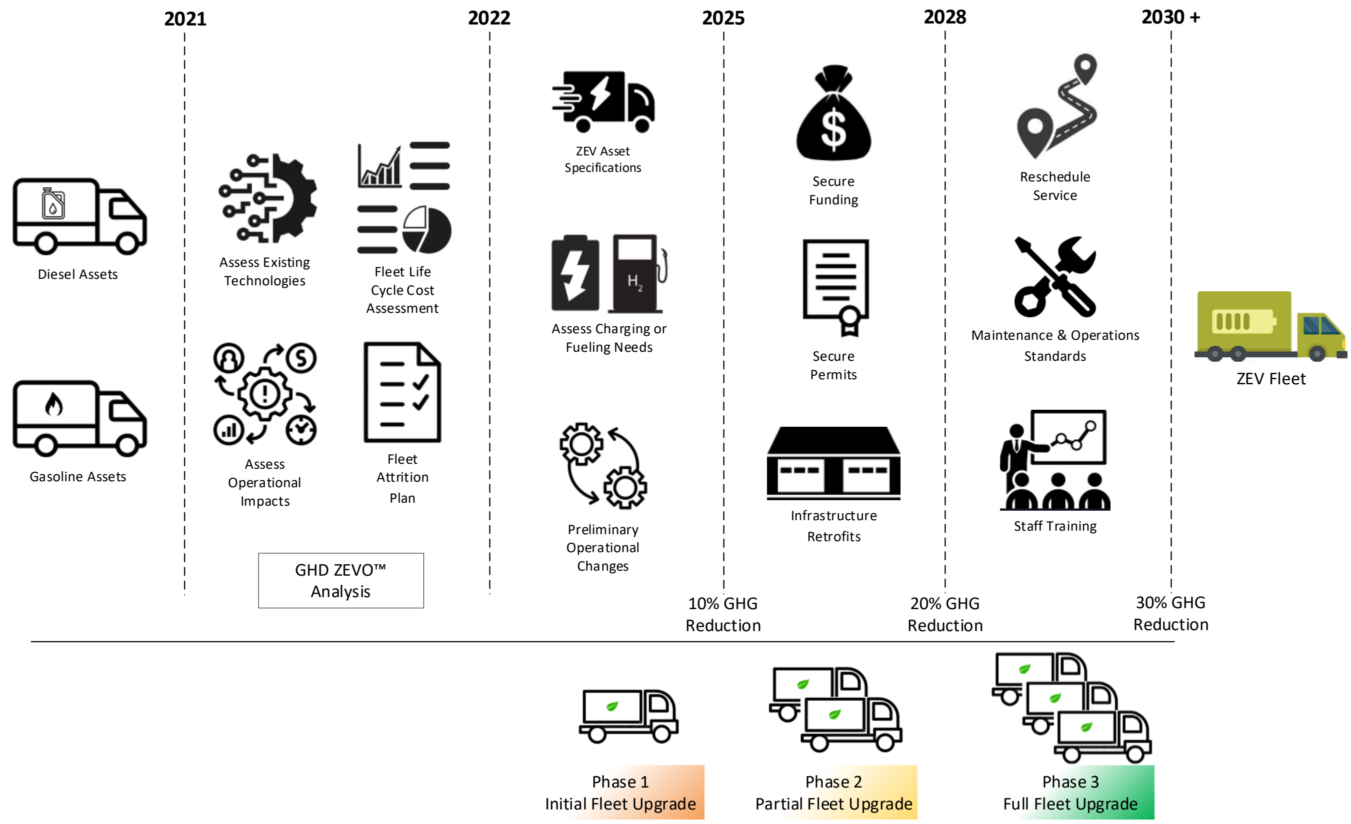


Figure 12 – Three phase fleet transition plan

Phase 1 is the feasibility planning stage, which begins with this 'Initiation Plan' study. Through this study, DNLTC and GHD have identified the key stakeholders in the region and set goals based on the local carbon mandate/regulations and performance indicators. The existing fleet assets and public charging infrastructure have been assessed to create transitions scenarios with their corresponding financial, environmental, infrastructure and energy profiles. Next step is to engage in procurement exercises to secure a pilot project of purchasing a single ZEV along with a single instance of basic charging infrastructure to be placed for the benefit of the public. The pilot ZEV can be determined through discussion between the various fleet stakeholders based on financial appetite and ability to maintain and operate the vehicle. It must also aim to maximize the available grant funding. This will provide four benefits:

