CALIFORNIA ENERGY COMMISSION

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

The Plug-In Porterville Blueprint Final Report

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PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to $20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about $100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce-training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued solicitation number GFO-20-601 to develop planning "blueprints" to identify actions and milestones needed for implementation of medium- and heavy-duty zero-emission vehicles and the related electric charging and/or hydrogen refueling infrastructure. In response to solicitation number GFO-20-601 *Blueprints for Medium-and-Heavy-Duty Zero-Emission Vehicle Infrastructure*, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards on April 8, 2021, and the agreement was executed as Agreement ARV-21-034 on September 9, 2021.

ABSTRACT

The Plug-In Porterville Blueprint (Plug-In Porterville) was a two-year effort led by CALSTART in partnership with the City of Porterville (Porterville), as well as public and private community stakeholders, to develop a comprehensive strategy for deployment of electric vehicle charging infrastructure to serve medium- and heavy-duty electric vehicles (EVs). To help accelerate the adoption of medium- and heavy-duty EVs centered around Porterville by both public and private EVs, Plug-In Porterville focused on the design and development of three microgrids for Porterville Transit, Porterville Unified School District, and a commercial development. Each design incorporates a similar methodology that maximizes usage by fleet vehicles. The Plug-In Porterville team leveraged surveys from community members with the support from the MLK CommUNITY Initiative and researched synergetic efforts for workforce development at the local and regional level.

Keywords: Battery Energy Storage System, Charging, Class, Conceptual Design, Cost-Effective, Direct Current, Distributed Energy Resources, Electricity, Heavy-Duty, Hydrogen, Infrastructure, Levelized Cost of Electricity, Microgrid, Natural Gas Generators, Photovoltaic Array, Resilience, Solar Array, Travel Center, User Experience, Utility Grid Disruption, Zero-Emission Vehicles

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EXECUTIVE SUMMARY

CALSTART, in collaboration with multiple public and private community stakeholders in and around the City of Porterville in California, curated *The Plug-In Porterville Blueprint* (Plug-In Porterville). Plug-In Porterville develops a comprehensive strategy for the installation of electrical charging infrastructure to accelerate deployment of medium- and heavy-duty electric vehicles by both public and private fleets. Residents of Porterville have long been impacted negatively by transportation as a source of pollution, along with a geographically disadvantaged pollution burden.

Activities included robust initial stakeholder process that captured the city's intent to electrify its fleet and provide resilience. The engagement also was inclusive of community members, capturing their perspectives as they relate to resiliency with microgrids and interest of future jobs supporting energy industry. The results were optimistic in determining that even amid a lack of widespread knowledge of microgrids as a technology or as a resiliency solution, there was an overall interest to be engaged in the planning process as the city continues to consider building resiliency into medium- and heavy-duty infrastructure development.

The primary fleets considered for a microgrid were the transit and public-works fleets located at the shared Corporation Yard. The transit fleet had already transitioned to zero-emission vehicles and had charging infrastructure on site. The resulting microgrid concept captured the existing fleet, future fleet vehicles, and a portion of the refuse trucks at the facility. Porterville Unified School District had already begun to transition their school bus fleet to zero-emission and provided a feasible use case for a microgrid design. Porterville also had exciting economic development plans that this Blueprint effort supported with preliminary microgrid designs and considerations for charging stations in the southwest quadrant of the city. Moreover, the Plug-In Porterville team analyzed the feasibility of three different locations with charging stations that would support a growing fleet of zero-emission medium- and heavy-duty vehicles in the region. Each microgrid design was accompanied with a preliminary test plan to evaluate the effectiveness and efficiency of the microgrid at various relevant scenarios.

Activities also included an analysis of workforce trends and considerations in Porterville, and Tulare County by extension. While multiple programs, such as the Climate Action Pathways program, are in place advancing zero emission training and hands-on opportunities for high school students, there remain many opportunities to explore at the Kern Community College District, as well as development of future and medium- and heavy-duty curriculum at the state level.

CALSTART's analysis was also very inclusive of communities in need of resiliency throughout the San Joaquin valley region - not only in identifying these communities, but in providing a guiding framework leveraging this blueprint for replicability at the city or community level.

As CALSTART presented this vision and plan to Porterville residents and decision-makers, there was a need to identify the environmental and economic benefits to be reaped in the implementation of this Blueprint.

CHAPTER 1: Resiliency in the South San Joaquin Valley

Microgrids enhance resilience, reliability, and dynamic adaptability, encompassing environmental hazards, grid support, demand response, cost savings, and zero-emission energy integration. Resilience is commonly understood as the ability to maintain functionality within a state of disturbance or, "bounce back" to a functional state of equilibrium after total disruption. Considering electrical infrastructure, resilience can be assessed using familiar reliability indices such as System Average Interruption Duration Index (SAIDI) and Customer Average Interruption Duration Index (CAIDI). These measure outage durations caused by various factors, from bird strikes to blown fuses. SAIDI and CAIDI are industry metrics for electric systems experience with power outage durations per customer per year and the time it takes to restore power after an outage, respectively.

Resilience Demand in the San Joaquin Valley

Defining Resilience

Resilience requires ongoing efforts to evaluate conditions and adaptively manage complex situations across multiple actors and scales. Within infrastructure and energy resilience, we focus on two critical systems- social systems and physical (e.g., built environment) systems which promote resilience through actionable concepts such as:

- Adaptive Capacity – building flexible decision-making into management approaches and system designs.
- Community Engagement – recognizing local community member needs through active dialogue, inclusion, and equity principles.
- Interconnectedness (e.g., redundancies) – providing critical services through multiple means.
- Policy and Plan Development – policies set agency principles and directives, while plans translate these policies into actionable physical implementations in the built environment, with policies informing plans.
- Risk Assessment – specific identification and quantification system threats.
- Risk Mitigation – plans implemented to reduce threat exposure or lessen impacts to a system.

Resilience Considerations

Critical considerations for resilience necessitate a balance between social and physical components to ensure infrastructure resilience, with substantial emphasis on the development and support of forward-facing influences and forecasting rather than historical conditions and processes. Resilience can take various forms in response to environmental and human hazards, and the contributing factors and outcomes may need to be evaluated with varying importance.

Infrastructure resilience varies by built-environment components and hazard type. Conditions that may contribute to resilience for certain conditions do not automatically translate to other systems. For example, contemporary discussions and solutions around undergrounding powerlines to improve wildfire resilience in high-risk communities do not translate directly to other hazards. For instances where there are analogous solutions, additional factors such as budgetary constraints or limited person-hours may prevent implementation. As California is a geologically, economically, environmentally, and climatologically diverse state, each community's current and future resilience levels and driving factors may vary dramatically. Social and physical resilience are primarily connected to historic conditions, developed over decades of landscape transformations and legislation from local through federal influence.

Therefore, successful planning requires specified actions built around shared understandings. Beyond the basic quantification of temporal return to the energized baseline, resilience must be explored contextually. Context-dependent resilience-building processes must emphasize the importance of local knowledge and engagement at intermediate planning levels to situate externally contributed expertise for optimized success. Risk must be perceived in an ongoing manner for resilience to persist. Maintaining engagement across agencies between any system disruptions limits distance decay in risk perception.[1]

Planning in Progress

The City of Porterville has engaged in multiple efforts to increase energy and transportation resilience. CALSTART collected and reviewed local and regional plans to best align the Plug-in Porterville Blueprint with established objectives. CALSTART has identified common goals and methodologies in the ongoing plans, and additional elements to consider in the development of an improved transportation network in the City of Porterville. As a result, the region has cohesive overall recognition and resilience-enabling policies guiding actionable efforts.

1 Zhang, F., & Maroulis, S. 2021. *Experience is not enough: A dynamic explanation of the limited adaptation to extreme weather events in public organizations.* Global Environmental Change, 70, 102358. https://doi.org/10.1016/j.gloenvcha.2021.102358

CHAPTER 2: Stakeholder Engagement

The Plug-In Porterville team visited the City of Porterville in August 2022 to determine what the electrification and resilience goals were from each organization or city department. The team visited the Porterville Unified School District (PUSD) facilities, the Porterville Community College, as well as the transit depot ("Corporation Yard" or "Corp. Yard") where the team met with transit and public-works authorities and city officials. Porterville transit (fixed route and micro-transit) vehicles are intended to be fully transitioned by 2035 and will be accompanied by resilience at the transit yard that will also support the public-works planned zero-emission fleet. PUSD also has committed to a fully zero emission fleet, starting with the school buses and then evaluating their white fleet. The Porterville Community College has previously conducted EV feasibility studies and is committed to deploy more electric vehicles when feasible and as appropriate.

