CALIFORNIA ENERGY COMMISSION

ENERGY RESEARCH AND DEVELOPMENT DIVISION

FINAL PROJECT REPORT

California Opportunities for Procurement to Accelerate Clean Energy (Cal-Op ACE)

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ACKNOWLEDGEMENTS

This project results from the visionary thinking of colleagues at ProspectSV, Berkeley Lab, Energy Solutions, and ZNE Alliance. These project partners recognized that institutional purchasing policies and processes can and will pave the way to carbon reduction, and that studying the organizations attempting to implement carbon reduction initiatives could reveal how to improve the process for everyone. Empower Procurement is a humble attempt to realize that vision. The authors thank our partners for their diligent and insightful efforts throughout this work. We also thank all the cities, counties, school districts, and institutions of higher learning that worked with us. Finally, our thanks to the Energy Commission's Commission Agreement Managers, who worked with us from start to finish, adjusting and responding throughout four years of evolving efforts. We're grateful for the collaboration all around

PREFACE

The California Energy Commission's (CEC) Energy Research and Development Division supports energy research and development programs to spur innovation in energy efficiency, renewable energy and advanced clean generation, energy-related environmental protection, energy transmission, and distribution and transportation.

In 2012, the Electric Program Investment Charge (EPIC) was established by the California Public Utilities Commission to fund public investments in research to create and advance new energy solutions, foster regional innovation, and bring ideas from the lab to the marketplace. The CEC and the state's three largest investor-owned utilities—Pacific Gas and Electric Company, San Diego Gas and Electric Company, and Southern California Edison Company—were selected to administer the EPIC funds and advance novel technologies, tools, and strategies that provide benefits to their electric ratepayers.

The CEC is committed to ensuring public participation in its research and development programs that promote greater reliability, lower costs, and increase safety for the California electric ratepayer and include:

- Providing societal benefits.
- Reducing greenhouse gas emission in the electricity sector at the lowest possible cost.
- Supporting California's loading order to meet energy needs first with energy efficiency and demand response, next with renewable energy (distributed generation and utility scale), and finally with clean, conventional electricity supply.
- Supporting low-emission vehicles and transportation.
- Providing economic development.
- Using ratepayer funds efficiently.

For more information about the Energy Research and Development Division, please visit the CEC's research website (www.energy.ca.gov/research/) or contact the CEC at ERDD@energy.ca.gov.

ABSTRACT

California Opportunities Procurement Program Accelerate Clean Energy is a California Energy Commission-funded program designed to accelerate the deployment of best-in-class distributed energy resources (DERs) at the speed and scale required to meet the state's decarbonization goals. *Empower Procurement*, the program's market-facing name, bridged the gap between DER "sellers" and California-based "buyer" organizations by improving institutional procurement processes and outcomes.

Led by Prospect Silicon Valley, the primary project partners included Lawrence Berkeley National Laboratory, Energy Solutions, and ZNE Alliance. The four-year, $4 million project created an integrated set of DER Procurement Initiatives: DER Products and Services, Vehicle Fleet Electrification, Building Decarbonization, DER Consulting Practices, and Contract Language. The team engaged client partners from local governments, higher education, and K-12 schools to identify specific measures that addressed procurement barriers, produced measurable energy cost savings and reductions in carbon emissions, and scaled across similar institutions. In addition, a Working Group of expert stakeholders identified measurable and scalable improvements in the design and deployment of Electronic Procurement Systems to improve and standardize DER procurement.

The project team shared insights from these initiatives across public sector institutions by hosting webinars and workshops throughout the grant, and it provided technical assistance for the more complex sectors undertaking fleet electrification and building decarbonization.

The Empower Procurement effort declared a goal of identifying pathways to achieve annual energy savings of $322 million and annual greenhouse gas emissions reduction of 780,000 metric tons of CO_2e (MTCO_2e). The observations and recommendations of the project initiatives identified pathways to avoid emissions of more than 1 million MTCO_2e across the local government, schools, and higher education sectors.

Keywords: Distributed Energy Resources, Consumer Behavior Studies

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TABLE OF CONTENTS

LIST OF FIGURES (EXAMPLES BELOW)

LIST OF TABLES (EXAMPLES BELOW)

Executive Summary

Background

California has set aggressive goals to curb climate change, and its leading cities, businesses, and public institutions have set similarly challenging decarbonization goals. One opportunity for reducing carbon is through procurement. Procurement policies and practices significantly impact how much energy an organization uses and how much carbon it releases. Public institutions are a primary driver of distributed energy resources (DER) product and solution sales and remain leaders in green purchasing programs.

For California to realize its climate goals, institutions must substantially increase their deployment of DER solutions. However, there are barriers to connecting buyers and sellers. DER technology companies must navigate complicated institutional procurement processes, and customers must overcome structural inertia to adopt new DER technologies. As a result, customer acquisition costs for DER sellers are far too high, and adoption rates for innovative technologies are far too low.

Project Purpose and Approach

California Opportunities Procurement Program (Cal-Op) Accelerate Clean Energy (ACE) is a California Energy Commission (Energy Commission)-funded program designed to accelerate the deployment of best-in-class DERs at the speed and scale required to meet the state's decarbonization goals. Empower Procurement, the market-facing name of the program, was designed to bridge the gap between DER sellers and California-based buyer organizations by improving institutional procurement processes and outcomes.

Led by Prospect Silicon Valley (ProspectSV), the team designed the project research, results, and resources to benefit procurement managers and other buyers of DER products and services in California local governments, higher education, and K-12 schools, and sellers of DER products and services that target these institutional buyers.

The project created an integrated set of six DER Procurement Initiatives (PIs) that identified and overcame critical barriers to procurement in public institutions representing significant carbon-emitting sectors. In preparation for determining the PIs, target sectors, and the PI work plans, the team engaged stakeholders in Buyers and Sellers surveys and researched market segments with the highest potential impact on California climate goals and the barriers they face in procuring DER products. Further, they applied a Roles, Rules, and Tools (RRT) framework to analyze each sector's procurement process and barriers. The analysis identifies the RRTs of an organization's procurement system that do not align with an organization's sustainability goals for reducing energy costs and greenhouse gas (GHG) emissions, thus creating barriers to procurement. It also identifies opportunities for streamlining existing processes or developing new RRTs to advance sustainability priorities and goals.

For each PI, a team engaged client partners from local governments, higher education, or K-12 schools in pilot programs. The team assessed the barriers to DER procurement using the RRT framework, provided the client with recommendations, analyzed the impacts the measures would make on energy savings and GHG emissions, and then scaled the results statewide.

Based on these findings, the team engaged in knowledge transfer activities, including technical assistance, webinars, workshops, and peer forum meetings. Finally, based on the PIs' impact and market feedback, they proposed a Business Plan to continue targeted technical assistance beyond the program's completion.

Key Results

The Empower Procurement program designed and deployed DER PIs and follow-on technical assistance targeting gross annual energy savings of at least $322 million per year and annual GHG reductions of at least 780,000 metric tons of CO_2 equivalent (MTCO2e).

The team found that the procurement barriers in the public sector appear consistent across organizations of similar types. This work implies that the barriers characterized and addressed in the limited scope of PI activities, if addressed sector-wide, would contribute significantly to the potential outlined here, unlocking millions of MTCO2e reductions and millions of dollars of cost savings.

Table ES.1 presents the annual reductions in GHG emissions, and the cost savings institutions would achieve if they implemented the measures recommended by each PI team to address the identified procurement barriers. It presents pilot results and statewide scaling. Summaries of the procurement barriers each PI addressed to achieve the results and the refinements to the project work based on pilot results follow these quantitative results.

Table ES.1 Quantitative Results of Empower Procurement Project

Procurement Initiative	Pilot Results		System or Statewide Scaling	
	GHG Reductions ($MTCO_2e$)	Cost Savings ($)	GHG Reductions ($MTCO_2e$)	Cost Savings ($)
Contract Language*			2,527	392,231
Procurement Practices*			35,391	5,537,517
Products	0.545	583	19,344	18,605,282
Services	6.0	210,203	32,520	97,650,844
EV-Fleets Schools	32,362	21,360,701	420,000	81,890,878

Procurement Initiative	Pilot Results		System or Statewide Scaling	
Building Decarbonization**	414		28,511	1,976,226

*These PIs focused on specific higher education systems, so scaling is across the system. ** Due to highly variable project costs, natural gas prices, availability of incentives, and uncertainty of project timelines, the team did not estimate cost savings for the pilot.

Source: ProspectSV

Contract Language for Higher Education aimed to enhance the clarity and standardization of acquisition language, enabling vendors to understand that buyers are soliciting clean energy technologies and to provide them with the right products. The team worked with the California State University System and the California Community College System, identified specific measures to improve acquisition language, and estimated the impact of adopting those measures across each system.

DER Consulting Practices in Higher Education was a foundational PI that assessed procurement practices and identified institutional barriers. The PI team first determined if the client had an organizational goal relating institutional procurement with sustainability and carbon reduction and, if not, helped them develop one. Second, based on that goal, the team applied the RRT framework to identify the right actors to target, the related processes, and the systems or tools in place related to institutional procurement. The team worked with the University of California System and the California Community College System to analyze procurement policies and tools and identify the main procurement barriers within each system. The team offered specific measures to address each barrier and estimated the increase in energy-efficient product procurement and savings the measures would deliver across each system.

Program participants in these two PIs targeted at higher education identified electronic procurement systems (E-Procurement Systems) as barriers to procurement leading the team to explore these systems.

DER Products for Local Governments introduced pilot institutions to the tools and practices that yield the full benefits of sustainable products. The team worked with the City of San Luis Obispo and estimated potential energy, cost, and GHG emission savings by requiring energy-consuming office equipment to meet ENERGY STAR specifications for the city. It then extrapolated the results for all cities and counties in California.

Given the marginal results of the pilot and the widespread use of cooperative purchasing agreements, ProspectSV refocused the program to explore the uptake of DER products and services through E-Procurement systems, which could have a far more significant impact on local governments and other public sectors.

DER Services for Local Government helped local governments assess their processes to find qualified DER service professionals, connect them with resources and technology solutions, and streamline their request for proposal (RFP) and contractor selection pipelines. The team helped the City of Cupertino plan the retrofit of municipal buildings. They identified key barriers to sustainable procurement, provided specific measures for each barrier, estimated the impact of adopting them, and then extrapolated the results statewide.

ProspectSV determined that while connecting local governments with qualified service suppliers was useful, refocusing the team's efforts on building decarbonization could yield far greater energy cost savings and carbon reductions.

E-Procurement Systems support requisitioning, ordering, and purchasing goods and services online and, in large organizations, drive what gets bought. Program participants consistently identified the limitations of E-Procurement Systems as a barrier to achieving sustainable procurement goals.

Without sufficient knowledge to develop a PI pilot to quantitatively assess the impact of E-Procurement Systems on energy costs and GHG emissions, the team instead assembled a Working Group of key stakeholders across different industries to discuss challenges, determine best practices and help establish better standards to enable identifying, verifying, and reporting sustainable products in organizations' E-Procurement Systems.

Electric Vehicle Fleets for Schools offered resources and strategies for school districts to assist buying activity with technical, financial, and planning assistance to accelerate and support the transition to an electric fleet. The team provided Bakersfield City School District with goals, objectives, and next steps toward a long-term bus replacement schedule and estimated vehicle-related costs, including capital and operating costs, maintenance, and electric fueling. The team also provided Twin Rivers Unified School District with the information, resources, and technical assistance it needed to strengthen its existing fleet electrification effort through detailed EV-fleet transition planning. The team estimated cost savings and reductions in GHG emissions of a complete full-fleet transition for both school districts.

To amplify these results, the team developed Technical Assistance Work Packages for EV-Fleets, supporting several more school districts during the grant period. They consulted with a school district on its specific needs, modified the work package into a detailed proposal, and confirmed the scope of work with the client.

Electric Vehicle Fleets for Local Governments explored opportunities for cost savings and GHG reductions by addressing procurement barriers to electrifying local government fleets. The team supplemented the Empower Procurement Buyer and Seller surveys with in-depth interviews of staff of several diverse cities, reflecting the spectrum of size and expertise.

Based on the research and the successful adoption of Technical Assistance Work Packages for EV-Fleet adoption by schools, the team developed solutions to the barriers they could provide to multiple cities and counties and created Technical Assistance Work Packages for EV-Fleet adoption by local governments. The team provided EV-Fleet Technical Assistance to several cities and counties, and the program is ongoing.

Building Decarbonization for Local Governments helped local governments identify their opportunities for building electrification, address barriers to procuring equipment and installation services, and to focus implementation of the most immediate opportunities. The project team recommended that the City of Burlingame enroll in a government incentive program to help fund and manage the replacement of its natural gas water heaters with highly efficient heat pump water heaters. The team also assessed the procurement process and calculated the reduction in GHG emissions to support the City of Piedmont's efforts to replace natural gas water heaters with electric heat pump water heaters in all 14 municipal buildings. To scale the benefits, the team estimated savings of switching to electric space and water heating for all California city, county, special district, and superior court buildings.

Based on the lessons learned from the Building Decarbonization PI and additional interviews, the team created a Technical Assistance Work Package for Building Decarbonization for local governments. Several cities and counties have participated in this ongoing program.

Knowledge Transfer and Next Steps

ProspectSV designed the knowledge transfer activities to amplify the work of the PIs by making the findings accessible to a broader audience. In addition to creating and distributing marketing and outreach materials and technical resources throughout the project, the team engaged stakeholders through the following activities.

- **Technical Advisory Committee:** ProspectSV organized a technical advisory committee (TAC) to advise the project team and help disseminate information about the project and its learnings within their communities.
- **Events:** The project team organized 11 Webinars and 15 Workshops to educate stakeholders on topics and issues relevant to the PIs and the target market segments. More than 1,050 individuals attended these events, which the team recorded and made available to new audiences through the Empower Procurement website, ProspectSV social media channels and Peer Forum portals.
- **Peer Forums**: ProspectSV's Peer Forums convene groups of asset managers and decision-makers from communities facing similar sustainability challenges to share expertise, experiences, and best practices. For Empower Procurement, the knowledge transfer team employed ProspectSV's Local Government Fleet Electrification Peer Forum and the Decarbonization Buildings Peer Forum.