1. Understanding the limitations and opportunities associated with the specific ZEV make and model through running the vehicle in various localized operating conditions such as the four seasons and utilizing it for a diverse range of work trips. This will help to understand the specification (make & model) of ZEVs that is appropriate for the DNLTC stakeholders in terms of range, power, HVAC, price and local distributorship network.
2. Identifying the power and energy requirements of this pilot vehicle, to drive the ongoing discussion with Pacific Power. Study the data from the EVEMS (Electric Vehicle Energy Management System) and chargers to forecast the electrical demands for a full ZEV fleet as that will directly impact the electrical capacity of the fleet depot. Utilize that to right size the necessary electrical connection from Pacific Power as anticipated for 2030 and beyond. This exercise needs to be repeated for all DNLTC stakeholders for their respective fleets since the fleets are domiciled in their independent depots.
3. Collecting feedback from the drivers on the positives and negatives of the ZEV and capturing any potential points of concern. Utilize this feedback to set-up the initial processes associated with change management and communicate them to key personnel to get their buy-in before the project progresses to the next phase. Communicate the pros and cons with DNLTC so that the information can be shared with the other

stakeholders and enable them to skip the trial stage in a significant way. This cycle of process creation and feedback will allow right sizing of approach to fleet decarbonization and avoid any major roadblocks in the future in terms of the viability of these assets as it pertains to the fleet's daily operations. These preliminary processes will eventually evolve into a full operating model, as mentioned in Phase 3.

4. Validating the required fleet size and make-up into the future per each stakeholder. Each fleet owner must utilize the pilot as a way of understanding whether it requires the exact same current vehicles or specialized vehicles in its fleet and in the same numbers. If efficiencies can be identified through operating ZEVs, the total number of assets can be reduced through a fleet optimization exercise, which would directly benefit the bottom-line of the stakeholder's operating budget.

5. On the public infrastructure side, the pilot charger must be assessed for usage. This will provide the basis for application of grants and funds which help to expand the network of chargers in the region. Today's chargers have a strong data generation ability, and DNLTC must use that data in conjunction with its stakeholders to determine next steps. To increase the exposure to charging and ZEV up-take, DNLTC must market its initiative to the public and showcase the new infrastructure in a positive light. To assist with that, hold public engagement sessions to gather the local population's feedback and aspirations.

The primary outcome of Phase 1 is to identify the optimal specification of ZEVs that will work for the regional fleets and continue procuring it year-over-year to grow the ZEV fleet and reduce emissions. Similarly on the public charging side, it will help determine the desired level and specification of the charger and how the local public intends to utilize the infrastructure.

Phase 2 is the detailed implementation planning stage of the transition, which utilizes lessons learned from the Phase 1 pilot (one ZEV and one charger) to develop a robust implementation plan with an aim to fully decarbonize the fleet and incorporate more charging lots throughout the region. Through steady attrition of procuring one to two ZEVs each year, DNLTC stakeholders should have a growing fleet of ZEVs at this stage and may require significant investments in terms of upgrading their electrical connection and purchasing expensive variants of ZEVs. Similarly, between 2025 and 2028, we anticipate a larger share of the public vehicles in the region will transition to ZEVs and will demand a larger network of chargers, similar to the current state of the gas-station network. Since infrastructure will play a large role in the success of this phase, the DNLTC and their stakeholders must:

1. Communicate the outcomes from its pilot and the subsequent fleet transition goals to the California state government and specifically Caltrans, and CARB. Depending on the timeline, each of these organizations may have rebates or funds to help with the necessary investments. This study provides a high-level assessment of the required infrastructure, but eventually DNLTC's stakeholders need to complete a detailed design and financial assessment of the essential infrastructure upgrade through engaging an electrical contractor and utilize that to apply for various grants, incentives, rebates, and loans as needed. The local utility company, Pacific Power, needs to be engaged to verify if they provide any financial support towards these electrical upgrades. These rules and funds are however subject to change in the future and DNLTC should liaise with all relevant state and federal organizations to keep itself up to date.

2. Keep scalability in mind. A majority of DNLTC stakeholder's fleet size will most likely grow leading up to 2045 and any infrastructure being planned, needs to be built with at least a 10–15-year view into the future and should be upgraded with a future-proof design that allows scalability. The funds secured above should be used to engage appropriate suppliers in this field of facility retrofits. This can be a large scale 'design-build' engineering exercise which GHD has accomplished around the world in many capacities and can help support that in the future.