Earlier conversations with public officials led to animated discussions over economic development plans at the industrial area where the Eagle Mountain Casino was recently relocated and where the airport runway renovation will improve wildfire mitigation and spur logistics hub development. Planning was in its early stages for this commercial development, but CALSTART projected a resilience solution as those plans expand.

Fleet Engagement

In 2022, CALSTART held a webinar to engage fleets for participation in the Plug-In Porterville Blueprint. Engagement included reaching out to all medium- and heavy-duty fleets domiciled in Tulare County. This was done intentionally to capture fleets operating in Tulare that have operations in or utilize corridors in Porterville. Despite targeted outreach to about 900 fleets, the webinar received low attendance, not surprising given the challenge in engaging trucking fleets throughout the state. The fleets that did attend and participate in the discussion had varying characteristics. Among the callers was a large corporation that operates more than 50 trucks and a small fleet of about three trucks. The team also observed attendance from school districts within Tulare County. School districts were provided additional resources following the call on general bus electrification.

Community Survey Results

In 2022, MLK CommUNITY Initiative, a community-based organization, administered surveys at local Porterville events and compiled responses for CALSTART. CALSTART analyzed results to identify notable trends, gaps in knowledge, and potential community involvement in the project's future stages.

Planning and Workforce Development Engagement

In addition to gauging respondents' familiarity with emerging transportation concepts, the survey also sought to estimate the community's interest in the project's planning, and in the potential for professional development courses in the cleantech transportation industry. The responses showed strong support for the project, and a vested interest in being directly involved in the planning process. Over 60% of all respondents were at least in support of the project, and nearly 30% of respondents expressed interest in being involved in planning discussions. With nearly a one-fifth of respondents still considering their involvement, only about 17% of respondents were explicitly not interested in the project's next steps.

This interest in the planning process also translated into a notable interest in potential certificate courses related to the cleantech transportation industry. Over one-third of all respondents expressed interest in taking certificate courses providing professional skills in cleantech transportation, and nearly another third of all respondents said they would like to receive additional information about such a program. Should education providers in the Porterville area decide to offer such coursework, it appears that there may be a sizeable crowd of potential students.

If the 536 respondents who completed the survey are an accurate depiction of the Porterville community, the City of Porterville demonstrates substantial potential for success with the proposed project. There appears to be a consensus of support for a greener transportation landscape in Porterville.

CHAPTER 3: Microgrid Development

Desired Use Cases

CALSTART performed detailed assessments of several microgrid sites. Many details are omitted here due to length limitations for published final reports. Generally, Porterville and stakeholders within the city and surrounding communities aim to use microgrids for multiple purposes. The main objective of a microgrid is to provide resilience against grid outages. In the event of an outage, a microgrid needs to provide power so fleet operations can continue.

Porterville and stakeholders in the city also aim to use microgrids to offset utility costs and/or generate revenue. This can be achieved by using the microgrid to reduce demand charges by limiting peak demand from charging. It can also be used to offset electricity drawn from the grid to reduce energy costs. The microgrid can also be used to generate revenue by providing grid services or participating in demand response programs.

Microgrid Design

CALSTART developed a conceptual design for the Porterville microgrid. This conceptual design consists of a site layout for the microgrid and a single-line diagram. The conceptual design was created based on the established microgrid design parameters. The Corp. Yard is located at 555 N Prospect Street, Porterville, CA. Porterville identified two locations in this depot that can host microgrid components – the bus parking lot and the employee parking lot. The bus parking lot is located to the south of the chargers for the current buses. The employee parking lot is located on the northeast corner of the depot. CALSTART then developed a conceptual design for the microgrid based on these space constraints and the design parameters.

Policy Need/Implications

The microgrid designed for Porterville transit is constrained by regulations imposed by SCE, some of which are influenced by SCE's Charge Ready Transportation Program (CRT). CRT is a "make-ready program" intended to streamline the development of charging infrastructure by providing funds for installation costs. CRT is designed to reduce, or in some cases eliminate the cost of installing charging infrastructure for medium- and heavy-duty electric vehicles. Eligibility requirements for the program include:

1. A fleet of at least two medium or heavy-duty battery powered EVs.
2. Ownership or lease of the property where chargers are installed, and operation and maintenance of chargers for a minimum of 10 years.
3. The selection, purchase, and installation of SCE-approved charging equipment.
4. Provision of data related to charging equipment usage to SCE for a minimum of five years of on-road vehicles only.
5. A property easement for the SCE infrastructure.
6. Agreement to terms and conditions.

Funding provided through the CRT can be distributed through one of two pathways. The SCE-Built Pathway has SCE finance and install Front-of-the-Meter (FTM) and Behind-the-Meter (BTM) infrastructure, including transformers, the service drop, meters, panels, and interconnecting conduit, allowing fleets to deploy infrastructure at no cost. However, the SCE-

Built pathway does not allow DERs to be attached to the circuits. Since DERs are critical components of a microgrid, this pathway effectively prevents the deployment of a microgrid.

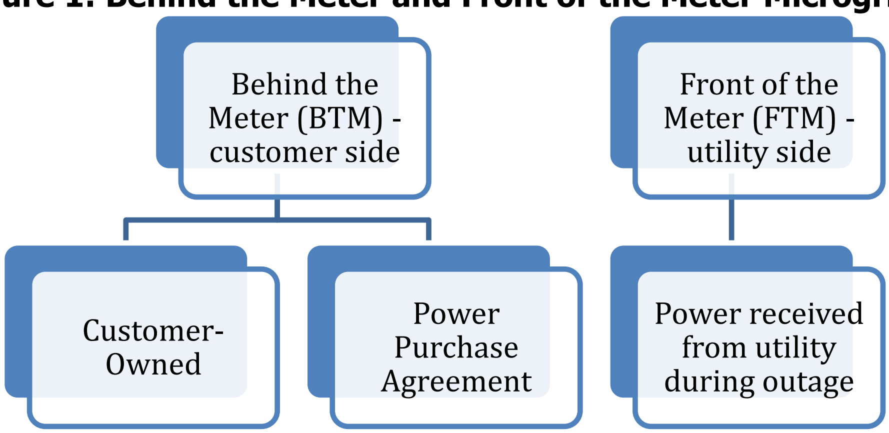
Alternatively, the customer-built pathway has SCE cover the cost of deploying the FTM infrastructure and a partial reimbursement of up to 80% for BTM installation costs. The customer is then responsible for deploying infrastructure on their side of the service interconnection. There are no restrictions on deploying DERs if the customer opts to use the Customer-Built pathway.

Microgrid Operational Models

There are multiple models under which a microgrid can be owned and operated. These operating models are classified based on who owns the microgrid and where the microgrid is in relation to the meter.

The BTM operating models refer to situations where the microgrid is located on the customer's side of the meter. In most cases, the microgrid is located directly on the customer's property. There are two main ownership models that can be implemented BTM. The first model is the customer-owned model. Under this model, the microgrid user finances and builds the microgrid. Once the microgrid is built, the user owns the microgrid and is responsible for operating and maintaining it. Alternatively, the microgrid user benefits from the microgrid through a third-party power purchasing agreement, which a third-party company finances, builds, and operates the microgrid. Oftentimes, the third-party company bundles the microgrid with the charging infrastructure. The third-party company then signs a power purchasing agreement with the user utilizing electricity in return for payment. These agreements are usually for a defined period and are structured so the user pays per kWh. One advantage of power purchasing agreements is that the microgrid user can deploy the microgrid without the upfront capital costs. Microgrid users can also opt to use a FTM operating model. Under FTM, the microgrid is located on the utility's side of the meter. Usually this means that the microgrid is attached to the utility's distribution system. The microgrid is typically located on utility property but can be located on the user's property. In most cases, the utility will own and operate the microgrid for the benefit of customers. Customers downstream of the microgrid will receive power if there is a grid outage. Utilities typically charge a recurring fee or a higher per kWh rate for the energy to recover the costs of the microgrid.

Figure 1: Behind the Meter and Front of the Meter Microgrids



Source: CALSTART, 2023.Medium/Heavy-Duty Private Fleets

Charging Location Strategy and Methodology

Along with the microgrids built to support the transit and school fleets, the Plug-In Porterville Blueprint was inclusive of privately owned fleets. CALSTART mapped current and anticipated fleet use in key corridors located within Tulare County. The two primary datasets utilized in this analysis are the agricultural truck routes that transit goods between farms and markets and the overall truck volume data, represented as trucks per day. This information was provided by the Tulare County Association of Governments and incorporated into a map of Porterville's city boundary and current and future truck parking locations. Potential changes to traffic volume because of planned corridor development is also considered.