Technical Assistance: The KT team tapped the expertise of project partners and other sources to review current practices, assess the current state, provide tools, recommendations, and guidance, and/or refer organizations to experts or other resources. After working with several clients, the team developed Technical Assistance Work Packages for EV Fleets and Building Decarbonization

ProspectSV will continue supporting the communities developed through the project's KT efforts. The team anticipates expanding and refining the Peer Forums for electrifying fleets and buildings and continuing to engage both buyers and sellers of DER products with the insights gleaned from this program. In addition, ProspectSV will seek means to refine the technical assistance program to benefit new recipients and to share critical information gained in those engagements with all its clients and partners.

Next Steps

Public institutions often require incentives, tools, and technical assistance to initiate and maintain sustainability procurement programs. However, most smaller institutions, such as school districts, community college districts, and small/medium municipalities, lack experience, bandwidth, and the necessary decision structure to move these programs forward. The cost of transition is often too great.

As described in the Business Plan Memorandum, the Energy Commission can support these institutions with transition assistance to launch comprehensive procurement for full-fleet electrification, infrastructure improvements, or building decarbonization.

The Energy Commission can also support emerging technologies and solutions that cannot deliver value at the scale required of even moderately sized institutional customers. Continued investment in large-scale applications for fleets and buildings is an essential counterpart to the demand created through more effective procurement.

Berkeley Lab continues to lead the Working Group establishing best practices and recommending standards for E-Procurement Systems, and the Energy Commission can support this ongoing research.

CHAPTER 1: Introduction

Project Context

California set aggressive goals to curb climate change, including to reduce greenhouse gas (GHG) emissions by 40 percent below 1990 levels and to double energy efficiency savings in electricity use by 2030,[1] to support the deployment of five million electric vehicles and 250,000 public charging stations by 2025,[2] and to transition the state's bus and truck fleets to electric operation.[3] Many of California's leading cities, businesses, and public institutions followed suit with similar decarbonization goals.

Procurement has a significant impact on how much energy an organization uses and how much carbon it releases (Good Company 2015). Furthermore, team research[4] indicates that public institutions are a primary driver of distributed energy resources (DER) product and solution sales and remain leaders in green purchasing programs. Of the DER manufacturers, service providers, distributors, and contractors surveyed, 44 percent indicated that they targeted public sector buyers. DER product sellers and service providers also identified governments and educational institutions as the sectors that are most engaged in energy efficiency and green procurement issues. This aligns broadly with sellers' focus on public institutions as a primary sales target.

For California to realize its climate goals, institutions must substantially increase their deployment of DER solutions, which in turn means that procurement activity must be turned toward these outcomes. While scaling up DER solutions can simultaneously help buyers and sellers of DER technologies, there are barriers to connecting the two parties. For DER technology companies to sell into institutional and commercial markets, they must navigate complicated institutional procurement processes, and procurement customers must overcome structural inertia to adopt new DER technologies. As a result, customer acquisition costs for DER sellers are far too high, and adoption rates for innovative technologies are far too low.

Several major areas of organizational procurement are drivers of DER deployment, including:

- Maintenance, repair, and operations

[1] SB-350 Clean Energy and Pollution Act of 2015

[2] Executive Order B-14-18

[3] California Air Resources Board Advanced Clean Truck Regulation (June 2020) requires over half the trucks sold by manufacturers in the state be zero-emission vehicles by 2035. California Air Resources Board Innovative Clean Transit Regulation (December 2018) set a statewide goal for all public transit agencies to transition to 100percent zero emission bus fleets by 2040.

[4] Cal-OP ACE Seller Survey (project deliverable)

- Building construction, renovation, and energy retrofits
- Service contracts
- Fleet management
- IT purchases
- Non-IT appliances

Of these products and services, maintenance, repair, and operations and energy retrofit contracting services are the most commonly purchased items (according to team research),[5] which is consistent with prior assumptions about what California organizations are purchasing.

This project addressed these issues by creating a buyer/seller-oriented program geared toward bridging the gap between California clean energy companies and institutional customers who rely on formal procurement processes to purchase DER solutions and packages.

Prospect Silicon Valley and its partners assessed stakeholder requirements and limitations and designed and implemented procurement initiatives (PIs) to eliminate or mitigate identified procurement barriers between California's DER sellers and institutional buyers.

Project Goals and Objectives

The California Opportunities Procurement Program (Cal-OP) Accelerate Clean Energy (ACE) project, presented as the Empower Procurement program, had the following goals:

- Create an integrated set of DER PIs that address known barriers to accelerated clean technology deployments in high-volume markets.
- Identify improvements to procurement processes or approaches to common procurement barriers within institution types to accelerate DER deployment.
- Determine long-term solutions that would scale across institutions, resulting in statewide impact.

To achieve these goals, the project team identified these specific actions:

- Assess and prioritize the needs, barriers, and opportunities of DER buyers and sellers.
- Design and deploy high-impact DER procurement assistance initiatives yielding annual energy savings of at least $322 million per year and annual GHG reductions of at least 780,000 metric tons of CO_2 equivalent ($MTCO_2e$).
- Develop educational resources for DER buyers and sellers including a series of networking events and webinars to connect the Empower Procurement community and the [Empower Procurement] website to provide education, information, and market insights

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[5] Cal-Op ACE Buyer Survey: Barriers and Opportunities Memorandum (project deliverable)

- Develop a Business Plan Memorandum that leverages the results, insights, and networks created by the Empower Procurement program and further supports organizational transition within public institutions to achieve consistent, scalable, and sustainable procurement activity in DER and sustainability applications.

Primary Project Partners

Prospect Silicon Valley (ProspectSV) enables the transition to carbon-free energy and transportation by connecting the funding, expertise, and collaborative partnerships that move solutions forward. ProspectSV focused the efforts of more than 60 startups and corporate enterprises, partnered with more than 100 local governments, and catalyzed more than $500 million in venture investment and public funding. ProspectSV led Empower Procurement, coordinating the work of the PI lead partners, organizing a technical advisory committee (TAC) and Knowledge/Technology Transfer activities.

Energy Solutions harnesses the market economy's power of energy, carbon, and water-use savings to offer proven, performance-based solutions for its utility, government, and institutional customers. Energy Solutions does this by targeting the best new technologies, working with key partners in the supply chain for seamless adoption, and then helping governments and market partners set rules that require people to use them.

For this project, Energy Solutions led the Building Decarbonization PI, providing technical tools, resources, and assistance to local government clients, developing case studies, and participating in webinars, workshops, and other events.

Lawrence Berkeley National Laboratory (Berkeley Lab) is a multiprogram science lab in the national laboratory system supported by the U.S. Department of Energy through its Office of Science. Managed by the University of California, Berkeley Lab conducts unclassified research across a wide range of scientific disciplines.

For Empower Procurement, Berkeley Lab led the Contract Language PI, providing technical assistance and resources to higher education clients, led the Working Group on Electronic Procurement, and participated in Empower Procurement Knowledge/Technology Transfer webinars, workshops, and other events.

ZNE Alliance is a nonprofit organization partnering with leading communities and organizations to advance a zero net emissions future. The Alliance deploys integrative approaches to rapid decarbonization at city and regional scales—working across the domains of clean energy, the built environment, sustainable mobility, and climate finance.

For this project, ZNE Alliance led the Fleet Electrification PI, providing technical assistance to school district and local government clients and contributing to Empower Procurement Knowledge/Technology Transfer webinars, workshops, and other events.

Advisors

Early in the project, ProspectSV invited project partners, technology partners, market consultants, and representatives of the target buying sectors and DER sellers to join a TAC. The TAC included the following experts:

- energy and sustainability managers in higher education and local government
- program managers of California electric utility companies
- representatives of nonprofits, non-governmental organizations and consultancies supporting sustainable purchasing, clean energy adoption, and building decarbonization
- government agency and corporate purchasing and supply chain managers
- DER seller account executives

Appendix A lists TAC members and other advisors who attended TAC meetings

Chapter 2: Project Approach

Strategic Approach

Several key insights drove program design and assessment. First, the extent to which DER buyers align with institutional goals may be hindered by internal or systemic barriers to DER procurement. Second, the extent to which DER sellers cannot reach and serve institutional buyers creates a gap and presents a measurable opportunity to increase energy savings and decrease carbon emissions. Third, identifying and overcoming barriers to DER procurement activity in specific market segments offers a method for realizing that opportunity. Finally, institutional segments that are attractive to DER sellers by virtue of their size and stability offer the greatest opportunity for energy savings and decreased carbon emissions.

The core strategy of the project, as further elaborated in this chapter, was to create an integrated set of DER PIs that overcome key barriers to accelerated clean technology deployments in high-volume markets.

Target Institutional Segments

The team researched market segments with the highest potential impact on California climate goals and the barriers they face in procuring DER products. Customer outreach activities focused on DER influencers and buyers in the following organizations:

Higher Education

- University of California Office of the President (UCOP) representing the ten-campus UC system
- California State University (CSU) Chancellor's Office representing the 23 campus CSU system
- California Community Colleges System representing 116 campuses within 73 Districts

Local and Regional Government

- California local governments, including 550 cities, 58 counties, and dozens of special districts, each independently managing its own facilities, vehicle fleets, and other energy intensive resources
- California Community Choice Association representing the existing 24 Community Choice Aggregation (CCA) electricity providers and those now in the planning stage will soon serve nearly 80 percent of California electricity consumers
- California K-12 Schools

The California public school system, prekindergarten through grade 12, has 977 school districts[6] operating and maintaining more than 500 million square feet of buildings and 23,800 school buses (Brunner, E. J. and J. M. Vincent 2018, CARB 2022).

- California Association of Schools Business Officers representing 370 California K-12 public schools and others including charter schools.

Federal Agencies[7]

- U.S. Department of Energy Federal Energy Management Program, which works with the largest energy procurers in the federal government and private sector.
- General Service Administration (GSA), the principal procurement arm of the federal government.

Buyer and Seller Types

The project research, results, and resources were designed to benefit these two primary audiences:

- Procurement managers and other buyers of DER products and services in California local governments, higher education, and K-12 schools.
- Sellers of DER products and services that target these institutional buyers.

Developing Procurement Initiatives

In preparation for identifying the PIs, target sectors, and the PI work plans, the team engaged stakeholders in Buyers and Sellers surveys.

The team conducted a Seller Survey that targeted DER manufacturers, service providers, distributors, and contractors. They invited participation from DER sellers who had previously sold their products and services to California institutional buyers, responded to request for proposals (RFP) and request for quotes (RFQ), or otherwise engaged in the procurement process. Sellers reported that while they thought the potential market was quite good, they did not feel they could adequately access large California buyers. They cited the lack of connections and business relationships and the lack of information on upcoming RFPs or RFQs as the key barriers to access.

A Buyer Survey assessed the needs, barriers, and opportunities for DER technologies procurement in California organizations across the state's major sectors (e.g., healthcare, higher education, K-12 schools, state and local government, retail, technology, etc.). The survey identified the following key barriers:

- gaining approvals, developing contract documents, and undergoing legal reviews

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[6] Ballotpedia (website) Public Education in California

[7] Berkeley Lab conducted outreach to these federal agencies under a cost sharing arrangement.

- using procurement tools that do not support purchasing new DER products
- managing the high-cost and long-term return on investment
- navigating the lack of financing options, interoperability with existing equipment, and top management support

More broadly, the team found significant barriers to matching DER buyers and sellers with innovative technology and service solutions at scale. For example, DER sellers must navigate complicated institutional procurement processes, diverse policies and systems, and technical requirements. The team found that today, even a committed change agent in the procurement decision process must overcome structural inertia and address a host of perceived or actual operational challenges to adopt new DER technologies.

One reason for this intransigence: traditional procurement has focused on economic considerations, with first cost a dominant "lens" for evaluating procurement options, instead of the more complex Total Cost of Ownership (TCO) calculation, which often favors low carbon technology. The aim and the challenge of sustainable procurement is to reduce adverse impacts on the environment (especially the climate), public health, and social conditions, thereby reducing the burden of these "externalities" on the community at large.

The principal organizational barriers to achieving sustainable procurement are:

- challenges in changing habitual procurement behavior;
- a lack of suppliers of sustainable products and services;
- the complexity of comparing costs and benefits with conventional options;
- the difficulty of including factors broader than environmental considerations; and
- a perception that low carbon technology may be too costly and/or time-consuming to procure, install, or maintain.

Adopting the Roles, Rules, and Tools Framework

Integrating DER technologies into the institutional procurement process requires understanding the hierarchical system within institutions, unraveling the complex procurement rules and decision-making process, and identifying the resources and pathways institutions use to purchase products and services. As a result, the team adopted a Roles, Rules, and Tools (RRT) framework developed by Berkeley Lab for implementing best practices in institutional procurement (Malone, E.L. et al. 2011).

The framework defines the following essential elements of a procurement system:

- *Roles:* the organization, structure, and function of people in the procurement process
- *Rules:* the formal (and informal) policies and procedures by which procurement functions are guided, managed, and implemented
- *Tools:* the products, technologies, and services that enable purchasing, from distributors to web platforms to procurement co-operatives

The analysis identifies the RRT of an organization's procurement system that are misaligned with an organization's sustainability goals for reducing energy costs and GHG emissions, thus creating barriers to procurement. It also identifies opportunities for streamlining existing processes or developing new RRTs that can advance sustainability priorities and goals.

Developing Procurement Initiatives

Ultimately, the team created two types of PIs. *Institutional PIs* focus on procurement practices designed to serve the entire organization and the DER solutions that support all departments. *Functional PIs* instead focus on procurement practices of a single department and the DER solutions relevant to the assets of that department. Table 1 shows the type and market sector of each PI.

Table 1: Procurement Initiatives Type and Market Sector

Procurement Initiative	Target Sector	Type
Contracting Language	Higher Education	Institutional
Procurement Practices	Higher Education	Institutional
Products Procurement	Local Governments	Institutional
Services Procurement	Local Governments	Institutional
Electronic Procurement Systems[8]	Cross-Sector	Institutional
Vehicle Fleet Electrification	Schools, Local Governments	Functional
Building Decarbonization	Local Governments	Functional

Source: ProspectSV

For each PI, the team engaged a partner to undertake a pilot as a case study of the sector. Applying the RRT framework, the case study interrogated the procurement systems for that sector and identified flaws or potential improvements that could be made to the systems to deliver scalable recommendations to the sector statewide. Where pilots demonstrated potential for significant carbon and/or cost savings, work was continued.