3. Train the vehicle operators on the typical metrics associated with operating ZEVs such as Battery SOC (State of Charge), remaining operating time, estimated range and other notifications from the vehicles and the charger. Vehicle operators from each DNLTC stakeholder should become familiar with the dashboard controls

and warning signals. DNLTC's stakeholders must upskill the operators by building on and creating procedures and processes that capture this information.

Phase 3 is the optimization stage of implementation. Lessons from Phase 1 and Phase 2 should be utilized to right-size the daily vehicle operations and driver behavior to allow for effective on-road operations which incorporates the preferred fleet charging strategy. Charging Infrastructure across the region should have electric vehicle energy management systems (EVEMS) systems on them, allowing the stakeholders to manage the cost of electricity and ensure profitability for the lot owner. The transition to ZEVs will be a complex change management exercise for the region and its fleet operators in terms of the human resources needed for the new vehicles and chargers to properly function. New resources may need to be hired and existing resources will require upskilling and training to handle the new technology of ZEVs and new maintenance standards will need to be created. A net new operating model will support the new fleet technology through implementation of SOPs (Standard Operating Procedures), and diagnostic facilities. In terms of fleet sustainment, the DNLTC stakeholders must:

1. Organize maintenance and parts contracts if procuring vehicles from an OEM (Original Equipment Manufacturer) which has not been purchased from in the past. This will ensure that the ZEVs get priority service upon breaking down. These contracts must also be converted into internal processes that the Fleet Manager communicates to their team. For various fleet sustainment activities, Develop RACI (Responsible, Accountable, Consulted, Informed) charts that identify and flag individuals in the County who need to be involved in the overall process.
2. Organize and develop a maintenance policy and standard for the public chargers, if those chargers are owned directly by any of the DNLTC stakeholders. If the region decides to outsource the chargers to a private company or another agency, then ensure that contractual language is clear around maintenance standards and the stakeholder is comfortable with the terms. A thorough maintenance standard will help lengthen the service life of the chargers and ensure smooth reliable service for the local population.
3. Enforce proper driving behavior as it can have a significant effect on ZEV energy consumption and overall performance. Operators need to be trained on the detailed concepts of ZEV specific systems such as regenerative braking, mechanical braking, and the fact that electric motors produce instantaneous 100% torque at all times compared with ICE vehicles. They should also be trained on optimizing their driving which maximizes energy efficiency through appropriate acceleration and deceleration. ZEVs are also quieter than ICE vehicles and can present a danger to pedestrians who may not be aware of its presence.
4. Consider the safety implications of ZEV fleets and make it the highest priority. All maintenance personnel must be educated on the nature of this technology so that they are conscious of the dangers when conducting service, inspection, or repairs. PPE guidelines must be enforced as legislated by local laws and regulations. Occasionally, the OEM may mandate that the ZEVs with high-voltage components be only maintained by the OEM and not by the mechanics at the depot. In that situation, understand the implication of 'off-site' maintenance both from a financial and operational perspective and determine if the OEM's terms are suitable.
5. For common issues and troubleshooting measures for ZEVs and chargers, develop attractive shop charts that personnel can refer to. For more detailed information, develop troubleshooting trees which show the process for fixing any given issue on these vehicles. The DNLTC stakeholders can collaborate with other neighboring counties or operators of the same type of ZEVs to develop these materials and share between organizations. The objective is to reduce 'down-time' and 'unexpected failures' and a large contributor to that is to set-up a Preventive Maintenance (PM) program for ZEVs. Depending on the stakeholder's ability to handle their own repairs, the PM program can be as labor intensive as needed. Even a simple PM program which touches the asset once every 6 months for 1 hour can alleviate unexpected failures and reduce down-time. Given ZEVs typically have 30% fewer moving parts than ICE vehicles, the PM process does not have to be intensive.
6. As part of the change management, develop a training model that focuses on continuous improvement as opposed to one-time learning. Utilize a mixture of virtual sessions, classroom learning and hands-on training

for mechanics, electricians, and operators who are directly responsible for maintaining and operating the vehicles. It should be noted that zero-emissions technology in transportation is constantly evolving and hence the need for regular updates to the processes and the content of training being provided.

The specific roles and requirements needed to sustain a BEV depend on each DNLTC stakeholder's fleet size and overall transition process. There may also be opportunities to share resources among the various stakeholders through DNLTC.