These combined datasets have been used to evaluate potential charging station availability and optimal locations for charging sites. Growth of ZEV fleets is dynamic and ongoing, subject to change based on adoption of regulations such as Advanced Clean Trucks and Advance Clean Fleets. As a scaled approach to infrastructure becomes financially feasible, the focus of the microgrid can be shifted to maximize capacity, resulting in additional design challenges and considerations.

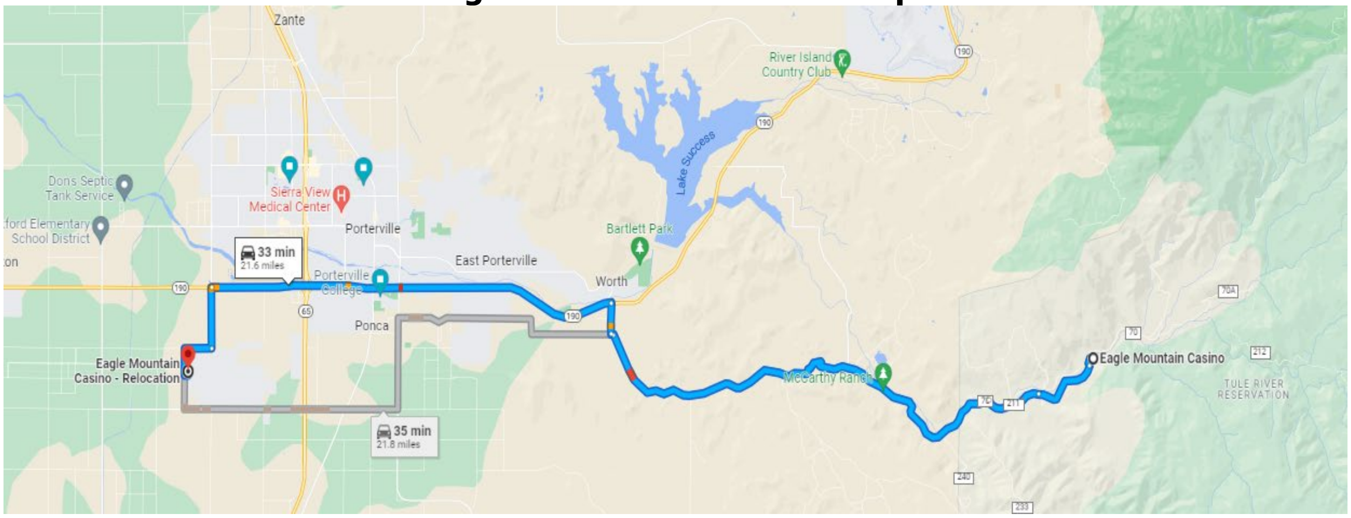
Porterville Planned Economic Development

According to the City of Porterville budget, there are some key considerations from the city's perspective that should be captured in planning for public charging infrastructure that will be available to privately-owned fleets. Within the southwest quadrant of State Route 65 and State Route 190, Porterville has a vision of a future job center and activity center of the community along with the opportunity for growth and economic development. A first move toward an economic development center was the relocation (Figure 2 and Figure 3) of the Eagle Mountain Casino within the city's boundary - a result of a Joint Powers Agreement, between the City of Porterville and the Tule River Tribe. The new site, a 40-acre property operated by the Tule River Tribe, is adjacent to the Porterville Airport.

Figure 21: Eagle Mountain Casino

Source: Fox 26 News, 2023.

Figure 2: EMC Relocation Map



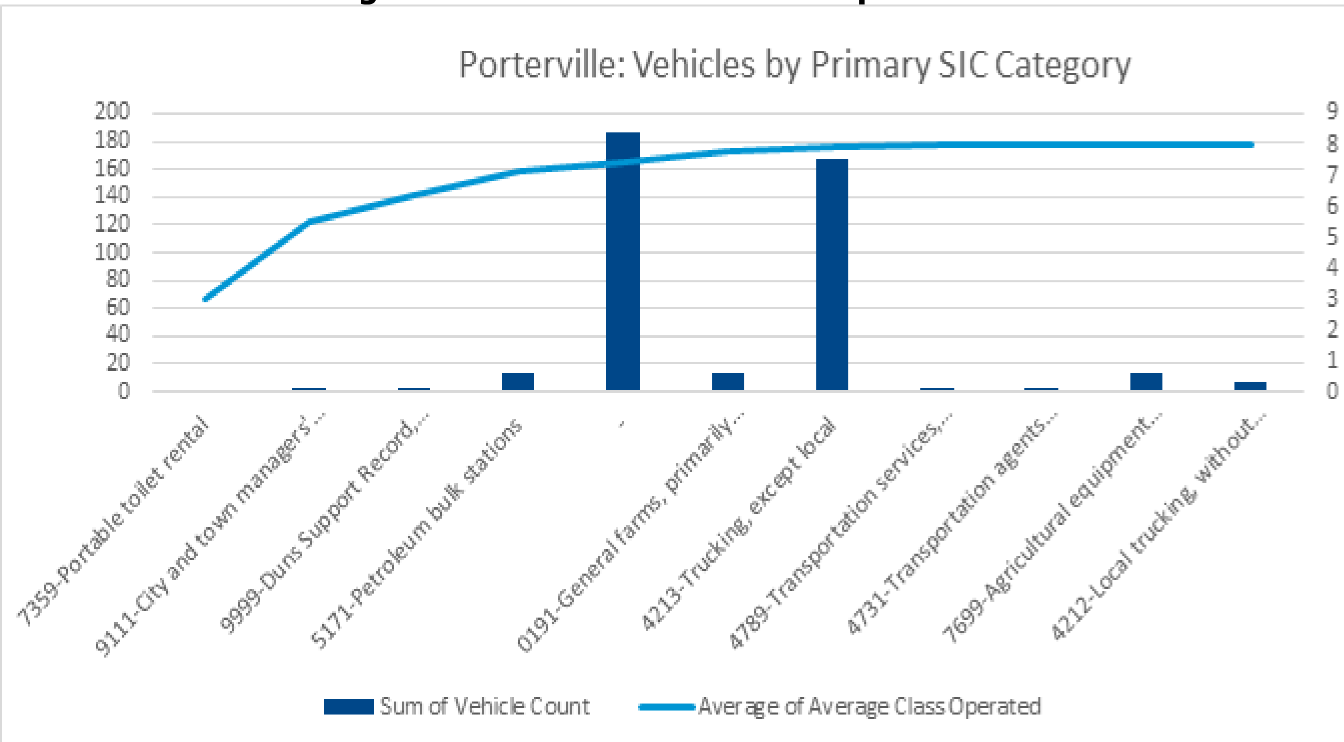
Source: Google Maps, 2023.

The relocation included the development of intergovernmental agreements with the City of Porterville and Tulare County to address any environmental impacts and to provide funding for various governmental services, including Tulare County's Road improvements. The Plug-In Porterville includes a hotel, event center and convention space, sports bar, restaurant, buffet and food court, and entertainment lounge. It will also include a new tertiary water treatment facility and a fire station at the casino site to assist the City and County on emergency calls.

Fleet Demand Scenarios

The Plug-In Porterville team analyzed city and county-wide fleet databases to better understand the potential demand of vehicles. For fleets domiciled within the city of Porterville, data demonstrated that many private fleets are operating vehicles within the Class 7-8 classification (Figure 4). The average class of Porterville fleets by weight is 7.7, revealing the high concentration of larger-sized fleet vehicles. Most vehicles operate with an undefined SIC[1] code or within the "trucking, except local" SIC code. The "Trucking, Except Local" category covers establishments primarily engaged in furnishing "over-the-road" trucking services or storage services, including household goods either as common carriers or under special or individual contracts or agreements, for freight generally weighing more than 100 pounds. It is assumed that the fleets within the undefined SIC code are small, owner-operator fleets because the average fleet size is between 1-2 vehicles.