The PI process was highly iterative, and the PIs were interrelated; learnings from individual initiatives continuously informed and shaped the project over its duration. Each PI team had a lead organization responsible for creating and implementing the PI Workplan. Other team

[8] Electronic procurement systems was a special focus of the effort due to their potential impact on all aspects of enabling greater DER procurement.

members and channel partners provided expertise, tools, outreach, knowledge/technology transfer activities, and specific information or potential enrollees from other PIs.

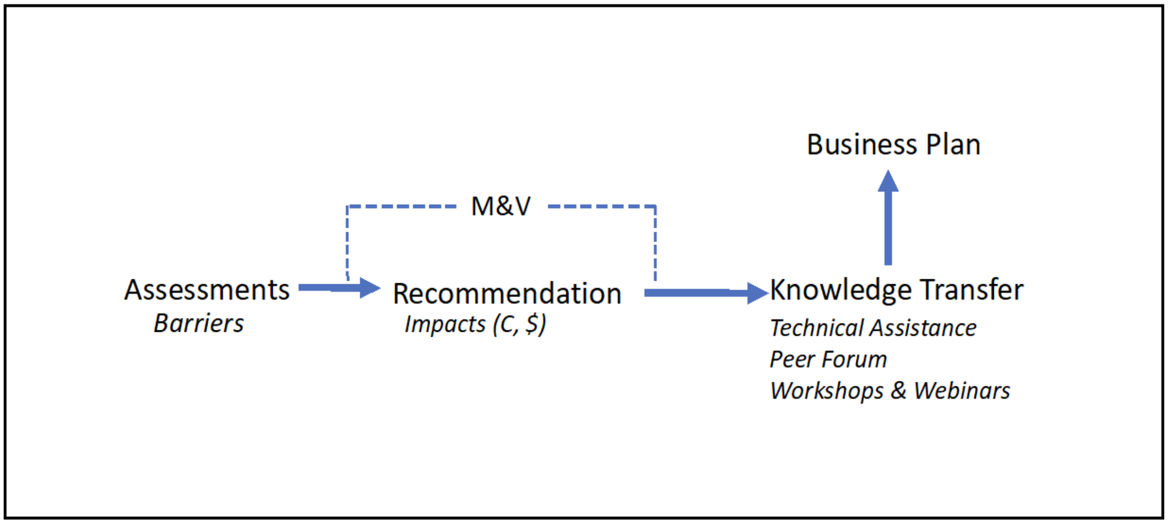
Each PI Workplan included a roadmap that, while specifically designed for the PI, included the following steps:

- *Preparation:* Understand the market, customer needs, and institutional barriers to purchasing DER products. Identify key attributes of target clients based on buyer/seller survey results.
- *Pilot:* Develop PI's and test with Pilot clients to test messaging, materials, methodology, and data collection for future efforts.
- *Iteration and Modeling:* Based on Pilot results and continuous engagement with the target market, refine the PI process, quantify the annual energy savings and annual reduction in GHG emissions and scale the savings and reductions statewide (measurement & verification [M&V]).

Rollout: Devise customizable PI work packages for new clients and develop a sustainable business model to accelerate DER procurement following the end of the California Energy Commission (Energy Commission) grant support in 2024.

The flowchart shown in Figure1 illustrates the overall process. First, the team assesses the barriers to DER procurement using the RRT framework. Next, it provides the client with recommendations and an analysis of the impacts they would make on energy savings and GHG emissions. The team then scales the results statewide (M&V). Based on these findings, the team engaged in knowledge transfer activities, including technical assistance, webinars, workshops, and peer forum meetings. Finally, based on the impact of the PIs and the feedback from the market, the team proposed a Business Plan to continue targeted technical assistance beyond the program's completion.

Figure 1: Procurement Initiative Process



Source: ProspectSV

Metrics and Implications

The PIs investigated procurement barriers experienced in a diversity of specific cases including procurement and contracting processes in the higher education sector, decarbonizing office buildings in the public sector, and decarbonizing school and city fleets. Findings were cross-verified through M&V activity. The team conducted these specific analyses to demonstrate the impacts in measurable cases. However, the broader implications of carbon and cost savings from the recommended measures detailed in the PI Results section are that greater carbon reductions could be expected. Two of the more significant and tangible examples of this potential are in fleets and buildings.

Indeed, two decarbonization priorities for the Energy Commission are the consumption of fossil fuels by vehicle fleets and buildings. As this report describes, the Empower Procurement project addressed these asset cases in focused efforts from PI analysis to technical assistance. However, the more significant implications of this work lie in the potential savings to be realized in these major public sectors across California.

For example, decarbonizing school buses involves replacing about 24,000 vehicles across 1,037 school districts in California.[9] School districts vary widely in sophistication and resources. The PI pilot districts' specific experiences with EV-Fleets may not represent the experiences of all districts. However, the project team's engagement with school districts revealed that the vast majority of districts lack the necessary resources, expertise, and bandwidth to plan or perform decarbonization programs. Based on current fleet sizing, the potential annual carbon

[9] California Department of Education. Fingertip Facts on Education in California

savings of full decarbonization is estimated to be between 0.7 and 1.1 million $MTCO_2e$. Since the largest school districts have more sophisticated purchasing programs, the remaining school districts would benefit the most from the PI recommendations, comprising about 35 percent of the fleet for a reduction potential of 350,000 $MTCO_2e$.

Local government fleets will soon undergo a similar transformation. Although the project team found no definitive census of local government fleet vehicles, a cursory analysis of reported fleet size and composition indicates that local governments own approximately 225,000 vehicles statewide. As this report notes, the barriers to EV-Fleet procurement experienced by school districts are similar to those of local governments. Decarbonizing all local government fleets statewide requires replacing light-duty vehicles, representing about 35 percent of the fleet,[10] and medium/heavy-duty vehicles for which there are currently extremely limited options.

Still, according to the Environmental Protection Agency (EPA) emission factors for these vehicle classes,[11] the light-duty local government fleets have an annual carbon reduction potential of approximately 750,000 $MTCO_2e$, with the potential additional reduction of more than 2 million $MTCO_2e$ once more EV options for medium/heavy-duty vehicles are available.

Lastly, local government buildings are a nascent focus of decarbonization. The Building Decarbonization PI demonstrates that office buildings with gas water heating present excellent potential for GHG reductions and cost savings if procurement barriers to electrification were systemically addressed. Using data from the Commercial Buildings Energy Consumption Survey (CBECS),[12] the team estimates that local governments own more than 900 million square feet of facilities consuming more than 24 million cubic feet of natural gas, representing the potential to eliminate more than 1.3 million $MTCO_2e$ by decarbonization.[13]

The team found that the procurement barriers in the public sector appear consistent across organizations of similar types. This work implies that the barriers characterized and addressed in the limited scope of PI activities, if addressed sector-wide, would contribute significantly to the potential outlined here, unlocking millions of MTCO2e reductions and millions of dollars of cost savings. (Appendix B summarizes assumptions for estimating the savings in this section.)

Given these implications, beginning in the second quarter of 2022, the team concentrated on EV-fleets and Building Decarbonization and developed Technical Assistance programs for EV-Fleets and Building Decarbonization.

The following Results section considers each PI and presents the methods used to measure the potential annual energy savings and GHG reductions that could be achieved by following

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[10] Estimated by ZNE Alliance

[11] EPA GHG Emissions Hub

[12] CBECS Table C30. Table B5.

[13] Per EPA's Greenhouse Gas emission factor of 0.0550 metric ton/Mcf

the project team’s recommendations. In addition, appendixes provide further detail and references for the savings estimates and M&V.

Chapter 3: Results

The following sections describe the results of each PI. They identify barriers to DER procurement for specific sectors and present the interventions developed through the pilot project to address them. They demonstrate how addressing these barriers can unlock significant carbon reduction and cost savings.

Table 2 summarizes the results for each PI and the potential for scaling them throughout a higher education system or the State.

Table 2: Procurement Initiative Results Summary

Procurement Initiative	Pilot Results		System or Statewide Scaling	
	GHG Reductions ($MTCO_2e$)	Cost Savings ($)	GHG Reductions ($MTCO_2e$)	Cost Savings ($)
Contract Language*			2,527	392,231
Procurement Practices*			35,391	5,537,517
Products	0.545	583	19,344	18,605,282
Services	6.0	210,203	32,520l	97,650,844
EV-Fleets Schools	32,362	21,360,701	420,000	81,890,878
Building Decarbonization**	414		28,511	1,976,226

*These PIs focused on specific higher education systems, so scaling is across the system. ** Due to highly variable project costs, natural gas prices, availability of incentives, and uncertainty of project timelines, the team did not estimate cost savings for the pilot.

Source: ProspectSV

Institutional Procurement Initiatives

Contract Language for Higher Education

Large organizations typically use standardized acquisition language to facilitate their procurements. However, contracting officers and in-house counsel often do not have the subject matter expertise to provide standardized contract language and technical specifications that accurately specify clean energy technologies, which can prevent the integration of these specifications into existing contract templates.

This PI aimed to enhance the clarity and standardization of acquisition language, enabling vendors to understand buyers are soliciting clean energy technologies and to provide them with the right products. Providing acquisition language to institutions would support institutions to:

- Improve the clarity of the clean energy technology acquisition process, both pre-award (i.e., solicitations, RFPs) and during the award (i.e., contracts), by providing pre-written cut-and-paste language and/or templates that explicitly prioritize clean energy; and technical specifications to ensure that vendors are more likely to provide the buyer with the right clean energy product.
- Improve the replicability of the clean energy technology acquisition process by standardizing acquisition documents and/or product standards that buyers use, and familiarizing clean energy sellers with the information they need to provide.
- Reduce the administrative burden of procuring new clean energy technologies by expediting the procurement process and improving the ease of contracting with vendors, enabling easier, faster adoption of clean energy products.

Table 3 presents contract practices that create barriers to procurement developed from the Buyer Survey and working with channel partners.

Table 3: Barriers Created through Contract Practices

Institutional Barrier	Misaligned Rule, Role or Tool?
Difficulty integrating clean energy specifications and supporting terms and conditions in contracting documents	Rule
Knowledge gaps (specifiers, legal counsel, contract officers may lack subject matter expertise for incorporating clear and suitable clean energy specifications)	Tool
Contract language not up to-date (not reflecting climate goals)	Tool
Negotiation of terms and conditions can cause bottlenecks	Rule
Lack of staff resources (time, expertise)	Rule

Source: Berkeley Lab

Berkeley Lab led this PI, helping the CSU and CCC systems in developing tailored contract language for purchasing energy-related products and services.

Contract Language: California State University System

Based on assumptions and models described in Appendix C, the team estimated that the CSU system could save $580,000 (in 2020 USD) each year for a five percent increase in the share of energy-efficient products purchased each year. This translates to annual GHG savings of 3,729 $MTCO_2e$. These savings estimates apply to all 23 educational campuses in the CSU system. (For savings at a single campus, divide the total savings by 23).

The team reviewed the lighting specifications and design guidelines[14] and provided specific recommendations for increasing the energy efficiency of the products specified. The team estimated savings and implementation costs associated with their specific recommendations, as shown in Table 4.

Table 4: Recommendations to CSU System with Estimated Costs and Carbon Savings

Technical Assistance	Assumptions	GHG savings ($MTCO_2e$)	Cost Savings ($)	Implementation Costs ($)
Provide suggestions to lighting specifications and design guidelines	Increase in the percentage of energy-efficient lighting products out of total lighting products purchased each year by 20percent at all the 23 campuses	1,572	244,620	800

Source: Berkeley Lab

Contract Language: California Community College System

Based on assumptions and models described in Appendix C, the team estimated that the CCC system could save $640,000 (in 2020 USD) each year for a five percent increase in the share of energy-efficient products purchased each year. This translates to annual GHG savings of 4,140 $MTCO_2e$. These savings estimates are for all the 116 campuses in the CCC system. The team provided suggestions to exterior lighting contract language for the CCC system. Table 5 presents the estimated savings and implementation costs associated with specific recommendations provided by the team.

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[14] CSU Office of Chancellor, Task Order Construction Agreement, Master Enabling Agreement Design Delivery Method for Indoor Lighting Design January 2021

Table 5: Recommendations to CCC System with Estimated Costs and Carbon Savings

Technical Assistance	Assumptions	GHG savings ($MTCO_2e$)	Cost Savings ($)	Implementation Costs ($)
Provide suggestions to exterior lighting contract language	20percent increase in energy-efficient exterior lighting at all campuses	241	37,266	800
Contracting Webinar	10percent at 10 Campuses	714	110,345	1000
Total		955	147,611	1800

Source: Berkeley Lab

Lessons Learned

The team noticed that the UC system had a decentralized procurement system. It could instead employ a centralized procurement system to decrease the time individuals spent researching products and increase the efficiency of the purchasing process. This insight contributed to this team's pivot to exploring E-Procurement Systems.

DER Consulting Practices in Higher Education

This foundational PI assessed procurement practices and identified barriers. As a broad consultation service, the assessment framework, questions, and core insights helped inform the implementation of other PIs. This PI, led by Berkeley Lab, aimed to:

- Increase the uptake of DER technology adoption by helping organizations identify and address institutional procurement barriers revealed by the assessment process.
- Provide direct technical assistance regarding procurement barriers where Berkeley Lab had experience, steer clients to other established PIs, or identify opportunities for new PIs.
- Collaborate with other PI leads to reveal relevant specific organizational factors that affect the institutional procurement process.
- Determine the client's institutional capacity to track procurement data (e.g., the attributes of the products they're purchasing) and establish 'baseline' data on procurement processes and spend categories. This baseline assessment can be used to assess a client's procurement performance over time and/or in comparison with other organizations.

The Consulting Practices PI had two phases. First, the PI team determined if the client had an organizational goal related to institutional procurement, carbon reduction, etc., and if not, helped them develop one. Second, based on that goal, the team applied the RRT framework to identify the right actors to target, the related processes, and the systems or tools in place related to institutional procurement. Table 6 presents the misaligned RRT this PI identified.