Generally, the roles that will be needed are:

1. EV Technicians - for diagnosing and repairing electrical components, batteries, charging systems, and other BEV-specific parts.
2. Automotive Technicians - for conventional vehicle parts and routine maintenance tasks like tire rotations, brake inspections, and general vehicle upkeep.
3. Battery Specialists or Electrical Technicians - to monitor battery health, perform diagnostics, and address any battery-related issues.
4. Charger Technicians - for electric vehicle supply equipment (EVSE) installation, maintenance, and troubleshooting are necessary to ensure efficient and reliable charging operations.
5. IT Specialists - New BEVs often rely on sophisticated software systems for monitoring, data analysis, and remote diagnostics. IT specialists can help maintain and update these systems, ensuring proper functionality and addressing any software-related issues.

These are specialist roles, and their regional availability will be challenging. However, with further uptake of EVs and slow transition away from ICE vehicles, more specialized resources will become available. One way to mitigate this risk, will be re-training and up-skilling existing maintenance personnel to be able to carry out these roles. Typically, OEMs can provide the class-room training and other materials to enable to the local staff to maintain these vehicles and carry out basic troubleshooting and parts replacements. Another option would be for DNLTC stakeholders to purchase maintenance packages at the time of the vehicle purchase and off-load the highly technical and specialized tasks to the respective dealership. Volvo for instance, contractually does not allow any non-Volve personnel from maintaining the critical components of their EV truck including the battery and motors.

The purpose of this report was to develop a high-level analysis of potential Zero Emission Vehicle (ZEV) transition plans which will allow DNLTC to use the results of the fleet analysis and subsequent recommendations to formulate a complete fleet replacement plan. The three potential transition scenarios were utilized to create the 3-phased approach to decarbonization above. The data analysis done throughout the project alongside the risk considerations in the following section helped formulate the next steps in *'5.3 Next Steps'*.

5.1 Risk consideration

The proposed fleet decarbonization plan is designed to minimize the financial burden while balancing the requirements for new vehicles that fall in line with current operational practices and projected use across communities in the Del Norte region. A preliminary risk analysis was performed to gauge expected barriers that could arise during the initial and middle stages of the ZEV implementation process. Mitigation strategies are listed below to recommend early-stage procedures that reduce costs, increase community awareness, and provide resiliency strategies against unexpected environmental changes.

Table 7 – Risk Register and mitigation recommendations

Category	What is the risk?	Likelihood 1=Unlikely 5=Very likely	Severity 1=Little impact 5=Major impact	Risk factor (L x S =) Low Risk 1-8 Medium Risk 9-14 High Risk 15-25	Mitigation What can you do about it?	Priority
Fleet	ZEV range is insufficient	3	4	12	Minimize risk by piloting vehicles and explore opportunity charging options	Medium
Fleet	ZEV reliability is poor leading to downtime	2	4	8	Pilot ZEVs and assess their reliability. Coordinate with other operators on maintenance practices	Low
Financial	Unexpected capital costs associated with infrastructure	5	5	25	Maintain a ZEV contingency fund	High
Financial	ZEVs are unavailable or delayed due to supply chain issues	2	2	4	Explore alternative OEMs which better delivery timelines	Low
Electrical	Brown-out or Black-out adversely affects vehicle operations	1	5	5	Explore micro-grid potential through solar and other means	Low
Fleet	ZEV is unable to handle cold weather operations	3	3	9	Explore options with 'Heat Pump' as opposed to electrical heating	Medium
Fleet	ZEV Servicing is available within the County (or within 60 mins of Crescent City, CA)	2	5	10	Upskill local personnel through classroom and hands-on training	Medium

Infrastructure	Charging stations are inoperable due to unreliability	2	3	6	Install 'back-up' L2 chargers which offer an alternative solution	Low

5.2 Conclusion

The Del Norte region stands to achieve significant air quality improvements over the next several years through a comprehensive fleet decarbonization plan. This project is an excellent opportunity for the Del Norte region to be a leader in sustainable transportation among rural communities and create a zero-emission transition plan that resonates with the people of local communities, groups, and businesses. Throughout the project, the parameters associated with strategic decarbonization were quantitatively analyzed in the BetterFleet™ assessments and qualitatively discussed in the Infrastructure Workshop and touch-point meetings throughout the project duration.

The key takeaways from the fleet research, staff interviews, and financial analyses are as follows:

- The DNLTC ZEV Transition Plan is structured in three (3) phases to ensure that the DNLTC stakeholders are not overwhelmed and undertake risky decisions simply to meet the mandates set by the State of California.

  (1) The Feasibility Planning stage is used to assess roadblocks and develop an analysis-based economical assessment with respect to the existing fleet. This stage informs of expected costs, and emission reduction potential should the DNLTC stakeholders choose to decarbonize the fleets.