Figure 4: Porterville Vehicle Composition



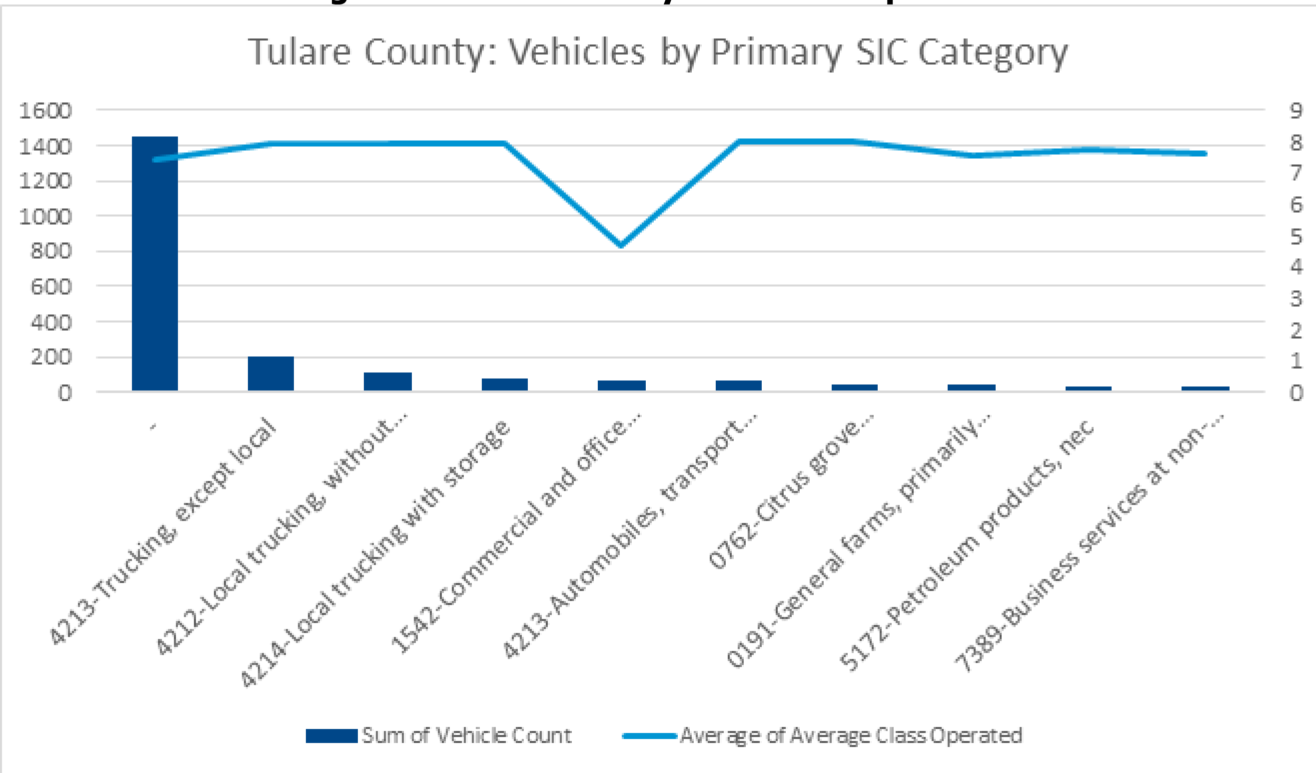
Source: CALSTART, 2023.

As a result, charging demands for vehicles domiciled in Porterville will need to service regional trucking fleets that are composed of 1-2 Class 7-8 vehicles. The only exception to this is Young's Commercial Transfer Inc. that operates 166 of the 168 vehicles in the "trucking, except local" category.

Regional Fleet Compositions

The distribution of fleets within Tulare County has a similar composition profile compared with the fleets domiciled in Porterville. Unsurprisingly, Tulare County has a more robust distribution of SIC codes, which are representative of the fleet vocations. However, the top ten SIC codes include 81 percent of all vehicles (Figure 5). Most vehicles are within the undefined or unlisted SIC code list. While some fleets can have up to 50 vehicles, the average fleet size is around two vehicles. The average class of Porterville fleets by weight is 7.4.

Figure 5: Tulare County Vehicle Composition



Source: CALSTART, 2023.

Like Porterville fleets, charging demands for vehicles domiciled in Tulare County will need to support small fleets that are composed of 1-2 vehicles. County-wide there are only 12 fleets with more than 20 vehicles (Table 1).

Given the feedback that fleets (i.e., small or large) may still prioritize depot or private charging, it will be important to look toward corridors and key locations for public charging opportunities to complement on-site charging.

Table 1: Tulare County Fleets >20 Vehicles

Company/Fleet	Count
Young's Commercial Transfer Inc	166
American Inc	68
Central Valley Automotive Transport Inc	60
Connecticut Commodities Inc	59
Monrovia Nursery	51
Central California Cartage Co. Inc	49
Fisher Brothers Trucking Inc	45
Ohk Transport LLC	34
G & J Heavy Haul Inc	31
Shannon Brothers Co Inc	23
Brenda D Hastings Timothy Thomas	22

Source: Trucking History Report, 2023.

Traffic Count Assessment

To assess the demand for public electric vehicle charging stations, historic, current, and/or future traffic count data needs to be obtained. California Department of Transportation (Caltrans) reports Annual Average Daily Traffic (AADT) data for trucks on major corridors through the state of California from 2013 through 2022. The Caltrans' GIS data portal is used to download historic and recent truck AADT data.[2] Caltrans provides truck AADT data in both spreadsheet and geospatial forms, allowing for easy mapping of the traffic count regions to the proposed EV charging stations. Additionally, truck AADT data reports truck traffic counts in terms of axles. It is assumed that medium-duty vehicles have between 2-3 axles and heavy-duty vehicles have between 4-5 axles to determine the number of medium- and heavy-duty vehicles (Table 2).

Table 2: Traffic Count Data

Location Name	Traffic Count Data (based on axles)
Location 1	Medium-Duty: 2593 and Heavy-Duty: 1670.
Location 2	Medium-Duty: 1058 and Heavy-Duty: 201.
Location 3	Medium-Duty: 1438 and Heavy-Duty: 756.

Source: CALSTART, 2023.

2 California Dept. of Transportation. Caltrans. 2024. Caltrans Highway Datasets GIS Data. https://gisdata-caltrans.opendata.arcgis.com/

Energy and Load Assessment

Once the location of the proposed station and the quantity and type of vehicles arriving to electric vehicle charging stations is determined, then the energy needed to transfer from the grid to the battery of each modeled electric vehicle needs to be estimated. For public charging infrastructure, it is assumed that all vehicles arriving to the charging station will charge 80% of their usable battery capacity. This assumption provides a conservative estimate of the total power demands of the charging station.

Electric vehicle charging load profiles can be estimated from NREL's *Heavy-Duty Truck Electrification And The Impacts Of Depot Charging On Electricity Distribution Systems*.[3] This assessment includes data for the 24-hour fleet depot charging load profiles in 15-minute increments for the charging of heavy-duty battery electric trucks with 100 kW chargers. These load profiles can be extrapolated to estimate the approximate charging profiles for 19.2 kW, 50 kW, 150 kW, and 200 kW chargers which is used in infrastructure optimization tools. All the necessary assumption that are used in the optimization tool are listed below.

The *Heavy-Duty Truck Electrification And The Impacts Of Depot Charging On Electricity Distribution Systems* is available at (https://doi.org/10.1038/s41560-021-00855-0https://data.nrel.gov/submissions/162).

Assumption and limitations for optimization tools

The Infrastructure Optimization Sizing Tool effectively determines the optimal infrastructure requirements for individual electric vehicle charging station locations. However, it's important to acknowledge that the model operates within certain defined limitations and assumptions.

These assumptions and limitations are as follows:

- The model does not account for partial charging of vehicles. It assumes that all vehicles must either fully charge or receive a predefined level of charging, representing the energy demand.
- An unmanaged charging approach is assumed, as all the chargers are working most of time and all the vehicles will charge sequentially.
- The model assumes continuous operation of all estimated chargers throughout the day to estimate the maximum load on the gird.
- 15 mins break in charging is considered in each subsequent vehicle charging.
- The tool is limited to considering only two vehicle groups for this analysis: medium- and heavy-duty vehicles.
- The tool is restricted to depot charging and does not incorporate on-route or opportunity-based charging solutions.
- The model examines one location at a time to run for r multiple locations, the model needs to run separately with the same assumption for each simulation.
- The charging process involves consecutively charging vehicles up to an 80% state-of-Charge for the purpose of assessing the maximum potential load that

3 Borlaug, B., Muratori, M., Gilleran, M. et al. *Heavy-duty truck electrification and the impacts of depot charging on electricity distribution systems.* Nat Energy 6, 673–682 (2021). https://doi.org/10.1038/s41560-021-00855-0https://data.nrel.gov/submissions/162

the charging station can handle.