Table 6: Institutional Barriers Revealed by DER Consulting Practices

Institutional Barrier	Misaligned Rule, Role or Tool?
Lack of DER technical specifications for contracts	Tool
Lack of buy-in from top-level management (e.g., CFOs)	Role
Priority on lowest first cost rather than lowest lifetime cost, or emission reduction potential	Tool

Source: Berkeley Lab

DER Consulting Practices: University of California System

Throughout 2020 and 2021, researchers from Berkeley Lab conducted a series of assessment interviews with UC and UCOP campus staff. The team spoke with procurement, energy, and sustainability department staff to discuss institutional practices with purchasing energy-efficient and clean energy technologies. They analyzed findings from the interviews to identify institutional barriers and opportunities for improvement. Finally, they leveraged Berkeley Lab's federal experience in energy-efficient product procurement, institutional change, and behavioral science principles to develop interventions addressing the procurement challenges.

The assessment interviews revealed four main barriers within the UC system and offered specific recommendations to address each.

Split Incentive Problem: This refers to a difficulty in isolating incentive dollars/energy cost savings that obscures the reward of doing the work needed to save energy. For example, the system did not return cost savings in energy bills to the budgets of the individual departments that achieved the savings.

The team recommended creating social norms and encouraging leadership through "spotlighting" procurement champions within the UC system, essentially promoting those who use best practices with sustainable procurement through department newsletter shoutouts, social media posts, or equivalent acknowledgments. The team also recommended developing a formal procurement analysis process.

Difficulty Implementing Centralized Procurement Practices: Despite the centralized purchasing office, the team observed decentralized decision-making within different departments and nonuniform adherence to a standard purchasing process across campuses and departments.

The team recommended motivating departments through internal education webinars on the benefits of centralized procurement systems. They also recommended creating social norms to encourage leadership, again through "spotlighting" procurement champions within the UC system.

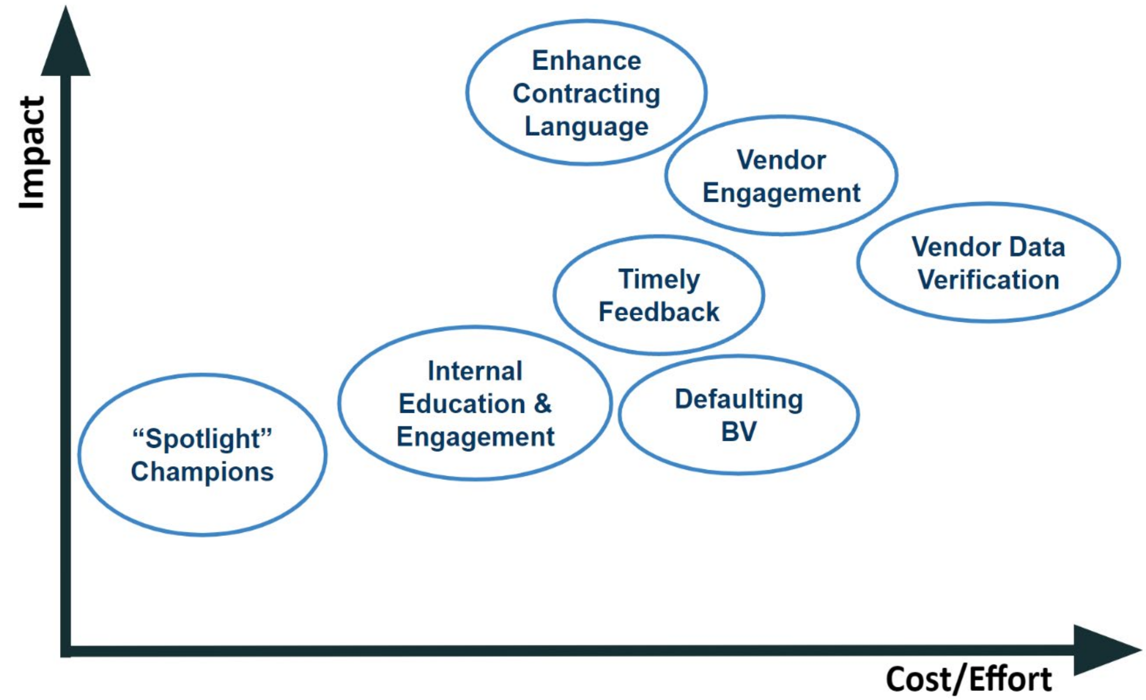
Trouble Implementing the Best Value Approach: Respondents found implementing the Best Value approach to be a resource-intensive process and that they required a standardized definition of Best Value for each project. They found quantifying total lifecycle cost required a substantial investment in time due to a lack of tools and guidelines.

The team recommended enhancing contracting language to effectively communicate UC's needs and prioritize its purchasing standards. They also recommended making Best Value the default and providing instructions to handle exceptions. This would be achieved through campus-level engagement to standardize Best Value procurement practices as well as direct technical assistance from the Berkely Lab staff to UC staff.

Lack of Reliable Data on Product Attributes: The assessment revealed that the marketplace does not provide consistent access to reliable data for sustainable product attributes. Often the product performance data comes directly from the vendor and it is difficult for buyers to verify the data supplied by the vendors is 100 percent accurate. In addition, respondents found it hard to flag which products are sustainable within their E-Procurement Systems (e.g., BearBuy, AggieBuy, Gateway).

The team recommended creating more accuracy in benchmarking and increasing vendor transparency by implementing a verification process to increase the accuracy of vendor input data. They also recommended educating and engaging with the vendor community to improve data accuracy, which could include training from the Berkely Lab. Figure 2 illustrates the relative impact, and cost or effort of these recommendations.

Figure 2: Relative Impact and Cost or Effort of Recommendations



Source: Berkeley Lab

Based on various assumptions and models described in Appendix A, the team estimated that the UC system could save $660,000 (in 2020 USD) each year for a 5percent increase in the share of energy efficient products purchased in a given year. This translates to GHG savings of 4,200 $MTCO_2e$. These savings estimates are for the 10 educational campuses in the UC system. The hospitals in the UC system were not considered in this analysis. For savings at a single campus, divide the total savings by 10. Table 7 presents the specific measures recommended by the team, the assumed increase in energy-efficient product procurement, and the estimated savings the measure would deliver.

Table 7: Estimated Costs and Carbon Savings for UC System

Measure Overview	Assumptions	GHG savings ($MTCO_2e$)	Cost Savings ($)	Implementation Costs ($)
Product Data: Implement verification process to increase the accuracy of vendor input	Increases the percentage of EE products out of total energy consuming products purchased each year by	4,200	660,000	96.000

Measure Overview	Assumptions	GHG savings ($MTCO_2e$)	Cost Savings ($)	Implementation Costs ($)
	5percent increase at all 10 campuses			
"Spotlight" Procurement Champions: Developing case studies about procurement champions	10percent at 10 Campuses	8,400	1,320,000	96,000
Internal Engagement: Webinars, educational content about campus procurement tools	20percent increase at 3 campuses	5,040	792,000	12,000
Vendor Engagement: Engaging with vendors to improve product data attribute reporting accuracy	5percent increase at all 10 campuses	4,200	660,000	20,000
Policy Consultation: Provide edits to Sustainable Procurement Policy documents for the UC system	5percent increase at all 10 campuses	4,200	660,000	1,400
Total		26,040	4,092,000	225,400

Source: Berkeley Lab

DER Consulting Practices: California Community College System

Based on various assumptions and models described in Appendix A, the team estimated that the CCC system could save $640,000 (in 2020 USD) each year for a 5percent increase in the share of energy-efficient products purchased in a given year. This translates to GHG savings of 4,140 $MTCO_2e$. These savings estimates are for all the 116 campuses in the CCC system. For savings at a single campus, divide the total savings by 116. Table 8 presents estimated savings and implementation costs associated with specific recommendations for the CCC system provided through the DER Consulting Practice PI.

Table 8: Estimated Costs and Carbon Savings for CCC System

Technical Assistance	Assumptions	GHG savings ($MTCO_2e$)	Cost Savings ($)	Implementation Costs ($)
Sustainable Procurement Policy Webinars	Increases the percentage of EE products out of total energy consuming products purchased each year by 10percent at 10 campuses	714	110,345	3,000
Policy Consultation: Provide edits to Sustainable Procurement Policy documents for Santa Rosa Junior College (SRJC)	25percent increase at 1 campus	178	27,586	100
Policy Consultation: Provide edits to Sustainable Procurement Policy documents for CCC Foundation	10percent increase at all 116 campuses	8,280	1,280,000	12,000
Procurement Tool: Guidance on	25percent increase at 1 campus	178	27,586	100

Technical Assistance	Assumptions	GHG savings ($MTCO_2e$)	Cost Savings ($)	Implementation Costs ($)
improving the ERP system for SRJC				
Total		9,351	1,445,517	15,200

Source: Berkeley Lab

DER Products for Local Governments

Institutional buyers face numerous challenges when acquiring DER products, including complex approval structures, first-cost barriers, and lack of easy access to product information or DERs equipment specifications. This hampers an institution's ability to make well-informed, timely, and cost-savvy purchases. Table 9 presents the barriers to DER product procurement developed from the Buyer Survey and working with channel partners.

Table 9: Barriers to DER Product Procurement

Institutional Barrier	Misaligned Rule, Role or Tool?
Lack of DER product marketplace	Tool
Lack of alignment between purchasing decision makers and facilities/energy managers	Role
Priority on lowest first cost rather than lowest lifetime cost, or emission reduction potential	Rule
Lack of available product information via technology solution	Rule
Lack of clean energy product technical specification (best in class language)	Tool
Lack of staff resources (time, expertise))	Rule

Source: Energy Solutions

To address these barriers, the team designed the DER Products PI to introduce pilot institutions to the tools and practices that yield the full benefits of sustainable products.

DER Products PI: City of San Luis Obispo

The project team, led by Energy Solutions, partnered with the City of San Luis Obispo to help improve IT product sustainability. The team analyzed purchase quantities, cost, dates, the types of IT purchases, and Title 20[15] compliance rates to understand how the city could find higher efficiency products at a lower cost. To effectively analyze Title 20 compliance, the team analyzed the model numbers from products for which the city purchased more than 10 units. The team compiled tips to leverage the best energy and cost savings opportunities. They recommended the city undertake the following steps:

- Require all vendors to verify their products are compliant with Title 20 and certified by the Modernized Appliance Efficiency Database System (MAEDbS).[16] This ensures products meet the minimum efficiency requirements set by the Energy Commission.
- Ensure products are certified by the Electronic Product Environmental Assessment Tool (EPEAT)[17]. To evaluate multiple products with EPEAT certification, the city could use the Empower Procurement Ecomedes tool[18] that contains shortcuts to the product page on the EPEAT website. This will help the city understand how the EPEAT certifications differ and prioritize the criteria that matters most, including energy conservation.
- Prioritize purchasing products certified by ENERGY STAR.[19]
- Evaluate the annual energy consumption of products using the Empower Procurement Ecomedes tool or the MAEDbS. Additionally, the city should request more details on the computer's power draw and sleep mode from sales representatives.
- Purchase laptops, which use significantly less electricity than a desktop computer.
- Ensure that power management software is installed on all computers and that the sleep settings are operating correctly.

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[15] California's Appliance Efficiency Regulations (Title 20) set minimum efficiency standards for energy and water consuming products. Computers and monitors are among the Title 20-regulated product categories and were therefore analyzed in this assessment.

[16] MAEDbS is a program of the California Energy Commission.

[17] EPEAT, developed with an EPA grant, is owned and managed by the Global Electronics Council (GEC)EXITEXIT EPA WEBSITE. GEC maintains EPEAT's website, product registry and calculators that document the cost savings and environmental impact reductions resulting from purchasing EPEAT-registered products. EPEAT-registered products must meet environmental performance criteria that address: materials selection, supply chain GHG emissions reduction, design for circularity and product longevity, energy conservation, end-of-life management and corporate performance.

[18] Ecomedes, Inc. collaborated with ProspectSV to create a tool acessible from Empower Procurement website.

[19] ENERGY STAR, a program run by the U.S. Environmental Protection Agency and U.S. Department of Energy, promotes energy efficiency by providing information on the energy consumption of products and devices using standardized methods.

- Purchase computers with solid-state drives instead of rotating hard drives for storage.
- Purchase products that are appropriate for the use-case.

The team also recommended cost negotiation strategies to the city, including requesting more information from sales representatives on the following aspects to seek additional cost information during each transaction:

- Volume order discounts and/or discounts for future orders
- Other discounts available now or in the future
- After sale service and support contracts
- Warranties
- Insurance
- Software licenses

Competitor comparison pricing

Potential Savings

Using the methods outlined in Appendix D, the team estimated potential energy, cost, and GHG emission savings by requiring energy-consuming office equipment to meet ENERGY STAR specifications for the city and then for all cities and counties in California (Table 10.)

Table 10: DER Product PI Cost Savings and GHG Reductions

Metric	San Luis Obispo*	Statewide
Annual energy savings (KWh)	2,930.56	103,998,222
Annual energy cost savings ($)	583	18,605,282
GHG emission reductions ($MTCO_2e$)	0.545	I19,344

* San Luis Obispo’s annual energy cost savings and emissions reductions are lower than average because they are already purchasing ENERGY STAR compliant products for certain office equipment. Source: Energy Solutions

Lessons Learned

The Empower Procurement team encountered several challenges relating to the outreach model and local government market sector:

- Timing and Bandwidth of Local Government Sector. The Product PI deployment fell in 2020 when local governments were responding to both COVID-19 and California wildfire emergencies. This challenged outreach and scheduling for the project team and made it difficult for government staff to prioritize the Empower Procurement project. Piloting this effort in another year would have been preferable, but the team was constrained by the project timeline.
- One on One Engagement Model. A key feature of the PI outreach model was its individual assessments and ability to tailor recommendations to each enrollee. This was

an attractive recruitment point for local governments; however, the cost and emissions savings didn’t justify the time investment.

- Cooperative Purchasing. Through additional market research conducted after the Buyer and Seller Surveys and during PI pilots, the team learned that many if not most local governments already employ cooperative purchasing agreements. These agreements provide them with competitive pricing and procurement solutions. This restricted the scope of Empower Procurement recommendations and limited potential impacts.

