California Energy Commission EV Ready Communities Challenge

An EV Readiness Plan for Santa Clara

The challenge

The City of Santa Clara and its electric utility Silicon Valley Power (SVP), in concert with Siemens, was awarded funding by the California Energy Commission (CEC) to develop a Phase 1 Electric Vehicle (EV) Blueprint to identify the actions and milestones needed to proceed toward implementation of the EV ready community. The CEC required EV Blueprints to develop a comprehensive and replicable blueprint to detail the steps needed for a regional electrified transportation network and to transition the identified region to an EV ready community. After review and selection, the CEC plans to award additional funding in Phase 2 to assist with implementation of the EV Blueprints. The EV Blueprint development process established a firm planning foundation which involved engaging internal and external stakeholders, analyzing the current state of transportation electrification, forecasting long-term impacts of EV adoption, and prioritizing key requirements to help The City of Santa Clara meet the greenhouse gas emissions reduction targets identified in the Santa Clara's Climate Action Plan 2.0 (CAP 2.0); these targets are 55% below the 2008 baseline levels, and must be achieved by 2035.

The City of Santa Clara (The City) and Siemens agreed to apply a customized version of Siemens' tried and tested stakeholder guided EV Implementation Framework (EV-IF) to craft the EV Blueprint. As depicted in Figure 1, the team structured the effort into three stages – Goals & Requirements, Infrastructure Siting Analysis, and Program Evaluation & Design.
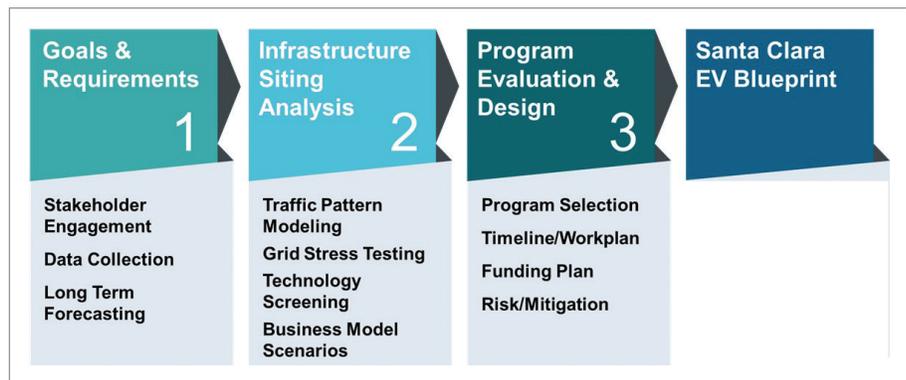

Figure 1: Siemens EV Blueprint Planning Approach

Goals and requirements

In Stage 1 the team included extensive stakeholder input and developed several EV adoption scenarios to establish the EV Blueprint goals. Siemens' stakeholder guided EV-IF process combined the different perspectives of City residents, SVP, City Planning and others with that of Plug-In Electric Vehicle (PEV) charging developers and financiers. Customer surveys and department-level workshops brought out the interests and very real concerns of a broad constituency, which proved a foundational element of the plan.

Team members found common cause around The City greenhouse gas reduction goal and agreed with the structured logical approach that linked tangible program initiatives to the key drivers and barriers of EV charging development which The City could influence. Through the process, team members learned the perspectives of other individuals and departments, and how working together, The City could develop a practical plan to combat greenhouse gas emissions.

Siemens developed several EV penetration forecasts and quantified the system impacts on the electric grid from projected rapid EV growth. Siemens then determined the number and types of charging plugs that would be required to support EV adoption across Santa Clara. From this foundation, Siemens worked with The City to establish their specific EV program goals.

Infrastructure siting analysis

In Stage 2 the team conducted three key tasks: they determined where and when within Santa Clara EV charging demand would grow, informed The City about charging system technologies and standards, and developed business and financial models for charging ownership to help The City determine the role they wanted to play.

Siemens applied 'big data' analytical approaches to hourly measured traffic patterns across a typical week, determined where and when private and commercial vehicles transited The City, and also how long those vehicles spent in any one place. With this foundation, Siemens forecasted traffic patterns across traffic area zones in The City and determined charging demand within those zones. Siemens then "stress tested" the system by comparing the forecasted load with existing substation capacity to identify substations and feeders which might require upgrades to carry incremental EV load, as depicted in Figure 2. It is important to recognize that increased feeder load will require interconnection studies, and increased development time and cost which will impact charging site attractiveness.