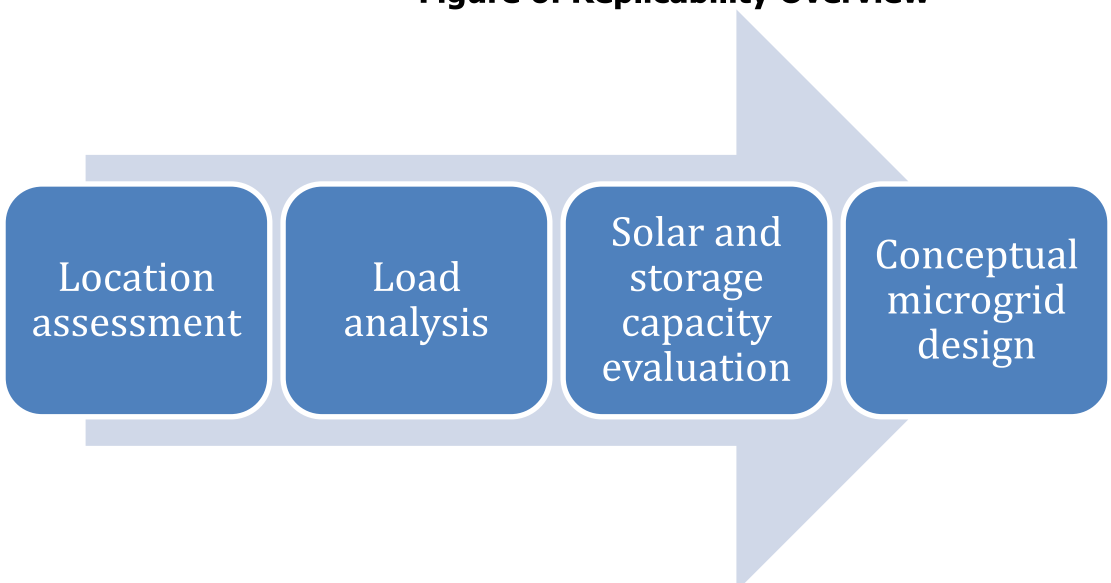
- As to maximum the conversation for heavy duty vehicle 19.2 kW charger is not considered.
- The battery capacity for medium- and heavy-duty vehicle are 115 kWh and 200 kWh respectively are considered both these types of vehicles are charger 80% of battery SOC.
- The vehicle with axle two or three is considered as a medium duty vehicle and axles four and five are considered as a heavy-duty vehicle.

CHAPTER 4: Replicability

In consideration of the multiple microgrids that were designed for this planning effort, CALSTART developed a methodology for small and medium sized cities as well as private and public partners can implement to design a microgrid.

A diverse set of tools can be used to aid in the design of electric vehicles charging infrastructure and microgrid components, such as PV units, BESSs, and/or generators. The methodology employed to assess these projects includes four generalized steps seen below.

Figure 6: Replicability Overview



Source: CALSTART, 2023.

When planning electric vehicle charging stations, it's important to follow these fundamental steps to ensure efficient use of zero-emission energy and resilience in power supply during unexpected events.

This process flow is designed to help cities, communities, and agencies understand the planning and implementation process for one or more microgrids. It also highlights the steps where tools should be used along with the Community Microgrid Development Guide, which provides more details on the sub-steps and guidelines for using the required tools. The green box represents the process step, and the purple boxes are the tools utilized at each step. While public and private charging stations have their differences, the overall methodology and tools used remain generally the same for both.

For public charging infrastructure, the primary focus revolves around determining the facility's dynamic daily load and optimizing the charging schedule. In this scenario, the EV fleet's charging window/timing and the daily energy need are unknown and require careful consideration for shifting and shading the load to maximize the utilization of the DERs.

On the other hand, when it comes to private/non-sharing charging infrastructure, the modeling technique varies slightly. This is because the daily energy requirements and the overall fleet size are already predetermined. This method enables a more accurate and strategic approach to demand modeling, which allows for the optimal utilization of DERs. The methodology for both these infrastructure rollouts is discussed below.

Public Charging Infrastructure

This section outlines the necessary steps and design considerations for conceptualizing the public charging infrastructure and DER integration.

Location Assessment

The first step to designing public electric vehicle infrastructure involves determining the potential site location. Key elements to consider when selecting the location for electric vehicle charging stations include electric vehicle demand, existing utility infrastructure, area, zoning, and environmental considerations.

Existing Utility Infrastructure Assessment

The state of existing utility infrastructure, interconnection capacity, and ability to accommodate additional DERs is needed to determine site feasibility for electric vehicle charging infrastructure. For SCE, the DRP external portal can be used to assess the capacity of the substation, circuits, and remaining generation capacity for any proposed site.**Error! Bookmark not defined.** If the existing utility infrastructure is deemed inadequate for the load of the planned electric vehicle infrastructure and microgrid systems, then substantial financial costs will be needed to upgrade the infrastructure as needed.

Zoning

Zoning ordinances define the legal use of a property within a city. The zoning for each proposed site location can be determined from the City of Porterville's published zoning map.**Error! Bookmark not defined.** The zoning map is an interactive map that allows users to select parcels of interest to determine the planned legal use of the property. The City of Porterville does not currently explicitly have any guidance for zoning for public charging infrastructure; however, it can be assumed that commercial and industrial zoning would be sufficient for electric vehicle charging usage.

Other Environmental Considerations

Areas of environmental significance or that could pose a risk to the electric vehicle charging or microgrid system equipment should be avoided, such as conservation areas, floodplains, or wildfire zones.

There are physical and legal limitations to construction and development within floodplains. FEMA publishes floodplain maps for the nation that can be downloaded from the FEMA Map Service Center.**Error! Bookmark not defined.** It is important to ensure that any proposed site development is located outside of the 100-year (e.g., Zone AE) and 500-year (e.g., Zone X) floodplains defined by FEMA.

The California Department of Forestry and Fire Protection has mapped fire hazard zones throughout the state. These Fire Hazard Severity Zones classify land based on fire hazard, like flood zones. A dynamic map of all fire hazard zones in California is published by the Office of the State Fire Marshal.**Error! Bookmark not defined.**

Collecting Data: Traffic Count Assessment

To assess the demand for public electric vehicle charging stations, historic, current, and/or future traffic count data needs to be obtained. Collection of truck traffic using Caltrans AADT reporting along major corridors through the state of California from 2013 through 2022. The Caltrans' GIS data portal can be used to download historic and recent truck AADT data.[2] Caltrans provides truck AADT data in both spreadsheet and geospatial forms, allowing for easy mapping of the traffic count regions to the proposed EV charging stations. Additionally, truck AADT data reports truck traffic counts in terms of axles, which can be used to determine the number of medium- and heavy-duty vehicles traveling through the region. It can be assumed that medium-duty vehicles have between 2-3 axles and heavy-duty vehicles have between 4-5 axles.

Predicting ZEV Adoption: Energy and Load Assessment

In addition to current and future traffic count data, it is important to gather information on the current and future adoption of electric vehicles in the region of the proposed public charging station. The Department of Energy's Alternative Fuels Data Center has developed the EVI-Pro Lite tool which estimates a city or state's adoption and demand for electric vehicle charging infrastructure over time.**Error! Bookmark not defined.** This tool can aid in determining the appropriate quantity of electric vehicle chargers for a corridor, region, or state.

Once the location of the proposed station and the quantity and type of vehicles arriving to electric vehicle charging stations is determined, then the energy needed to transfer from the grid to the battery of each modeled electric vehicle needs to be estimated. For public charging infrastructure, it can be assumed that all vehicles arriving to the charging station will charge 80% of their usable battery capacity. This assumption provides a conservative estimate of the total power demands of the charging station.

Electric vehicle charging load profiles can be estimated from NREL's Heavy-Duty Electric Fleet Depot charging Load Profiles and Substation Load Integration Assessment.[3] This assessment includes data for the 24-hour fleet depot charging load profiles in 15-minute increments for the charging of heavy-duty battery electric trucks with 100 kW chargers. These load profiles can be extrapolated to estimate the approximate charging profiles for 19.2 kW, 50 kW, 150 kW, and 200 kW chargers.