Given the results of the pilot, which contributed only marginally to the project goals, and the widespread use of cooperative purchasing agreements, the team decided to change its focus. While the team briefly considered an initiative focused on cooperative purchasing agreements, they found this to be a market fragmented by region and sector. Instead, ProspectSV refocused the program to explore the uptake of DER products and services via E-Procurement Systems, which could have a far more significant impact on local governments and other public sectors.

DER Services for Local Government

Increasing the uptake of DER technologies requires a similar uptake in trained, qualified DER installers and maintenance service professionals. Service providers can help reduce carbon impact using low-carbon and environmentally conscious materials and goods. This PI was designed to help local governments assess their processes for finding qualified DER service professionals, connect them with resources and technology solutions, and streamline their RFP and contractor selection pipelines. Table 11 presents institutional barriers developed from the Buyer Survey and working with channel partners.

Table 11: Barriers to DER Services Procurement

Institutional Barrier	Misaligned Rule, Role, or Tool?
Lack of DER product marketplace	Tool
Lack of alignment between purchasing decision makers and facilities/energy managers	Role
Priority on lowest first cost rather than lowest lifetime cost, or emission reduction potential	Rule
Lack of vetted service providers via technology solution	Tool
Lack of staff resources (time, expertise))	Rule

Source: Energy Solutions

DER Services: The City of Cupertino

The project team, led by Energy Solutions, partnered with the City of Cupertino, which requested technical assistance in benchmarking and planning the retrofit of municipal buildings. After a series of interviews with city staff involved in DERs procurement, the team identified three barriers to sustainable procurement:

1. Each department procured its own products and services leading to differences in procurement practices.
2. New service vendors found the city's insurance requirements challenging to meet.

Maintenance prioritized replacements based on the life of a product rather than energy use or GHG emissions.

To address the first barrier, the project team recommended the city standardize and align procurement across departments either through a dedicated procurement officer who ensures cross-departmental coordination, or a decentralized but collaborative committee with each department represented. In either case, the city should develop clear procurement benchmarks, a set of best practices, adequate training, and contract standardization. (The Empower Procurement Knowledge Technology Transfer team developed several workshops and webinars that addressed these issues.)

To address the second barrier, the team recommended the city bolster the vendor pool and increase more service provider options by offering educational resources to new vendors about the insurance requirements, and by reducing the complexity in the insurance requirements.

To address the third barrier, the team recommended the city undertake an energy audit of all municipal buildings and prioritize retrofits that offered the most energy cost and GHG emissions savings. They analyzed the funding, staffing, and insurance needed to retrofit the city's four largest and highest energy-consuming municipal buildings. They also worked with an Energy Services Company (ESCO) to analyze potential energy cost savings and GHG emission reductions.

Potential Savings

From the city's results the team extrapolated results for 486 cities in California, estimating facility utility bills savings from working with an ESCO to improve the energy efficiency of municipal buildings. Table 12 shows the costs savings and emission reductions for the City of Cupertino and for cities across California. (Appendix E provides the methods for these estimates.)

Table 12: DER Services PI Cost Savings and GHG Emission Reductions

Metric	City of Cupertino	Statewide
Annual energy cost savings ($)	245,376	97,650,844
GHG emission reductions ($MTCO_2e$)	6.0[a]	119,344

Metric	City of Cupertino	Statewide
Cost to implement ($)	7000	3,402,000

[a]Cupertino's emissions reductions are relatively small because the city sources 100 percent of its electricity from carbon-free sources and most of the emissions reductions statewide come from electricity.

Source: Energy Solutions

Lessons Learned

In piloting the DER Services PI, the team encountered the same challenges as with the DER Products PI. They determined that while connecting local governments with qualified service suppliers was useful, focusing the team's efforts on the more complex issue of building decarbonization could yield far greater energy cost savings and carbon reductions. Further, the team partners had deep expertise in electrifying buildings.

E-Procurement Systems

Work on the Institutional PIs revealed a significant opportunity to increase the deployment of DER solutions in higher-education institutions and local governments. Program participants consistently identified the limitations of E-Procurement Systems as a barrier to achieving sustainable procurement goals. E-procurement Systems support requisitioning, ordering, and purchasing goods and services online. In fact, in large organizations, E-Procurement Systems drive what gets bought. ProspectSV and Berkeley Lab team determined there wasn't sufficient knowledge yet to develop a PI and quantitatively assess the impact of E-Procurement Systems on energy costs and GHG emissions. Instead, they focused on identifying the institutional barriers program participants experience when using E-Procurement Systems and potential interventions.

Table 13 summarizes barriers to sustainable procurement experienced by participants using E-Procurement Systems.

Table 13: Barriers Presented by E-Procurement Systems

Institutional Barrier	Misaligned Rule, Role or Tool?
Institutions are unaware of the capabilities of E-Procurement Systems to support sustainable purchasing goals	Role
E-Procurement Systems lack the ability to identify sustainable products	Tool
E-Procurement Systems lack the ability to verify sustainable products	Tool

Institutional Barrier	Misaligned Rule, Role or Tool?
E-Procurement Systems lack the ability to report on sustainable products	Tool
Difficult to receive or verify environmental product certifications from suppliers/manufacturers	Role
Lack of industry standards for ecolabels[20] and green product certifications	Rule

Source: Berkeley Lab

The research further revealed the need to establish better standards to enable identifying, verifying, and reporting sustainable products in organizations' E-Procurement Systems. To address this need, the Berkely Lab team assembled a Working Group of key stakeholders across different industries to discuss challenges and determine best practices. The team recruited potential Working Group participants among buyers (public/private sector organizations), vendors (e.g., Staples and Amazon), E-Procurement system providers (e.g., Oracle, Workday, PlanetBids), third-party certifiers (e.g, ENERGY STAR, EPEAT), manufacturers (e.g., Honeywell, Dupont), standards organizations (e.g., UNSPSC, NAICS, GS1), industry organizations (Responsible Purchasing Network, SPLC), and subject matter experts. (Appendix F lists the Working Group participants.)

Hosted and led by ProspectSV and Berkeley Lab team, the Working Group set out to identify:

- The main challenges institutions face when using E-Procurement Systems to support sustainable procurement.
- The functionality and capabilities of E-Procurement Systems that support sustainable purchasing.
- The actions vendors and manufacturers can take to provide improved product labeling.
- The next steps for establishing product labeling standards across the industry.

Over several months, the Working Group held eight meetings in which invited vendors, system providers, data aggregators, and other expert stakeholders presented the latest technologies and developments in their industries and addressed questions from the group.

From these meetings and interactions with program participants through webinars and other knowledge transfer activities, the Working Group learned what institutional users want E-Procurement Systems to do: E-Procurement Systems allow the successful acquisition and reporting of sustainable products by default.

[20] An ecolabel identifies products or services proven to be environmentally preferable within a specific category.

A central finding of the Working Group is the need for key stakeholders to communicate with one another to clearly define and state their needs. Appendix F summarizes key learnings from the Working Group on what one type of stakeholder needs from another stakeholder and the specific requests that need to be made to satisfy that need.

Lessons Learned

The project team summarized key lessons learned through the Working Group and engagement with program participants:

- Sustainability requirements aren't universally known, applied, or reported.
- Complexity persists even as systems improve.
- Buyers and vendors don't need to quote policy; they need simple ways to follow it.
- Policymakers need curated data just as much as Buyers do so they can understand the impact of rules on market competition and availability and to identify opportunities to improve category rules.
- Product data should be digital and cultivated at the SKU/UPC level to be actionable.
- Buying best means integrating a multiplicity of sustainability and related, evolving, mission-critical product attributes, including SBA, Health, Made in the USA, etc.
- Institutions need trusted, nimble systems that simplify and automate these processes as much as possible.

Functional Procurement Initiatives

Electric Vehicle Fleets for Schools

Fleet owners and managers are incentivized to acquire EV options, yet they are often ill-equipped to navigate the complex process it requires. Led by ZNE Alliance, this PI offered resources and strategies for fleet owners to accelerate their program and assist buying activity. This PI aimed to:

- Reveal institutional barriers in adopting EV fleet and EV charging infrastructure and related procurement processes.
- Provide school districts with technical, financial, and planning assistance to support transition to an electric fleet.
- Assess electrification readiness and electrification opportunities.

Table 14 presents barriers to procuring EVs developed from the Buyer Survey and working with channel partners.

Table 14: Barriers for Schools to Procure EV-Fleets

Institutional Barrier	Misaligned Rule, Role or Tool?
No enabling policies that support EV adoption	Rule
Risk-averse cultures make it difficult to partner with innovative organizations and technologies	Role
Procurement function understaffed and uneducated in EV and EV charging infrastructure technologies, benefits, etc.	Role
Metrics emphasizing purchase price vs. total cost of ownership, minimizing or miscalculating environmental impact issues	Tool
Uneven performance of suppliers leads to a lack of confidence in electrification solutions	Tool
Lack of information on the operational requirements and characteristics of EVs, e.g., real-world range, maintenance needs and costs, battery degradation, charging infrastructure and related electrical requirements, etc.	Tool
Limited support from relevant stakeholders (governing board, executives, customers, labor, etc.)	Role

Source: ZNE Alliance

EV Fleets for Schools: Bakersfield City School District

With approximately 30,782 students, Bakersfield City School District (BCSD) is the largest K-8 school district in California. Approximately 90 percent of students are listed as Socioeconomically Disadvantaged. The district requested information, resources, and targeted guidance in planning a transition to electric school buses.

BCSD operates a fleet of 140 school buses that drove more than 1.4 million miles annually prior to the COVID school closures (March 2020). Buses typically run for 25 to 30 years; the district retires and replaces them as grants and budget surpluses allow. Historically it replaces aging vehicles with diesel buses at a rate of 10 vehicles per year.

The project team developed a replacement schedule, enabling the complete transition to battery electric buses (BEBs), beginning with procuring 8 BEBs in 2023, and 11 BEBs per year through 2035.

A comprehensive TCO assessment requires charging infrastructure capital costs, including EV charging hardware procurement and installation, and related electrical upgrades.

Unfortunately, this information is not available in advance of a fully developed fleet procurement plan, in-depth site assessment, utility infrastructure cost negotiation, and the results of an installation bidding process. Costs can vary significantly depending on the scale of the overall fleet electrification, the required speed of charging, the timing of transformer and service upgrades, and the impact of on-site analysis on construction requirements.

To support these cost analyses, the project team recommended that BCSD consult with PG&E, manufacturers of BEBs and charging infrastructure, and providers of Smart Charging Management systems[21] and Mobility as a Service[22] to gain a better understanding of the range of infrastructure costs based on different procurement scenarios, and, finally, issue an RFP to gain firm cost estimates.

The team also recommended the BCSD undertake the goals and objectives presented in Table 15 to realize the transition to a fully electric fleet and the projected savings of $20 million by 2035.

Table 15: Goals and Objectives Recommended to BCSD

Goals	Objectives
Rapidly electrify the district school bus fleet to reduce carbon emissions and unlock cost savings	Purchase and operate first cohort of 8 BEBs by 2023 Electrify 100percent of the school bus fleet by 2035. In coordination with PG&E and the BEB supplier, design and install sufficient electrical and bi-directional charging infrastructure to support the fleet. Implement a managed charging software platform to reduce capital and operating requirements for fleet charging.

[21] Smart charging management systems monitor and optimize EV charging operations, tracking charging activities and managing the network's power consumption.

[22] A Mobility-as-a-Service provider can bundle financing for the vehicle, electrical capacity upgrades, and charging equipment. Some firms will include electricity payments and maintenance costs in a long-term financing package.

Maximize external funding for EV fleet and clean energy programs	In partnership with BEB suppliers and fleet electrification solution providers, apply for competitive grants with a goal of winning at least $10 million in new grant funding for fleet electrification between 2021 and 2025.[23] Enroll in LCFS[24] programs directly or utilize a reliable third-party LCFS administrator such as E-mission Control.
Implement bi-directional Vehicle-to-Grid (V2G) charging infrastructure and access V2G revenue when buses are not in use	To gain access to valuable grid services revenues (which can lower electric charging costs by 40percent or more), utilize the bi-directional charging capabilities built into most BEBs in combination with bi-directional EV chargers (with a goal of participating in a V2G fleet aggregation program by 2025)

Source: ZNE Alliance

The team further recommended the district undertake these key activities:

2023

- Adopt formal capital budget and replacement schedule to facilitate electrification or engage with a Mobility as a Service provider via RFP.
- Identify electric charging and infrastructure requirements in concert with Smart Charging analysis.
- Identify preferred BEBs for procurement.
- Capture incentives and prepare to procure first cohort of BEBs.

2024

- Train drivers and facilities team on EV and charging infrastructure operation.
- Operate first BEBs and monitor performance.
- Continue to procure EV buses according to the recommended replacement schedule.

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[23] Funding will likely be available from federal programs (DOE/DOT), and state sources including PG&E, local Air Quality Management Districts, the CARB HVIP program (for vehicles), and the California Energy Commission (for charging infrastructure).

[24] LCFS (Low Carbon Fuel Standard) is a CARB regulation designed to decrease the carbon intensity of California's transportation fuel pool and increase the range of low-carbon and renewable alternatives.

- Implement smart charging management strategies.
- Integrate with V2G and Demand Response Programs to unlock additional revenues or cost savings.

Potential Savings

Based on assumptions and models presented in Appendix G, the team estimated vehicle related costs, including capital and operating costs, maintenance, and electric fueling. Table 16 compares the procurement and operations costs of diesel versus electric buses and projects reductions in GHG emissions.

Table 16: Comparison of Vehicle Procurement Costs and Savings

Vehicle	Procurement and Operating Costs Over 15 Years	Projected Cost Savings	Projected GHG Reductions* (MTCO2e)
Diesel bus (replacing 10 buses/year)	$52,091,197		
Electric bus (per replacement schedule)	$31,926,911	$20,164,285	26,601

*Assuming 100 percent carbon-free energy; Source: ZNE Alliance

EV Fleets for Schools: Twin Rivers Unified School District

Twin Rivers Unified School District (TRUSD) leads the largest BEB deployment in California to date. As of January 2021, TRUSD owned 130 buses, of which 35 were BEBs, 33 were compressed natural gas (CNG) buses, and the rest were diesel buses. Approximately 90 buses operate daily. TRUSD expected to add 15 or more BEBs by late 2021. TRUSD runs its diesel buses entirely on renewable diesel fuel and will soon transition its CNG buses to full renewal natural gas. In addition, by the end of 2021, TRUSD expected to have over 60 EV charging stations ports deployed from four different vendors.