  (2) The Implementation Planning stage is the time to report findings, conduct detailed design exercises and request investment and notification to start implementing the ZEV vehicles and charging infrastructure in a piloting manner.

  (3) The Optimization Stage is for refining budgets, operations, human resources, and accelerating fleet change once the testing concepts have been assessed. This is a pivotal point in which cumulative small changes will have the potential bring significant change for communities across the region.
- In the 133 vehicles assessed, age was the greatest factor used to determine urgency of replacement.
- Light-duty cab chassis vehicles generally have stronger feasibility for electrification in the short-term as the technology is more established and the TCO gap is more manageable.
- For the cost-optimized scenario, which is noted as a more realistic approach for the DNLTC stakeholders, the net-present value (NPV) of ZEV transitioning is estimated to be ~$6 million over the next 11 years. Whereas in the technology leadership scenario estimates ~$8 million over the next 13 years, noting that higher spending will be required at the start of the complete plan.
- To ensure a conservative estimate in the fleet analysis, each EV implemented is assumed to require an EV charger for 1-to-1 ratio of asset to infrastructure.
- The final three (3) recommended public EV charger sites are:
  - Idlewild
  - Del Norte Fairgrounds
  - Harbor District
- It is recommended that appropriate budgets be established with funding potential included to accurately assess the scale of transitioning to ZEVs annually and to build a strong network of public chargers.

- Emissions fall to ~265 tons and ~208 tons per year by 2030 for the cost-optimized and technology leadership scenarios, respectively. This is compared to the BAU emissions of ~290 tons of CO_2 per year.
- Over the next five years, the combined fleets of Del Norte County can expect to transition anywhere from 13 to 26 (out of 133) of its vehicles to EV alternatives, and over the next ten years, the combined fleets of Del Norte can expect to transition anywhere from 15 to 63 (out of 133) of its vehicles to EV alternatives. It is appreciated that the number of vehicles to be transitioned that is feasible for the DNLTC stakeholders may be on the lower end of those ranges, due to a number of reasons including, vehicle availability, financial constraints, and procurement barriers.
- DNLTC can minimize regional risks associated with decarbonization by suggesting piloting ZEVs to its stakeholders. The work plan has been described in detail while exploring opportunities with infrastructure upgrades if the fleet size, population, and projects scale grows.

5.3 Next steps

For Del Norte County to progress towards a successful decarbonization transition process, the following activities must be undertaken:

1. A highly technical Green Fleet Plan needs to be created for each DNLTC stakeholder which considers the specific constraints, preferences, and ambitions of each stakeholder in their quest to meet the state and federal mandates for emission reduction. This current study focussed on the entire regional fleet as a single entity and while that is good to get a general sense of the expenses and emissions savings, a deeper dive into each individual fleet is necessary as the immediate next steps. There are numerous rebates and grants that can also be explored to help pay for these subsequent assessments.
2. Procurement activities based on the fleet specific Green Fleet Plans, will include writing technical specifications and requirements for procuring both the vehicles and the necessary charging infrastructure. These requirements will then make the bulk of any future RFPs or RFIs as needed to assist in the decarbonization process.
3. This study restricted the electrical analysis to a desk-top study and relied on satellite and google imagery to make predictions and assessments. While it is good enough for a high-level analysis, a further detailed assessment of the public charging station sites and of the fleet depots is required. It will include having an electrical technician going physically on-site and collecting information and pictures specific to the site to assist in determining the current electrical capacity and identifying the key constraints and challenges with a potential utility capacity upgrade.
4. Grant and rebate application writing will need to be started preemptively as these applications can be labor intensive and time consuming. Certain popular funds are also competitive or first-come first-served, and hence it would be in DNLTC's and their stakeholder's interest to be proactive in their applications and ensure that they plan for the capital investments as soon as possible to take advantage of the funds while they last.
5. A 1:1 ratio of chargers to vehicles may not be necessary, i.e. two or more vehicles could share a charger, but it was modeled this way to be conservative so the costs are accounted for, and because we are not aware of the specific details about how their fleet is used (hours of operations, first pull-out, last pull-in, etc.) which would impact the feasibility of vehicles sharing chargers). DNLTC stakeholders should engage in simulations of their daily fleet drive-cycles to assess and optimize the number of chargers needed per depot or yard to reduce the capital investment pressure and make the overall fleet operations efficient.

GHD has extensive experience with each of these proposed activities and has the tools and people to assist DNLTC and its stakeholders in any capacity as required. Please reach out to the project team with any subsequent requests.

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