Private/ Behind the Fence Charging Infrastructure

The location for private electric vehicle charging stations is typically located at the current parking behind the fence infrastructure for a fleet and does not require as robust locational assessment procedures as described in the public electric vehicle charging station section. However, if private fleets are considering a new location for depot charging or their on-route charging for fleet they should consider the existing utility infrastructure, zoning, and environmental considerations outlined in the Location Assessment section of the public charging station infrastructure.

Fleet Size Estimation

The demand for private charging infrastructure depends on the current and future fleet size of the private entity. The demand for charging infrastructure is required to determine the number of electric vehicle chargers needed, and ultimately size the DERs and microgrid. Information on the current fleet composition and plans for future ZEV procurement will be needed to accurately size the required charging infrastructure for the fleet.

Energy and Load Assessment

The next step in determining the appropriate size of charging infrastructure for private charging stations involves determining the fleet's energy and power requirements. A 15-minute load profile is needed to optimally size the required ZEV infrastructure for a private fleet. This load profile is used to access the peak energy and power demands, local grid infrastructure requirements and DER component sizing to meet power and energy demands in real time. The 15-minute load profile can be collected if there already exists a ZEV fleet or a load profile must be generated based on current and future ZEV fleet and infrastructure requirements.

Collecting Data

If a fleet operator has an existing ZEV fleet and infrastructure, this data can be collected from the following sources:

- Utility: The utility provider can provide a 15-minute load profile for all the meter connections which can be aggregated to determine the overall load of the facility.
- EV chargers: EV chargers are typically equipped with data loggers, collectors, and monitoring platforms that allow for easy extraction of 15-minute load data.

For private charging infrastructure energy demands, the energy consumption and daily mileage of the fleet needs to be determined.

- Energy consumption for routes can be determined through route energy models and by estimating the approximate energy consumption based on vehicle type.
- Electric vehicle charging load profiles can be estimated from NREL's Heavy-Duty Electric Fleet Depot charging Load Profiles and Substation Load Integration Assessment.[3] This assessment includes data for the 24-hour fleet depot charging load profiles in 15-minute increments for the charging of heavy-duty battery electric trucks with 100 kW chargers. These load profiles can be extrapolated to estimate the approximate charging profiles for 19.2 kW, 50 kW, 150 kW, and 200 kW chargers.
- Also, the Infrastructure Sizing Tool generates an estimated 15-minute load profile based on the recommended EV chargers, charging window and total energy required.

Infrastructure Assessment

Once the vehicle quantity, energy, and load demands for charging has been determined, then the electric vehicle supply equipment can be determined. This step, and the proceeding steps of the charging station and microgrid design, remain the same across public and private charging stations. Therefore, the distinction between the two station types will no longer be made, instead generalized steps will be described.

CALSTART has developed an Excel based Infrastructure Sizing Tool that helps users estimate the ideal combination of type and quantity of electric vehicle chargers needed to minimize the load demand on the grid, maximize the service needs of the traffic or fleet, and minimize the capital costs of the charging station. The model works by estimating charging load profiles based on user inputs on vehicle specifications, traffic/fleet quantity, and charging time availability. Once charging load profiles are developed, the model then iteratively adjusts input variables to systematically assess the appropriate mix of electric vehicle chargers needed. The output of the model is the optimized number of types of chargers needed and an aggregate daily 15-minute peak load profile which represents the power demands of charging the fleet.

Distributed Energy Resources Assessment

NREL's REopt can be utilized to determine the optimal power rate of DERs, such as solar, battery, and generator systems for each planned microgrid site.[4] REopt is a techno-economic tool that optimizes user defined energy generation sources to meet cost savings, resilience, emission reductions, and/or energy performance goals. Using the load profile developed from the optimization tool, along with the site's utility rate structure and desired resilience parameters, REopt will estimate the optimized size of DER systems to minimize the total lifetime cost.

Concept Microgrid Design

After DER sizing is optimized, the next step in the process is to establish the microgrid parameters. These parameters determine the desired performance criteria based on the microgrid functionality that they would require to serve. The user must define several parameters, including the energy portfolio, microgrid functionality, and design-threat basis.

Microgrid Functionality

When designing a microgrid, it's crucial to consider its functionality. The agency should decide on how they plan to utilize the microgrid and what services they hope to receive from it. This decision has a significant impact on the design of the microgrid. The agency should prioritize resilience to protect their fleet from power outages. Additionally, using the microgrid to reduce utility costs by displacing energy from the utility and providing grid services like demand response may also be of interest to the agency.

Size Microgrid Components

After determining the microgrid's required load, energy assessment, regulatory framework, considering the utility the, considering the space and other environmental consideration, next critical step is sizing its components. This involves selecting the appropriate microgrid components and sizing them according to their power outputs. This step is crucial in shaping the overall microgrid design. The primary objective of this phase is to calibrate the equipment so that the DERs generate power that aligns with the required loads.

This is a complex process because DERs have different generation characteristics. For example, solar power generates most of its energy during daylight hours and can be stored in battery systems. Generators can also complement these resources. The optimal configuration of these DERs is selected during the sizing process to best meet the load requirements. Optimization depends on various factors, such as peak load, timing of peak demand, and rate of load fluctuations. REopt tools results will assist in determining the most suitable sizing for the microgrid components, and based on this sizing, various other tools help to conceptualize the design, which is discussed in the section below.

Conceptualizing Microgrid Design

Based on the results of REopt sizing, this design typically encompasses a site layout and a single-line diagram. The site layout illustrates the strategic positioning of microgrid

4 S. Mishra, J. Pohl, N. Laws, D. Cutler, T. Kwasnik, W. Becker, A. Zolan, K. Anderson, D. Olis, E. Elgqvist. 2021. *Computational framework for behind-the-meter DER techno-economic modeling and optimization—REopt Lite, Energy Systems*. https://www.nrel.gov/reopt/

components such as solar panels, inverters and microgrid controllers on the premises to meet the required demand. Although the design is conceptual, it offers crucial insights. The single-line diagram outlines how DER will integrate with infrastructure and how the overall system will be structured to support the microgrid apparatus. To complete this step HelioScope can be used to conceptually design the location of the microgrid system.[5] HelioScope offers tools that allow for easy assessment of weather conditions, shading, and energy production of planned solar projects. Furthermore, the tool can produce single line diagrams that are compatible with CAD and other engineering design software.

The conceptual design of a microgrid is important for various reasons. It provides detailed information about the microgrid's design, which is often required by utilities for interconnection applications. The design can also be submitted as part of funding proposals to secure financial support for Plug-In Porterville. Furthermore, the design can help potential bidders understand the scope, scale, and objectives of Plug-In Porterville when submitting construction proposals.

5 HelioScope, an Aurora Inc. Company. 2024. Sales & Design Software for C&I Solar. https://app.helioscope.com/

CHAPTER 5: Conclusion

The Plug-In Porterville Blueprint outlines recommendations to increase physical and social resilience for the Porterville Community. This includes the implementation of three microgrids and three charging station hubs throughout the region. Additionally, CALSTART has established a continued engagement model utilizing the Energy Assurance Response and Planning Consortium. CALSTART prepared recommendations for the proposed built infrastructure.

Microgrid Implementation

Transit/Public-Works Microgrid

From a readiness standpoint, transit is the most prepared of all public fleets to implement a microgrid. Microgrid implementation at the Corp. Yard that hosts the transit and public-works fleets is currently on hold because SCE has prohibited the implementation of DERs on charging infrastructure obtained through the SCE-build option of the CRT program. Because the CPUC's Transportation Electrification Framework will wind down or sunset current investor-owned utilities make-ready programs, there is an opportunity for the new Framework Program Administrator to reconsider the use case that added resiliency to a transit agency fleet. Another consideration here is that if transit agencies are considering public private partnerships in the future or the ability for private fleets to charge on public infrastructure, added resiliency or development of the microgrid for peak shaving purposes, will facilitate this and not burden under resourced transit agencies with overwhelming costs. CALSTART proposes that either CRT or Porterville advocate for an exemption to this policy to the California Public Utilities Commission. CALSTART also proposed that CRT or the City of Porterville advocate for the new Framework to accommodate this exemption in the program design phase.

PUSD Microgrid

The PUSD has already committed to an all-electric fleet and taken the steps to procure electric buses and charging infrastructure as well as solar panels at their school sites. Added resiliency with the implementation of a microgrid will support the school fleet's current duty cycle that largely does not operate during set time windows. The use case for the PUSD fleet is then a more obvious candidate for successful microgrid implementation. It would be beneficial for the school district to pursue funding for the microgrid soon since the fleet composition is unlikely to change soon.