TRUSD's school bus fleet included a significant number of older high-emission vehicles. Of its 130 buses, 32 fossil-fueled models were built in 2000 or earlier. An additional 55 are at least 10 years old. Nearly half of the district's non-bus "white fleet," 23 of 54, are at least a decade old. The district recognized the critical need to update all these vehicles to improve student safety, increase reliability of the fleets, and reduce toxic air emissions across the disadvantaged communities it serves.

The project team identified the district's top concerns regarding electrification:

- up-front vehicle capital cost
- charging infrastructure capital cost
- overall sufficient funding for fleet operations and capital needs (with or without electrification)

- overall complexity of electrification

The team found the district needed the following information and resources to strengthen the electrification effort:

- funding for infrastructure and vehicles, and the predictability of funding over time
- state and local mandates
- greater leadership support
- affordable technical assistance
- staff education and training
- more inclusive and flexible financing

The district also requested specific technical assistance, including,

- information on BEB procurement, infrastructure requirements, and selection
- TCO analysis, fleet replacement schedules, and financial options
- charging and energy management options and strategies
- strategies for integrating EV charging with onsite solar energy storage, facility loads
- overall EV-fleet transition planning

Potential Savings

Based on assumptions presented in Appendix G, the team estimated the impact of a complete full-fleet transition to 130 BEBs, at the current replacement rate, as shown in Table 17.

Table 17: Cost Savings and GHG Reductions for TRUSD's Full-Fleet Electrification

Metric	Projected Annual Savings
Fuel savings ($)	989,716
Maintenance savings ($)	206,700
GHG reduction (MTCO_2e) with 100percent renewable energy	119,344

Source: ZNE Alliance

Statewide Savings

Based on assumptions presented in Appendix G, the project team projected that if 80percent of school districts adopted the measures recommended in the two pilots for this PI, approximately 420,000 MTCO_2e could be mitigated and approximately $81,890,878 in total savings could accrue to districts, as summarized in Table 18.

Table 18: Impact of Statewide School Bus Electrification

Metric	80percent of School Buses
Total annual savings ($)	81,890,878
Annual GHG reduction ($MTCO_2e$)	420,000

Source: ZNE Alliance

Lessons Learned

To amplify these results, ProspectSV and ZNE Alliance developed Technical Assistance (TA) Work Packages for EV-Fleets to offer to other school districts. These packages provided examples of what the team could offer a client through the TA work. After consulting with a school district on its specific needs, they modified the work package into a detailed proposal, then confirmed with the client to finalize the Scope of Work. The school districts supported by this targeted TA include:

- Morgan Hill Unified School District
- Cabrillo Unified School District
- Mountain View Whisman School District
- Mt. San Antonio College
- Contra Costa Community College District
- San Mateo County Community College District

EV-Fleets for Local Governments

The project team also explored opportunities for cost savings and GHG reductions by addressing procurement barriers to electrifying local government fleets. They supplemented the Empower Procurement Buyer and Seller surveys with in-depth interviews of staff of several diverse cities, reflecting the spectrum of size and expertise. For example, they selected two cities that are relatively advanced in fleet electrification: San Jose, representing large, sophisticated cities, and Santa Clara, representing medium-sized and well-resourced cities. They also interviewed two localities that had just begun transitioning to EV fleets: Monterey County, representing smaller counties, and Petaula, representing smaller cities.

As with school districts, fleet owners and managers in local governments are incentivized to acquire EV options but often are ill-equipped due to staff resourcing, lack of information, and other barriers. Table 19 presents barriers to procurement for cities and counties.

Table 19: Barriers for Local Government to Procure EV-Fleets

Institutional Barrier	Misaligned Rule, Role or Tool?
No enabling policies that support EV adoption	Rule

Decentralized purchasing authority	Role
Procurement function understaffed and uneducated in EV and EV charging infrastructure technologies, benefits, reliability, availability of grants and incentives, etc.	Role
Metrics emphasizing purchase price vs. TCO, minimizing or miscalculating environmental impact issues	Tool
Lack information on purchasing collaboratives, flexible financing	Tool
Lack expertise with EV-fleet software, replacement scheduling, operations, online EV-fleet calculations, etc.	Tool
Limited support from relevant stakeholders (governing board, executives, customers, labor, etc.)	Role

Source: ZNE Alliance

Based on the Technical Assistance provided to schools as a result of the PI for EV-Fleets for schools, the team focused the work on developing solutions to the barriers that could be provided to multiple cities and counties as targeted Technical Assistance. Table 20 connects specific barriers with these Technical Assistance solutions:

Table 20: Addressing Barriers with Technical Assistance

Key Barrier	Technical Assistance
Overall complexity of E-fleet transition	Create a templated, comprehensive, and customizable E-Fleet Transition Plan for early stages of electrification to find the most cost-efficient approach to providing a "head start" to electrification. Customized and targeted planning support for organizations at a later stage of electrification to provide assistance in more technical domains, such as smart charge management, VGI and V2G, and specialized finance.
Capital cost of charging infrastructure	Access to site assessment strategies and resources that enable planning and

Key Barrier	Technical Assistance
	deployment of cost-efficient infrastructure upgrades for short and long term needs. Effective outreach and engagement with utility staff to negotiate timely and reasonable service upgrade costs. Deploy smart charging management analytics to ensure fleets "right size" charging infrastructure and management strategies based on a full analysis of routing, schedules, range requirements, and vehicle demand.
Access to funding and financing information	Current and comprehensive information on grants and incentives can be provided in the initial E-Fleet Transition Plan and through a comprehensive online resource. Information on innovative financing approaches to enable rapid and predictable fleet electrification. RFP templates to identify the most efficient providers of innovative & long-term finance for turnkey fleet electrification.
Stronger EV fleet goals	Process tools and assistance to ensure key managers and staff align on specific and robust goals for fleet electrification and rigorous policies and procedures to ensure goal achievement. Policy frameworks and templates to help align climate/sustainability goals and fleet policies.

Source: ZNE Alliance

The team provided EV-Fleet Technical Assistance to several cities and counties, including:

- City of Fremont
- City of La Mesa
- City of Sonoma
- City of Watsonville
- City of Richmond
- Contra Costa County
- Santa Cruz County

Building Decarbonization for Local Governments

Building electrification is a significant source of potential GHG emission reductions in California. To meet its environmental goals, California must replace gas-burning equipment as quickly as possible. Although local governments operate only a small fraction of their cities' buildings, they can help lead this market shift by setting an example. Many of the challenges they face are not technical but matters of procurement process and organization, such as getting approvals for less familiar technology and using TCO to weigh purchase options. In addition, the Empower Procurement Buyer Survey estimated that construction is the highest spending category for these institutions, followed by operations and maintenance. Table 21 presents procurement barriers to decarbonizing buildings developed from the Buyer Survey and work with channel partners.

Table 21: Procurement Barriers to Building Decarbonization

Institutional Barrier	Misaligned Rule, Role or Tool?
Lack of alignment between purchasing decision makers and facilities/energy managers	Role
Lack of specifications for all-electric building technologies	Tool
Risk averse cultures make it difficult to partner with innovative organizations and technologies or design approaches.	Role
Metrics emphasizing purchase price vs. TCO, minimizing or miscalculating environmental impact issues	Tool
Competing procurement objectives/priorities	Rule
Uneven performance of suppliers can lead to a lack of confidence in electrification solutions	Tool

Limited support from relevant stakeholders (governing board, executives, customers, labor, etc.)	Role

Source: Energy Solutions

Building Decarbonization: The City of Burlingame

The project team, led by Energy Solutions, partnered with the City of Burlingame. Under its updated 2030 Climate Action Plan (City of Burlingame 2019), by 2021 all Burlingame residents received power from Peninsula Clean Energy, which procures power through solar, wind, hydroelectric, and geothermal sources. A new rule enacted in 2020 requires residential and many commercial buildings to rely primarily on electricity (C. Browning 2022). This reflects the Plan's finding that in 2015, energy use in buildings (primarily from heating and cooling) contributed 44 percent of the city's GHG emissions, second only to transportation.

Burlingame operates 17 buildings with natural gas hot water heaters, furnaces, and boilers. Electrifying large equipment, such as furnaces, rooftop units, and boilers typically requires custom engineering to size the equipment and obtain utility incentives and can also require expanding the building's electrical system. With two water heaters in the Corporate Yard due for replacement, and incentives for replacing them relatively easy to obtain, the project team recommended the city focus on this opportunity first.

The Burlingame's facility management's major concern was centered on costs and allocating sufficient administrative time needed to plan, procure, and implement the installations. To address these concerns, the project team recommended the city replace the water heaters with heat pump water heaters, which are two to three times more efficient than conventional electric resistance water heaters (U.S. DOE n.d.). They further advised the city to enroll in the Government K-12 (GK12) Energy Efficiency Program, administered by PG&E[25]. The GK12 program makes procurement relatively easy with large subsidies, high-quality products,[26] turnkey installation, and a single package of documents. The city chose the program's turnkey option, with a single source for installation and equipment, program-qualified contactors, and a 1-year warranty on workmanship. The GK12 incentives covered 66 percent of the total cost of replacing the two water heaters.

Building Decarbonization: The City of Piedmont

The City of Piedmont, led by its Climate Action Task Force, began sourcing 100 percent clean electricity for its 14 municipal buildings in 2018. Between 2018 and 2020, it replaced three gas water heaters with heat pump water heaters using city funds. In May 2022, it replaced the

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[25] Funded by the California ratepayer and administered by PG&E under the auspices of the CPUC, GK12 supports and incentivizes local government, educational, and federal agency efforts to improve their buildings' energy efficiency while reducing ongoing operational and maintenance costs.

[26] All heat pump units provided by the GK12 Program meet [CA Title 24, Joint Appendix 13] requirements.

remaining six at no cost thanks to combined funding from PG&E's GK12 Program and East Bay Community Energy's (EBCE's) Municipal Electrification Assistance grant.

The project team, led by Energy Solutions, analyzed the procurement process and the calculated the avoided emissions. Since the city is relatively small, with a population of about 11,000, the procurement process is straightforward. Its limited staff includes a Sustainability Program Manager with a remit to research incentive and grant programs and inform the City Council of opportunities that help the city meet its climate goals.

Estimated Savings

Table 22 shows the estimates of GHG reductions for replacing the gas waters heaters with electric heat pumps in the Corporate Yard and in the five additional buildings the City of Burlingame targeted. The data does not take into consideration that the city uses 100 percent renewable energy.

Table 22: Estimates of GHG Reductions for the City of Burlingame

Facility	GHG Reduction* ($MTCO_2e$)
Corporate Yard	31.6
Public Works	25
Firehouse 34	25
Library	46.3
Police Station	25.1
Parks Yard	34.4
Total	187.4

*Totals are for 10-year lifetime; total annual savings are 18.7 $MTCO_2e$

Source: Energy Solutions

Table 23 estimates the GHG reductions for replacing gas waters heaters with electric heat pumps in five buildings the City of Piedmont has targeted.

Table 23: Estimates of GHG Reductions for the City of Piedmont

Facility	GHG Reduction* ($MTCO_2e$)
Police	32.4

Facility	GHG Reduction* ($MTCO_2e$)
Veterans Hall	47.8
Firehouse Rooftop	51.10
Community Hall	47.3
Recreation Center	47.8
Total	226.5

*Totals are for 10-year lifetime; total annual savings are 22.65 $MTCO_2e$

Source: Energy Solutions

Methods for calculating GHG emissions savings, approved by the CPUC (CPUC 2022) consider the efficiency of the existing gas water heater, the efficiency of the replacement unit, and typical hot water usage based on building type. The GHG savings calculations assume the typical energy mix determined by the CPUC. Since both cities use 100 percent renewable energy the actual savings would be greater.

The project team also estimated savings of switching to electric space and water heating for California city, county, special district, and superior court buildings. The team limited the scope to relatively smaller and simple systems estimating savings of 25 percent of space heating systems and 50 percent of water heating systems. Nonetheless, this limited scope demonstrates the savings potential as shown in Table 24. Appendix I outlines the methods used to calculate these savings.

Table 24: Statewide Savings for Local Government Buildings

Local Government	Annual GHG Reduction ($MTCO_2e$)	Annual Utility Bill Savings ($)
Cities	11,808	818,447
Counties	10,676	740,001
Special Districts	5,336	369,861
Superior Courts	691	47,917
Total	28,511	1,976,226

Source: Energy Solutions

Lessons Learned

Although these pilots focused on small projects, they provide experience and confidence to build on as these cities electrify more of their building systems. To expand on the lessons learned from the Burlingame and Piedmont case studies, the project team interviewed staff from other cities to gather additional details of procurement barriers. In some cases, the barriers could be addressed through educating staff, training implementers, and providing case studies and peer-to peer learning opportunities. Others might be addressed by the incentive and grant agencies considering how to adapt their funding opportunities. These specific barriers include the following:

- Legal staff are often hesitant to apply procurement policies, such as GC 4217,[27] that contradict aspects of standard policy resulting in significant delays in approvals.
- Local governments new to building electrification have complex and time-consuming permitting procedures.
- Administrators often believe the cost of building electrification is prohibitive, they are unaware of incentives and don't have available staff to research opportunities.
- Rural communities fear losing the dependability of gas during increasingly frequent power outages and share the concern of other communities that electricity is more expensive than gas raising utility bills.
- Some facility managers are concerned that electric equipment won't perform as well as gas-fired equipment.

Technical Assistance

Based on the lessons learned from the Building Decarbonization PI and the additional interviews, ProspectSV and Energy Solutions created a Technical Assistance Work Package for Building Decarbonization for local governments. Several cities and counties are participating in this ongoing program, including the City of Goleta and the County of Alameda.

[27] California Government Code GC 4217 provides flexiblity to local governments and public agencies entering into agreements for energy conservation and cogeneration projects and alternative energy supply sources. As a result, agencies may award contracts based on the contractor's experience and technology employed, the cost to the local agency, and any other relevant considerations rather than to the lowest bid, which may otherwise be standard policy.