In defining the scope of work, the CEC recognized the need for utilities to understand the EV charging technology landscape. To meet this need, Siemens leveraged its extensive European experience managing charging networks to provide insight into technology choices and standards. The key technologies reviewed were the EV charger requirements and the Information Technologies (IT) architecture that interfaces the charger with backend systems.

Based on the technology and systems considerations, the EV Blueprint team identified guidance for The City and/or SVP to further encourage the electric vehicle supply equipment (EVSE) infrastructure build out in cases where the lack of infrastructure may severely hinder PEV adoption in the concerned community. Furthermore, the EV Blueprint team highlighted technology and system combinations needed to potentially acquire SVP residential customer charging data to support PEV program funding through low carbon fuel standard (LCFS) credits.
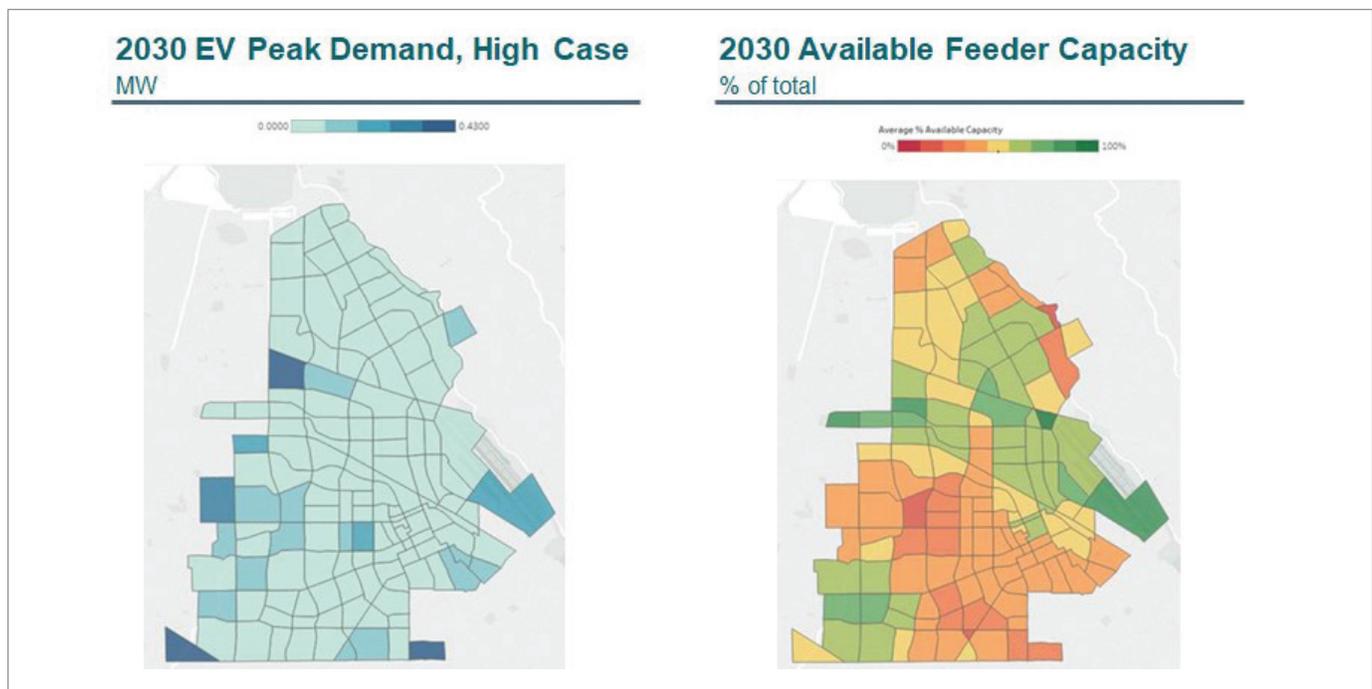

Figure 2: Santa Clara EV Demand and Available Feeder Capacity 2030 Forecast

In the final Stage 2 task, Siemens identified numerous viable charging ownership structures and business models. Each model identified ownership and partnership opportunities for The City, and for each a detailed project level financial model was constructed which quantified the investments, risks, and returns for parties under each structure. Further, the models determined the commercial viability and external funding support required. A sample business model for a charging station installed at a multi-unit dwelling is provided in Figure 3.