Airport Microgrid

The microgrid design for the airport will necessitate the most effort on Porterville's behalf to evaluate how and where that economic hub adjacent to the Eagle Mountain Casino and airport will develop. If there are forthcoming corridor or road developments or changes, then the city can reevaluate where the microgrid will most benefit medium- and heavy-duty vehicle traffic. Another consideration will be if there are any residential developments in that area where medium- and heavy-duty goods movement would be potentially discouraged.

Table 3: Microgrid System Siting Summary

Component	Units	Transit / Public-Works	PUSD	Airport
PV (AC Name Plate Capacity)	kW	1200 / 300	1200	1000
Battery-Power	kW	415 / 300	700	745
Battery-Energy	kWh	2600 / 2100	2000	2500
Generator	kW	460 / 0	1000	540

Source: CALSTART, 2023.

Charging Station Deployment

CALSTART analyzed various factors to develop a proposed list of sites for charger station hubs. Factors included zoning considerations, grid availability, utility coordination and prioritizing city owned land. The hubs are intended to be publicly accessible with the caveat that there may be some emergency planning considerations where Porterville may prioritize certain fleets in the case of evacuation. The Plug-In Porterville team acknowledges that Porterville will have to re-evaluate their ability to support loads if stations are not deployed in the shorter term or if corridor development changes significantly. The same will be considered from a permitting or zoning standpoint if the selected sites are rezoned or no longer considered city land. Additionally, the current design for charging infrastructure at the three different city sites does not include any DER equipment but that may change in the future, so it'll be important to consider additional spatial needs for microgrid assets in hub sites.

Table 4: Proposed Charging Stations (all sites)

Location	Location Name	Total Number of EVs	Number of Heavy-Duty EVs	Number of Medium-Duty EVs	Peak Load (kW)	Total Number of EVSE
Airport	West Industrial Airport	81	37	44	1498	15
1	Jct. Rode 190 & 65	83	30	53	1322.53	15
2	Hospital Road	85	13	72	1281.47	15
3	Linda Vista Avenue	84	30	54	1352.40	15

Source: CALSTART, 2023.

Funding Opportunities

The California Energy Commission funded this planning process as part of the medium heavy duty blueprint solicitation. In October 2023, the CEC released GFO-23-603, the solicitation for Implementation of Medium- and Heavy-Duty ZEV Infrastructure Blueprints. The city of

Porterville and its partners have an opportunity here to apply for funding that would see the realization of this planning process. There are also other funding opportunities in California that support zero emission charging infrastructure like the CEC's EnergIIZE, an incentive program that is focused on commercial infrastructure developments and the Clean Vehicle Fueling Infrastructure Program.

The influx of funding from Federal funding sources like the Environmental Protection Agency's Clean School Bus Program can fund the EVSE and microgrid infrastructure for the PUSD. Other funding mechanisms are included in Figure 7.

Figure 7: Funding Mechanisms

Grants and Incentives	Agreements	Rebates/Credits
• EnergIIZE • CVFIP (Valley Air) • Communities in Charge • CEC Implementation Funding	• Microgrid Service Agreements • Power Purchase Agreements	• Low Carbon Fuel Standard • Investment Tax Credit (Solar) • Production Tax Credit

Source: CALSTART, 2023.

The implementation of microgrids in Porterville promises to bring multiple benefits to the city and its local community. These advantages encompass utility cost savings, enhanced resiliency during events like PSPS, and the creation of economic opportunities and jobs that will particularly benefit the disadvantaged community within the city.

One significant environmental benefit is the reduction of CO_2 emissions through various means. Notably, the installation of four public EV chargers (i.e., three in the city and one at the Porterville airport) will contribute to the gradual displacement of ICE vehicles from the roads. The estimated GHG emission reductions resulting from these public chargers are contingent on their usage to charge vehicles covering distances ranging from 100 to 500 miles per day. Based on these considerations, the anticipated emissions savings fall within the range of 0.14 to 0.72 million metric tons annually. The detailed methodology is discussed in the section 1 below. In addition to emissions savings from the transport sector, the microgrid will also eliminate GHG emissions from the power sector with the aid of three microgrids (PUSD, Transit Center, and Airport). To estimate GHG savings from the microgrid, SCE's power mix is utilized, as all these microgrids fall under SCE's utility territory. The annual emissions savings from the microgrid are estimated to be approximately 1393 metric tons per year, encompassing the emissions savings of PUSD (383 metric tons per year), Transit center microgrid (600 metric tons per year), and airport (410 metric tons per year).

ANNUAL EMISSIONS SAVINGS:

1393 METRIC TONS CO_2e PER YEAR

The implementation of these microgrids will provide utility savings in operation as well as resiliency because they are grid connected microgrid which will not only provide the resiliency but also provide the utility saving in operation. The annual utility for all three microgrid would be $872,253, which includes the saving form PUSD microgrid $120,869, Airport $294,145 and form Transit center microgrid $457,239 per year which represent approximately 43% of annual saving as listed in Section 2.

In Addition to the GHG emission and utility saving the microgrid will also add the economic benefits to the community. One the deployment process starts all the three microgrid at transit center, PUSD and airport will also help in creating the jobs and provide economic benefits for city of Porterville, central valley and beyond. The build-out of the microgrids will support several classes of jobs. These include direct jobs, which are jobs supported by the construction of the microgrid. It will also create indirect jobs, which are jobs supported by the supply chain associated with the microgrid. Lastly, it will create induced jobs, which are jobs supported by spending from workers employed in the direct and indirect jobs.

CALSTART estimates that the microgrids will support 109.9 direct jobs, 73 indirect jobs, and 133.9 induced jobs. Collectively, laborers in the 109.9 direct jobs are projected to earn wages of $10,221,095.96 per year and laborers in 73 indirect jobs are projected to earn wages of $3,852,836.21 per year.

Recommended Stakeholder Engagement and Accountability

Infrastructure resilience decreases when systems cannot withstand current conditions; therefore, resilience is a dynamic process requiring ongoing engagement from local stakeholders. While traditional operations-based (i.e., reactive) response is commonplace for emergency management, its reflexive nature substantially threatens a system's ability to function during emergencies. Therefore, this Blueprint strongly recommends a community-based proactive approach to establish load management priorities for system stressors.

With the completion of the Plug in Porterville project, we strongly recommend implementing continual stakeholder engagement through a locally driven Energy Assurance Response and Planning Consortium. Maintaining a stakeholder-driven Consortium during clear-skies conditions will facilitate effective collaborative management during emergencies, enhance resilience, and minimize risks while fostering a more sustainable and secure infrastructure system respective to local and regional objectives. A Consortium-based approach recognizes and leverages multiple existing plans respecting individual stakeholder policy requirements and goals, maximizing co-production of knowledge, ultimately contributing to energy equity by avoiding a single, overarching strategy that can minimize or "other" stakeholders reflective of local power structures and pre-existing dynamics.[6] We specifically recommend the following considerations for successful stakeholder engagement over time. These considerations are not an exhaustive list and may be adjusted to best fit the criteria for success as determined by stakeholder agencies:

Host Consortium Kick Off

- Establish clearly defined roles and team-established goals.
- Identify internal Consortium lead and determine tenure length.
- Establish preliminary goals and corresponding milestones.
- Mutually define qualitative and quantitative success criteria.

6 Holgersen, S. 2015. *Spatial planning as condensation of social relations: A dialectical approach. Planning Theory*. 14(1), 5–22. https://doi.org/10.1177/1473095213501672

- Define common values and a brief purpose statement.

Resource Allocation

- Stakeholder should be responsible for self-funding needed to attend semi-regular meetings.
- The Consortium may choose to split materials costs equitably based on respective agency size or take turns hosting events and absorbing event costs.
- Stakeholders who may be disproportionately impacted by financial in-equity may choose to incorporate "in-kind" donations of goods, time, facilities.

Communication and Reporting

- Identify platform for knowledge sharing and engagement (e.g., similar interagency collaboratives in an analogous valley to foothill transitional zone utilizes Slack to share information before, during, and after emergencies and during clear skies status).
- Provide timely event summaries, goals, or relevant updates to Consortium members on identified platform.
- Post purpose statement in a highly visible location on shared platform and at in person engagements.

Sustainability and Continuity

- Post purpose statement in a visible location on shared platform and at events.
- Mutually establish several milestones for re-evaluation over time: What do the next 6 months, 1 year, and 5 years look like?
- Manage and update goals and desired outcomes as infrastructure changes or other considerations arise.