CHAPTER 4: Conclusion

The procurement barriers found in the public sector appear consistent across organizations of similar types. This work implies that the barriers characterized and addressed in the limited scope of PI activities, if addressed sector-wide, would contribute significantly to the potential outlined here, unlocking millions of MTCO2e reductions and millions of dollars of cost savings.

Emerging Business Opportunities

The Empower Procurement Business Plan Memorandum identified several emerging business opportunities arising from the Empower Procurement project. These include:

- **Sustainable Acquisition Consulting**: Institutions with organized sustainability programs would benefit from consulting on sustainable acquisition practices and process, helping them overcome barriers in purchasing systems, policies, and other misalignments with sustainability goals.
- **DER Research**: Buyers lack reference research and updates on available options to meet DER purchasing requirements not automatically delivered through a purchasing platform. In addition, existing specifications are often inadequate for effective purchasing of new products and systems. A buyer support model offering such resources would be sustainable on a fee basis.
- **Financing Resources:** Many buyers are not aware of the financing options available to them for large-scale purchases such as with fleets or building decarbonization projects. Providing financial training and alternative financing options could be provided to buyers under a consulting agreement, or under outside funding.
- **E- Procurement Systems -** Local governments and schools face significant challenges in providing the appropriate technical, financial, logistical and human resources to initiate and cultivate changes to procurement methods. E-Procurement Systems can alleviate many of these challenges and can drive consistent outcomes between otherwise independent procurement organizations. There is a significant opportunity to provide implementation support including underlying sustainable procurement policies and configuration.

Benefits to Rate Payers

The support provided by the Empower Procurement program yields significant benefits to both buyer and seller organizations, and as a result, California ratepayers. Benefits include:

- **Greater preparation:** Institutions seeking to align their procurement programs to meet carbon reduction goals will be prepared to act on those objectives through the work generated by the Empower Procurement Program

Economic benefits: More consistent demand for low-carbon products and DER assets will enable California companies to add jobs and grow.

- **Environmental benefits:** More consistent use of low-carbon products and DER assets can significantly reduce carbon emissions in one of the largest sectors of the California economy.
- **Consumer appeal:** Government and other institutional sectors that use best-in-class DER technologies and products with robust and verifiable savings may highlight their appeal for consumer and commercial sector purchases.
- **Resilience:** Broader use of solar, energy storage, electric vehicle and building systems will enhance energy security for California cities, schools, universities, healthcare institutions, and other critical community-serving organizations.
- **Potentially lower costs:** Empower Procurement clients may reduce acquisition costs through more efficient purchasing process, use of effective specifications, reduced energy and water costs through broader use of more efficient products, and reduced maintenance costs.
- **Stronger alignment with state and local climate action and sustainability objectives:** Empower Procurement programs may help create cohesion between high-level organizational or broader policy goals and the practices of the organization.

Recommendations and Further Research

The flow of funding from California's targeted budget allocations and the Federal Inflation Reduction Act will increase the potential for public institutions to make significant progress in sustainable procurement, building electrification, and transportation decarbonization. However, many organizations still need support to access and leverage funding to its maximum extent.

The Energy Commission can support institutions that lack the funding and expertise to launch comprehensive procurement activity. As noted in the Business Plan Memorandum, these include the following programs:

- DER Procurement Program Assistance provides smaller institutions with a comprehensive review of procurement practices, authorities, and processes to enable institutions to implement changes.
- Bridge Technical Assistance supports small to medium public institutions that lack the personnel and experience to effect large-scale purchasing activity by offering technical assistance and staff augmentation that allows these institutions to bridge the gaps represented by their current operations.

Such funding would help these institutions increase DER technology adoption, leverage procurement data, and focus on continuous improvement.

The Energy Commission has long provided statewide leadership with its investment in innovation research and deployment in pursuit of scalable solutions to California's energy challenges. There are numerous technologies and solutions that remain limited in their ability to deliver value at the scale required of even moderately sized institutional customers.

Continued investment in large-scale applications for fleets and buildings is an important counterpart to the demand that can be created through more effective procurement.

The Energy Commission can also support ongoing research of E-Procurement Systems. The Berkeley Lab intends to continue leading the Working Group establishing best practices and recommending standards for these systems.

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Project Deliverables

The following Project Deliverables, including interim project reports, are available upon request by submitting an email to pubs@energy.ca.gov.

- Cal-Op ACE Buyer Survey: Barriers and Opportunities Memorandum
- Cal-Op ACE Seller Survey, Empower Procurement: Seller Barriers and Opportunities Memorandum
- Final Procurement Initiative Strategy Memorandum
- Final Empower Procurement Business Plan Memorandum
- Annual Reports
- Webinar Reports
- Final Technology/Knowledge Transfer Report
- M&V Final Report
- Final Project Report
- Final Project Fact Sheet

Final Presentation Materials

APPENDIX A: Technical Advisory Committee

Table A.1 lists members of the Technical Advisory Committee

Table A.1: Technical Advisory Committee

Name	Organization	Title
Joe Aamidor	Aamidor Consulting	Smart Building Consultant
Panama Bartholomy	Building Decarbonization Coalition	Founder and Executive Director
Nancy Ander	California Department of General Services	Deputy Director, Office of Sustainability
Eleanor Oliver	California Energy Commission	Energy Deployment & Market Facilitation Office
Brian Meneghan	Carrier Corp.	Account Executive
Stephen L Prince	Centrica Business Solutions	Sr. VP, Distributed Energy and Power NA
Andre Duurvoort	City of Cupertino	Director, Sustainability Division
Joe Fullerton	California Community College Chancelor’s Office Climate Action and Sustainability Committee	San Mateo Community College District, Energy and Sustainability Manager
Rick Bolton	Compass Energy Platform	CEO
Ed Wisniewski	Consortium for Energy Efficiency	Executive Director
Sonika Choudhary	EDF Innovation Lab	Principal Energy Analyst
Mike O’Boyle	Energy Innovation: Policy & Technology LLC	Director of Electricity Policy
John Paul Jewell	ENGIE North America, Inc.	Clean Energy Program Development

Name	Organization	Title
Emily Douglas	ENGIE North America, Inc.	Clean Energy Program Development
Michael Bloom	General Services Administration Office of Federal High-Performance Buildings	High Performance Buildings Program Advisor
Nikhil Achwal	Google LLC	Supply Chain Program Manager
Seth Baruch	Kaiser Permanente	National Director for Energy and Utilities
Grace Peralta	Marin Clean Energy	Residential Programs Manager, MCE
Sam Beeson	Mitsubishi Electric Cooling & Heating	Manager, Strategic Accounts & Utilities
Mary Anderson	Pacific Gas & Electric	Energy Efficiency Codes and Standards
Karen Loida	Pacific Gas & Electric	Account Manager
Andrea Schumer	Pacific Gas & Electric	Senior Energy Efficiency Specialist
Jill Marver	Pacific Gas & Electric	Senior Programs Manager
Alicia Culver	Responsible Purchasing Network	Director
Nigel Daniels	SAIC Motors	Director, Development of Strategic Initiatives
Barry Hooper	San Francisco Dept of the Environment	Green Building Specialist
Jamie Seidel	San Francisco Public Utilities Commission	Manager, Distributed Energy Resources
Rachel Kuykenydal	Sonoma Clean Power	Senior Programs Manager
Sarah O’Brien	Sustainable Purchasing Leadership Council	Director of Programs

Name	Organization	Title
Eric Eberhardt	University of California Office of the President	Director, Energy Services
Ken Alex	University of California, Berkeley	Director, Project Climate, Berkeley Law
Rachael Larson	University of California, Davis	
Dr. Wendell Brase	University of California, Irvine	Associate Chancellor, Office of Sustainability
Jeff Murrell	US Department of Energy	Energy Program Manager, Federal Energy Management Program (FEMP)
Cate Berard	US Department of Energy	Team Lead for Sustainability
Holly Elwood	US Environmental Protection Agency	Senior Advisor, Environmentally Preferable Purchasing Program
Katharine Kaplan	US Environmental Protection Agency	Team Lead, ENERGY STAR product development

Source: ProspectSV

Table A.2 lists other participants in the TAC meetings, including channel advisors and members of the Empower Procurement team.

Table A.2: Additional Participants

Organization	Participants		Organization	Participants
CivicWell	Margaret Bruce Catherine Foster Julia Kim		Lawrence Berkeley National Lab	Molly Morabito Christopher Payne Gerald Robinson Liyang Wang
Ecomedes	Kathleen Egan Stephen Williams		Prospect Silicon Valley	Cynthia Carrillo Ruth Cox

				Doug Davenport Hillary Davidson Lauren Domagas Taylor Grossman Christian Hosler
D+R International	Lois Gordon		TerraVerde Energy	Rick Brown Karly Zimmerman Fogg
City of Cupertino	Andre Duurvoort		ZNE Alliance	Sam Irvine Richard Schorske
Energy Solutions	Brian Barnacle Daniel Cornejo Nate Dewart Cassidee Kiddo Renee Lafrenz Evan Neill Alanna Torres Yao-Jung Wen			

Source: ProspectSV

APPENDIX B:
Estimates for Project Implications

Statewide Local Government EV Fleets

The team estimated potential savings of GHG emissions though the transition to EV-Fleets by Local Governments using an estimate of different vehicle types used by local governments and applyiing a factor for GHG emissions. Table B.1 presents these estimates.

Table B.1: EV-Fleets for Local Government: Potential GHG Reductions

Vehicle Type	percent Total Vehicles	Emssion Factor (ton CO2/vehcle/year	Number of Vehicles	Carbon output (MTCO2e)
Light Duty Vehicles	65	5	146,250	731,250
Medium/Heavy Duty Venicles	35	35	78,750	2,756,250
All vehicles			225,000	3,487,500

Source: ZNE Alliance

Statewide Building Decarbonization

The project team estimated the gas usage in state and local government buildings to arrive at the potential GHG emissions that could be avoided by electrifying these buildings. The calculations and references follow.

1. Gas usage Cubic Feet/SF for buildings owned by State and Local governments (Assumed "mixed-dry/Hot-humid" per **CBECS** Table C30- Mixed dry/Hot-dry)[28]

[28] U.S. EIA Commercial Buildings Energy Consumption Survey CBECS Table C30: Natural gas consumption and conditional energy intensity by climate region, 2012

Table B.2: Gas Usage Cubic Feet/SF

	Mixed-dry/hot-humid
Government- State	26.1
Government - Local	26.6

Source: Energy Solutions

2. Square footage of buildings owned by state and local governments.
   (Use **CBECS** Table B5- Pacific to get square footage in the Pacific region)[29]
   Apply census data to estimate that California's portion of Pacific region is 73percent.

Table B.3: Square Footage of Government Buildings

States included in "Pacific"	2022 Estimated Population	Percentage of Pacific
AK	733,583	1percent
CA	39,029,342	73percent
HI	1,440,196	3percent
OR	4,240,137	8percent
WA	7,7785,786	15percent
Total	53,229,044	

Source: United States Census Bureau State Population Totals and Components of Change: 2020-2022

State buildings in CA: 620 x 73percent = 452.6 million sq ft

Local government buildings in CA: 1249* 74percent = 911.77 million sq ft

[29] U.S. EIA Commercial Buildings Energy Consumption Survey CBECS Table B5- Pacific

Census region and division, floorspace, 2012

3. Estimate total gas usage

   State: 26.1 * 452 = 11,797.2 million cubic feet per year of gas usage. 11,797,000,000 / 1000 = 11,797,000 thousand cubic feet (Mcf)

   Local: 26.6 * 912 = 24,259.2 million cubic feet per year of gas usage = 24,259,000 Mcf

   Total usage: 11,797,000+24,259,000=36,056,000 Mcf

   One thousand cubic feet (Mcf) of natural gas equals 10.37 therms.

   Total usage = 36,056,000*10.37=3.7390E8 therms/year (373,900,000 therms/year)

4. Compare to total gas usage in California

   Total usage = 2,172.8 trillion Btus[30]

   2,172.8E12/100,000=2.1728E10 therms /year

   3.7390E8/2.1728E10=0.0172, or 1.7percent of total California natural gas usage

5. Total emissions from burning natural gas, local buildings only

   Usage for local building in CA: 24,259,000 thousand cubic feet (per Step 3)

   0.055 metric tons of CO2 emissions per Mcf. [31]

[30] U.S. EIA California Energy Consumption Estimates, 2021

[31] EPA Greenhouse Gas Equivalencies Calculator

APPENDIX C
Savings and M&V: Contract Languages and DER Consulting Practices

The PI team adopted and modified the Fujita and Taylor (2012)[32] model to estimate the savings for the CSU system and the CCC system.

CSU System

To calculate the CSU system assignable area (in sq. ft), the team used data from the CSU annual Campus Space Report.[33] The assignable area was gathered from individual campus data and combined for the whole system's value. The total assignable square footage for instruction, research, office, and study spaces was counted together as "education facilities" for ease of calculation. In addition, the total assignable square footage included dormitories. The analysis did not consider any other categories of spaces.

The team used data from the 2012 Commercial Buildings Energy Consumption Survey (CBECS) to calculate product densities. CBECS (EIA 2012) lists 13 education facilities in U.S. census division 9 (Alaska, California, Hawaii, Oregon, and Washington), which were assumed to be representative of education facilities in California. For product densities of typical energy-consuming products used in dormitories, data from dorms in all the states available in the 2012 CBECS was used instead of the 5 dorms in U.S. census division 9, as it was not considered a large enough sample to calculate the product densities.

CCC System

Data on the total assignable area (in sq. ft) for the CCC system was obtained from the Long-Range Master Plan (California Community Colleges Chancellor's Office 2016). The team assumed that 90 percent of the total assignable square footage was for education facilities and

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[32] This model was designed to estimate the operational energy, cost, and GHG savings associated with the purchase and use of energy-efficient products in the U.S. federal government buildings. The model used data on the amount of floor space (in sq.ft) of federal office and residential buildings and product density (in a number of products per unit area) to calculate the number of energy consuming products installed in the federal government. In addition, data on product failure rates and compliance levels of federal procurement mandates was used to estimate the number of energy-efficient products purchased each year. That, along with data on energy, cost, and GHG savings associated with an energy-efficient product in each product category was used to estimate the total savings for the federal government. Refer to Fujita and Taylor 2012 for a more comprehensive description of the savings model.

[33] The CSU Campus Space Report, updated annually, is available from the Capital Planning Design and Construction Resource Library webpage.