Program evaluation and design

In Stage 3, Siemens worked with The City to devise an EV readiness program and workplan to align with the program goals agreed to in Stage 1. Using the original Blueprint goal, which was to meet the greenhouse gas emissions reduction targets, as a foundation, the team identified the key drivers of that goal. The exercise identified some non-transportation drivers and set those aside as The City was addressing those through other programs. The team agreed to focus on the key barriers hindering more rapid adoption of EVs for City owned fleet vehicles, private vehicles, and commercial vehicles. The EV Blueprint Team researched and identified potential EV acceleration projects and how each might break down the barriers slowing EV penetration and the attainment of The City's greenhouse gas goal.

These projects were combined into a larger program which would coordinate the effort, a workplan for each project and the overall program was devised. The workplan included staff hours, program costs, project sequencing, and schedules which together comprised the funding plan. Further, risks and mitigants were identified for each project within the program, and program contingency was included in the funding plan.
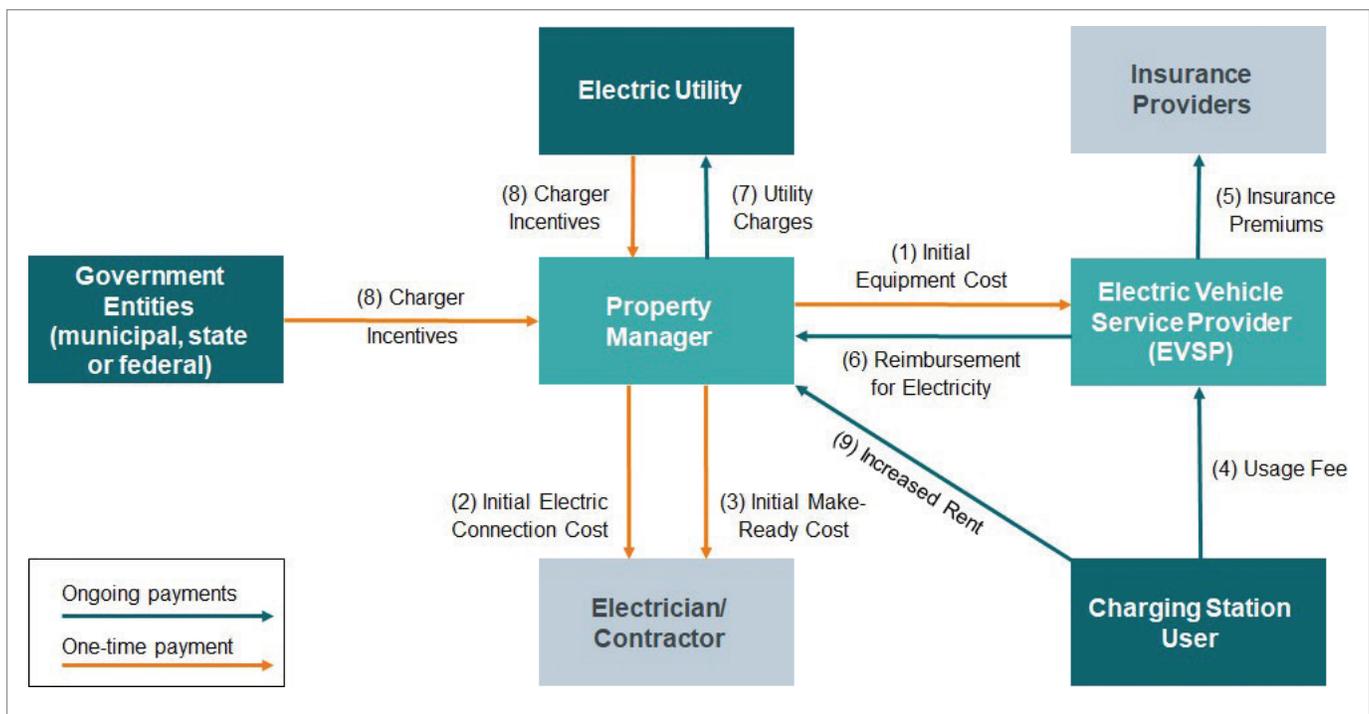

Figure 3: Multi-Unit Dwelling Charging Station Business Model

Santa Clara EV Blueprint

The EV Blueprint was designed to implement 20 initiatives through 2030 for an EV Ready Community to drive the outcomes depicted in Figure 4. Initiatives included:

- Citywide enablers: educational/ marketing, streamlined permitting, clarified building codes, curbside charging standards, smart charger incentives, payment standards for public chargers, sub-metering rules, streamlined grid interconnection. coordinated public private partnerships, technical charger standards

- Supportive incentives: time of use rates, EV only tariffs, smart charger incentives, EVSE rebates, PEV rebates, city traffic incentives (HOV/Free Parking/etc

- City investments: City funded/owned charging

- Special EV programs: car sharing programs, vehicle to grid pilot program, aged battery reuse

The EV Blueprint Team proposed The City adopt 20 program initiatives, kicking off January 1, 2020 together as the EV Blueprint, to ensure Santa Clara is an EV Ready Community by the end of 2030.
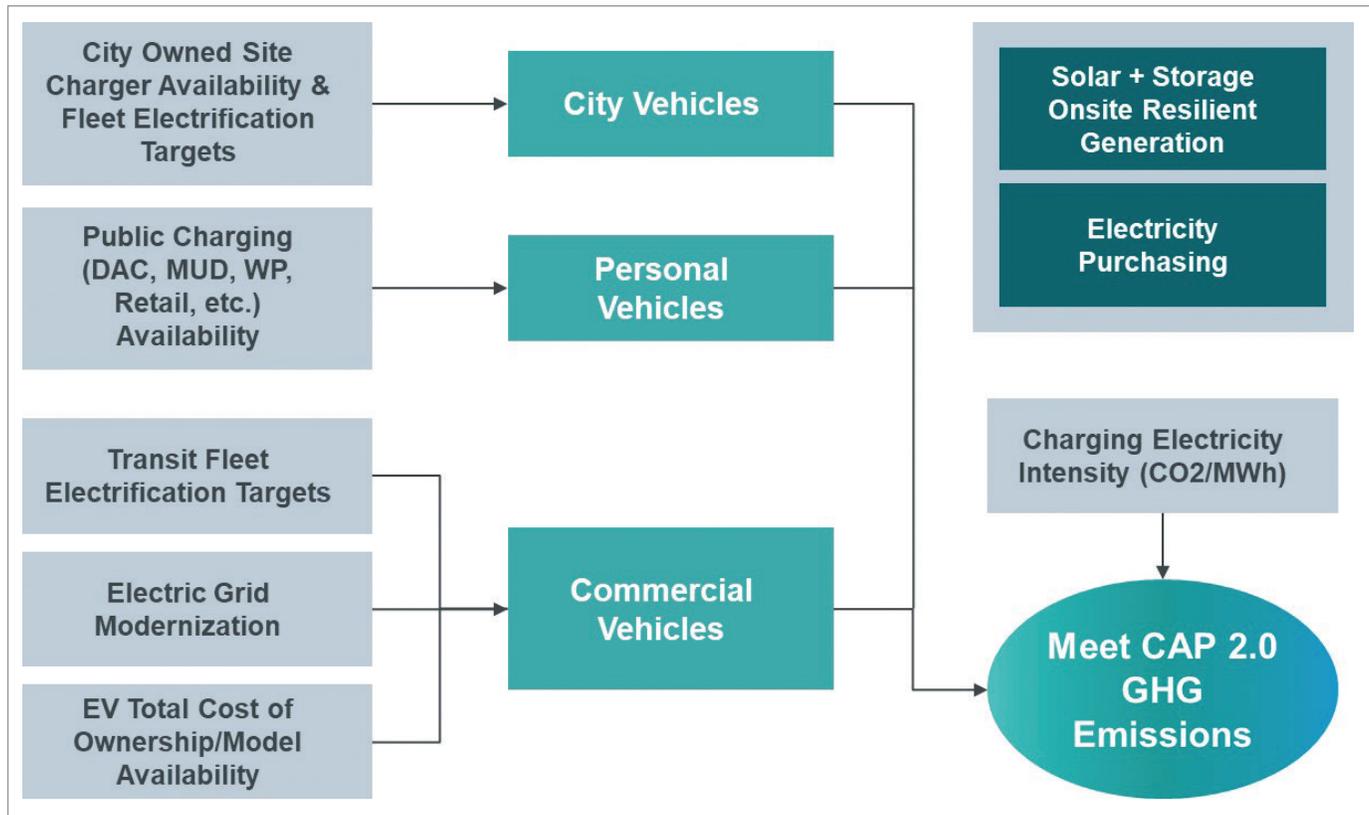

Figure 4: EV Readiness Project Linkages