Promote Transparency

- Establish clear channels for feedback from group members.
- Prioritize feedback based on significance and potential impact.

Recognition

- Celebrate milestones to maintain enthusiasm and motivation.
- Share public-facing updates of successes. of successes.

Other Recommendations

During the implementation of grant funds and in developing this blueprint, several recommendations arose that may be helpful to the CEC and/or future awardees of grant funding. As the prime awardee, CALSTART appreciated the streamlined approach that CEC incorporated into Plug-In Porterville management. This allowed for optimized spending in various cases and added flexibility throughout the agreement period. CALSTART greatly appreciated input and guidance from the Commission Agreement Manager. Despite ongoing projects and responsibilities, it was always clear the CEC was continuously engaged in the Plug-In Porterville Blueprint efforts and progress.

The Plug-In Porterville team had a significant personnel change at the City of Porterville that affected the overall outcome related to decision-making and guidance. It may be valuable in the future for the Plug-In Porterville team to identify a new lead or champion and for CEC and the grantee to hold a meeting to regroup on the intent and benefits of the Blueprint. For this Blueprint, CALSTART engaged several Porterville leaders and staff amid the personnel change and optimized planning to reflect their vision.

GLOSSARY

ANNUAL AVERAGE DAILY TRAFFIC (AADT) – [Caltrans] Traffic Counts (a.k.a. Traffic Volumes) are for the State Highway System only (in various formats – Traffic Volumes, Truck Traffic, and Ramp Volumes).[7]

BATTERY ENERGY STORAGE SYSTEM (BESS) – Is an electrochemical device that charges (or collects energy) from the grid or a power plant and then discharges that energy a later time to provide electricity or other grid services when needed.[8]

BEHIND-THE-METER (BTM) – refers to the energy systems [load or generator] located on the customer's side of the utility meter.[9]

CALIFORNIA DEPARTMENT OF TRANSPORTATION (Caltrans)—Responsible for the design, construction, maintenance, and operation of the California State Highway System, as well as that portion of the Interstate Highway System within the state's boundaries.

CALIFORNIA ENERGY COMMISSION (CEC)—The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The Energy Commission's five major areas of responsibilities are:

1. Forecasting future statewide energy needs.
2. Licensing power plants sufficient to meet those needs.
3. Promoting energy conservation and efficiency measures.
4. Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels.
5. Planning for and directing state response to energy emergencies

CALIFORNIA PUBLIC UTILITIES COMMISSION (CPUC) – A state agency created by constitutional amendment in 1911 to regulate the rates and services of more than 1,500 privately owned utilities and 20,000 transportation companies. The CPUC is an administrative agency that exercises both legislative and judicial powers; its decisions and orders may be appealed only to the California Supreme Court. The major duties of the CPUC are to regulate privately owned utilities, securing adequate service to the public at rates that are just and reasonable both to customers and shareholders of the utilities, including rates, electricity transmission lines and natural gas pipelines. The CPUC also provides electricity and natural gas forecasting, and analysis and planning of energy supply and resources. Its main headquarters are in San Francisco.

CHARGE READY TRANSPORTATION PROGRAM (CRT) – [Administered by the Southern California Edison utility company] The Charge Ready Transport Program gives your business

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7 The Annual Average Daily Traffic (AADT) definition source, https://dot.ca.gov/programs/traffic-operations/census

8 The Battery Energy Storage System (BESS) definition source, https://www.nrel.gov/docs/fy19osti/74426.pdf

9 The Behind-the-Meter (BTM) and Front-of-the-Meter (FMT) definition source, https://www.power-sonic.com/blog/behind-the-meter-vs-front-of-the-meter/

the opportunity to install the infrastructure to support a fleet of medium- and heavy-duty electric vehicles (EVs) at low or no cost to you. By taking your fleet from gas to electric, you'll have the unique opportunity to both help the environment and save on fuel and investment costs.[10]

CUSTOMER AVERAGE INTERRUPTION DURATION INDEX (CAIDI) – Measures the average duration of a single sustained outage (i.e., an outage that lasted for longer than five minutes) that a customer experienced in the reporting year.[17]

DIRECT CURRENT (DC)—A charge of electricity that flows in one direction and is the type of power that comes from a battery.

DISTRIBUTED ENERGY RESOURCE (DER) – Small-scale power generation technologies (typically in the range of 3 to 10,000 kilowatts) located close to where electricity is used (for example, a home or business) to provide an alternative to or an enhancement of the traditional electric power system.

DISTRIBUTION RESOURCES PLAN (DRP) – Public Utilities Code Section 769 was instituted by AB 327, Sec. 8 (Perea, 2013). This new code section requires the electrical corporations to file distribution resources plan proposals by July 1, 2015. According to the Code, these plan proposals will "identify optimal locations for the deployment of distributed resources." It defines "distributed energy resources" as "distributed renewable generation resources, energy efficiency, energy storage, electric vehicles, and demand response technologies.".[11]

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) – Federal agency within the U.S. Department of Homeland Security charged with responding to Presidentially-declared disasters. Also, Federal agency under which the NFIP is administered. In March 2003, FEMA became part of the newly created U.S. Department of Homeland Security.[12]

FRONT-OF-THE-METER (FTM) – [refers to energy] systems [that] are [on] the utility side of the meter [… like] energy generation and storage facilities.[9]

GREENHOUSE GAS (GHG) – Any gas that absorbs infra-red radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), halogenated fluorocarbons (HCFCs), ozone (O3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs). (EPA).

INTERNAL COMBUSTION ENGINE (ICE) – An engine in which fuel is burned inside the engine. A car's gasoline engine or rotary engine is an example of an internal combustion engine. It differs from engines having an external furnace, such as a steam engine.

JOB CO-BENEFIT MODELING TOOL (JCMT) – California Air Resources Board (CARB) staff developed the Job Co-benefit Modeling Tool and accompanying Job Co-benefit Assessment

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10 The Charge Ready Transportation Program (CRT) definition source, https://crt.sce.com/overview

11 The Distribution Resources Plan (DRP) definition source, https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/distribution-resource-plan

12 The Federal Emergency Management Agency (FEMA) definition source, https://www.fema.gov/about/glossary/f

Methodology to provide guidance for estimating the job co-benefits of California Climate Investments.[13]

NATIONAL RENEWABLE ENERGY LABORATORY'S (NREL) – The National Renewable Energy Laboratory (NREL), located in Golden, Colorado, is the United States' primary laboratory for renewable energy and energy efficiency research and development. NREL is the only Federal laboratory dedicated to the research, development, commercialization, and deployment of renewable energy and energy efficiency technologies.

PHOTOVOLTAIC (PV) – A semiconductor that converts light directly into electricity.

PORTERVILLE UNIFIED SCHOOL DISTRICT (PUSD) – public entity in Porterville, CA that comprises of 23 schools with schools in Porterville and Strathmore.[14]

PUBLIC SAFETY POWER SHUTOFFS (PSPS) – Utilities may temporarily turn off power to specific areas to reduce the risk of fires caused by electric infrastructure.[15]

RENEWABLE ENERGY INTEGRATION AND OPTIMIZATION TOOL (REopt) – [National Renewable Energy Laboratory] Web tool allows users to evaluate the economic viability of distributed PV, wind, battery storage, combined heat and power (CHP), geothermal heat pumps (GHP), and thermal energy storage. Identify system sizes and dispatch strategies to minimize energy costs. Estimate how long a system can sustain critical load during a grid outage.[16]

SOTHERN CALIFORNIA EDISON (SCE) – An electric utility company serving the southern California region.

SYSTEM AVERAGE INTERRUPTION DURATION INDEX (SAIDI) – Measures the average total minutes of outage that a customer on the system experienced in the reporting year.[17]

ZERO-EMISSION VEHICLE (ZEV) – A vehicle which produces no emissions from the on-board source of power (e.g., an electric vehicle).

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13 The Job Co-Benefit Modeling Tool (JCMT) definition source, https://ww2.arb.ca.gov/sites/default/files/auction-proceeds/final_jobs_userguide.pdf

14 The Porterville Unified School District (PUSD) definition source, https://www.portervilleschools.org/

15 The Public Safety Power Shutoffs (PSPS) definition source, https://www.cpuc.ca.gov/psps/

16 The Renewable Energy Integration And Optimization Tool (REopt) definition source, https://reopt.nrel.gov/tool

17 The System Average Interruption Duration Index (SAIDI) and Customer Average Interruption Duration Index (CAIDI) definition source, https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/electric-reliability/electric-system-reliability-annual-reports