10 percent was for dormitories. To calculate the product densities of typical energy-consuming products used in dormitories, the team used the same resources and methods as the CSU system.

An "energy-efficient product" is one that satisfies the minimum ENERGY STAR standard in a given product category. For product categories not covered by ENERGY STAR, the team adopted energy-efficiency standards set by the U.S. Federal Emergency Management Program. For a given product category, the savings per product were calculated based on the difference in operational energy consumption values between an energy-efficient product and a typical product available in the market. Also, the analysis did not consider all energy-consuming product categories. Table C.1 presents the list of product categories included and excluded from the analysis.

Table C.1: Product Categories

Included in the Analysis	Not Included in the Analysis
Compact Fluorescent Lamps (Light Bulbs)	Ceiling Fans
Fluorescent (Tube) Lamps (GSFLs)	Commercial Water Heater
Fluorescent Ballasts	Commercial Dishwashers
Exit Signs	Commercial Fryers
Decorative Light Strings	Commercial Griddles
Commercial Central Air Conditioners	Commercial Hot Food Holding Cabinets
Commercial Air-Source Heat Pumps	Commercial Ovens
Air-Cooled Chillers	Commercial Steam Cookers
Water-Cooled Chillers	Pre-Rinse Spray Valves
Commercial Boilers	Family-Size (Commercial) Clothes Washers
Commercial (Air-Cooled) Ice Machines	Enterprise (Computer) Servers
Commercial Refrigerators & Freezers	Residential Freezers
Water-Cooled Ice Machines	Residential Dishwashers
Desktop (Personal) Computer	Clothes Washers
Computer Monitor	Dehumidifiers
Notebook (Laptop) Computers - Tablet PCs	Room Air Cleaners
Docking Stations	(Residential) Air-Source Heat Pumps

Included in the Analysis	Not Included in the Analysis
(Computer) Printer	(Residential Gas) Furnaces
Fax Machine	(Residential) Boilers
Copier	(Residential) Gas Storage Water Heaters
Scanners	(Residential) Lavatory Faucets
Multifunction Devices	Showerheads
Mailing Machines	
Uninterruptible Power Supplies	
Televisions	
Phones	
Residential Refrigerators	
Room Air Conditioners	
Microwave Ovens	
(Residential) Central Air Conditioners	
Electric Storage Water Heaters	

Source: Berkeley Lab

Appendix D: Savings and M&V: DER Products

City of San Louis Obispo

The team first estimated savings for the city based on a review of office equipment. They calculated savings for switching from desktops to laptops, installing power management software, and purchasing higher efficiency computer monitors.

Specifically, the team used the Ecomedes tool and the MAEDbS to identify similar computer and monitor models and assess their annual energy usage. They found that if the city purchased 119 Dell 24 Monitors (S2421Ho) instead of the Dell UltraSharp 24 Monitor (U2720Q), it would have saved 890 kWh/year. Similarly, if the city purchased 120 Dell Latitude 7300 instead of Dell Latitude 5401, it would have saved 1,157 kWh/year. Combined, this would have avoided 0.545 $MTCO_2e$.

Statewide Savings

Extrapolating statewide savings followed these steps the team first estimated savings for the city based on a review of office equipment. They calculated savings for switching from desktops to laptops, installing power management software, and purchasing higher efficiency computer monitors.

1. Determine the average energy savings of ENERGY STAR certified office equipment, weighted by the product's approximate annual energy consumption (AEC) in commercial buildings in the US (Larsen, P. n.d.)
2. Estimate the fraction of office equipment energy usage covered by ENERGY STAR products using the same AEC weighting. Small network equipment and other miscellaneous equipment that isn't covered was determined to account for 25 percent of office equipment energy consumption, so 75 percent was covered.
3. Determine the number of public sector employees in cities, counties, and state offices across California.[34]
4. Estimate the square footage of office space per public sector employee, based on an estimate by the General Services Administration (UCLA Lusking Center for Innovation 2019) This was then used to calculate the square footage of relevant office space in California.
5. Estimate the typical office building energy use intensity in kWh/ft2 for office equipment based on the California Commercial End Use Survey.[35]

[34] Government Compensation in California

[35] California Commercial End Use Survey

6 Multiply the estimated square footage of relevant office space in California by the typical energy use intensity to determine the estimated office equipment baseline annual energy use in kWh.

7 Determine the tonnes of CO_2 emissions per kWh in California based on the CEC's 2018 Integrated Energy Policy Report Update and using the value forecasted for 2022.[36] Determining the cost per kWh in California in the commercial sector in 2022.[37]

8 Calculate the statewide CO_2 emission and energy cost impacts of requiring all office equipment be ENERGY STAR certified, using the 20 percent average energy savings calculated in Step 1).

[36] California energy Commission 2018 Integrated Energy Policy Report Update

[37] Electric Choice. Electric Rates. Electricty (kWh) Prices by State.

Appendix E: Savings and M&V: DER Services

City of Cupertino

The team worked with an ESCO to analyze potential emission reductions for the city's four largest municipal buildings based on pre-Covid shelter-in-place energy consumption values (May 1, 2019 – April 30, 2020).[38] Based on a Berkeley Lab report (Larsen, P., n.d.), the team assumed a 20 percent annual energy savings from working with an ESCO. They determined cost savings and the breakdown between electric and gas usage for the buildings by using the average price of electricity[39] and natural gas[40] for California. Emission reductions were determined using the emission factor provided by the California Energy Commission.[41] Since Cupertino sources 100 percent renewable electricity for its buildings, the team calculated emission reductions solely on natural gas use. As shown in Table E.1, Cupertino would save an estimated $245,376 annually in energy costs and avoid 5.7 $MTCO_2e$ emissions annually.

Table E.1: Estimated Annual Savings for the City of Cupertino

Building	2019-2020 Consump-tion (MkBtu)	Estimated Energy Savings (MkBtu)	Estimated Electric Savings (MWh)	Estimated Gas Savings (Therms)	Total Savings ($)	Cupertino GHG Reductions (MTCO2e)
Quinlin Community Center	2.76	0.55	150	409	95,926	1.8
City Hall	2.17	0.43	118	321	75,420	1.8
Sports Center	1.16	0.23	63	172	40,317	0.9
Senior Center	0.97	0.19	53	144	33,713	0.8
Total	7.06	1.41	383	1045	245,376	5.7

[38] Data page from a dashboard previously found on the City of Cupertino website.

[39] ElectricChoice.com website tracks electricity prices by state.

[40] Natural Gas Local website tracks natural gas prices by state.

[41] https://www.energy.ca.gov/media/3538

Source: Energy Systems

Statewide Savings

Savings were extrapolated for cities across California based on population. The four largest cities were excluded because they likely have staff that can perform this work and are likely already doing so, and cities with fewer than 10,000 residents were excluded because they likely do not have large enough city facilities to work with ESCOs. Of the cities included, 46 were known to source their electricity from 100 percent carbon free sources, and so no GHG emissions reductions were calculated for their reduction in electricity consumption (UCLA Luskin Center for Innovation 2019). The cost for finding and contracting with an ESCO in order to perform the efficiency upgrades was estimated at 70 hours of staff time per city and an estimated cost of $100/hour for a cost of $7000/city. Additional sources for the costs are as follows:

- cost of gas per thousand ft^3: Energy Information Administration[42]
- cost of electricity per kWh: ElectricChoice[43]
- $MTCO_2e$ for gas: U.S. EPA[44]
- $MTCO_2e$ for gas for cities that do not source 100 percent of their energy from carbon free sources: CEC 2018.

Based on these assumptions, 486 cities across California could save $97,650,844 annually (in 2020 USD) on their facility utility bills by working with ESCOs to improve the energy efficiency of their buildings. This would also result in a reduction of 32,520 $MTCO_2e$ emissions annually.

[42] U.S. Energy Information Natural Gas Prices

[43] ElectricChoice.com website tracks electricity prices by state.

[44] U.S. EPA Greenhouse Gases Equivalencies Calculator

Appendix F:
E-Procurement Systems Working Group Products

Table F.1 presents the members of the Working Group.

Table F.1: E-Procurement Systems Working Group

Name	Organization	Position
Alicia Culver	Responsible Purchasing Network	Executive Director
Arun Ramarao	Commonwealth of Massachusetts	Performance Analytics, Operational services Division
Beth Eckl	Ohio Health	Sustainable Procurement Advisor
Billie Holecek	Lawrence Berkeley National Laboratory	Sr. Research Associate, Energy Technologies Area
Dr. Christopher Payne	Lawrence Berkeley National Laboratory	Energy/Environmental Policy Research Scientist/Engineer
Eleanor Oliver	California Energy Commission	
Gerald Robinson	Lawrence Berkeley National Laboratory	Technology Researcher, Energy Technologies Area
Haley Holberton	ecomedes	Custom Success Manager
Holly Elwood	EPA Environmentally Preferable Purchasing Program	Senior Advisor
Johanna Anderson	Sustainable Purchasing Leadership Council	Director of Learning and Member Engagement
John Ullman	Practice Green Health	Safer Chemicals and Procurement Director
Julia Wolfe	Commonwealth of Massachusetts	Director of Environmental Purchasing

Name	Organization	Position
Michael Bloom	General Services Administration	Sustainability and Green Buildings Program Advisor
Nicole Darnell	Arizona State University	Foundation Professor of Management and Public Policy, School of Sustainability
Ria Diaz	Planet Bids	Director of Client Services
Scott Gallic	Port of Long Beach	Program Management Division
Shawn Postera	Multnomah County	Sustainable Purchasing Coordinator

Source: Berkeley Lab

Tables F.2 through F.5 present results from the Working Group summarizing how needs between stakeholders are best communicated as specific requests.

Table F.2: Stakeholder Communication: Buyers to Vendors

Need	Request
Product-specific ID	For all products, define the manufacturer product number and UPC.[45] Do not change to only SKU#[46] or any ID that can easily change.
Ability to tag products	Build filtering options that allow item tagging by user-desired fields. Examples include product certification, efficiency rating, etc.
Display/share only products that meet the organization's requirements	Limit offerings to products that meet organizations' specifications by blocking noncompliant options or allowing the buyer to block noncompliant options.

[45] UPC (Universal Product Code) barcodes are standardized global identifiers that enable products to be sold, reordered, and tracked through supply chains.

[46] SKU# is a stock-keeping unit number.

Need	Request
Searching and filtering options	Allow buyers to search for items by using multiple filters (e.g., Energy Star-certified, and an organization's preferred product list.
Product labeling	Provide images of third party certifications, ISOs and ecolabels with links to governing organizations to check guidance. When there is no third party certification, share environmental attributes with data verification.
Sustainability reporting	Provide vendor data sheets that track the product's supply chain data. Create reporting capabilities that allow system users to define the information reports contain.

Source: Berkeley Lab

Table F.3: Stakeholder Communication: Buyers to E-Procurement System Providers

Need	Request
Ability to tag products	Build filtering options that allow item tagging by user-defined fields
Searching and filtering options	Allow buyers to search for items by using multiple filters.
Ability to block items	Limit offerings to products that meet organizations' specifications by blocking noncompliant options or allowing the buyer to block noncompliant options.
Sustainable procurement reports	Create reporting capabilities that allow system users to define the information reports contain (e.g., carbon footprint, water and energy use).
Contract writing modules: automatic inclusion of required clauses for sustainability	Add automation to include contracting language based on products or services included in contract.

Source: Berkeley Lab

Table F.4: Stakeholder Communication: All Stakeholders to Environmental Product Certifiers/Data Aggregators

Need	Request
API information	Provide training on incorporating API's into stakeholders' system
Consistent product ID	If applying a new certifier-specific numbering scheme, keep manufacturer ID with product information.
Access to certified data	Make data available in an easily importable dataset.
Transparency of sustainability certifications	Provide information on what a product needs to qualify for the sustainability certification/label offered.
Photos of products	Display an image for all items certified.
Static links	Provide static links to all products certified that can be included in contracts.

Source: Berkeley Lab

Table F.5: Stakeholder Communication: Vendors to Manufacturers and Distributors

Need	Request
Product coding to include information on certified products	For every product sold, identify and display the relevant certification and/or indication of verified environmental claims.
Verified environment claims	For every product with an environmental certification, provide a static link to the certification.
Photos of products	Display an image of items sold.

Source: Berkeley Lab

Appendix G: Savings and M&V: EV-Fleets for Schools

Bakersfield Unified School District

Leveraging ZNE Alliance's e-fleet electrification replacement model and applying the State of California's HVIP model,[47] the project team analyzed the total cost of fleet electrification between 2021 and 2035.

Cost savings are based on assumptions gathered from the HVIP model and validated research provided by the ZNEA team and further validated by Empower Procurement's M&V provider D+R. The team based the TCO results on a replacement schedule consistent with the district's historic purchasing practices and substituting EVs for diesel buses. Under this model, the full fleet of 140 school buses would be electric by 2035 and the district could leverage available incentives to offset capital costs.

BUSD has historically replaced its aging vehicles at a rate of 10 vehicles per year with diesel vehicles. Continuing to replace aging vehicles with diesel is expected to cost the district $52.1 million over the next 15 years. The transition schedule begins with the procurement of 8 EVs in 2023, followed by the adoption of 11 buses per year through 2035. Following this schedule, the team estimates electrification will cost the district $31.9 million (not including EV charging infrastructure costs). This represents more than $20 million in savings compared to business-as-usual diesel replacement.

Emission savings assumes a total mileage of 9360 miles per year driven per vehicle (provided by BUSD fleet manager) and 2,680 gallons of diesel per mile, totaling ~28 tons of CO_2 per bus per year in emissions avoided if electric fueling is sourced from a 100percent carbon free source (Houston, S. 2019). Full fleet electrification will avoid emissions of 26,601 $MTCO_2e$

Twin Rivers Unified School District

The ZNE Alliance project team calculated savings for TRUSD using the same models as BUSD: Fuel Savings of $998,716; Maintenance Savings of $206,700. Each TRUSD bus travels 15,000 miles per year. Assuming buses are fueled with 100percent carbon free power approximately 44 tons of CO_2 can be avoided per bus per year. When extrapolated to the full 130 vehicle fleet this equates to approximately 5,761 $MTCO_2e$ per year in avoided emissions.

Statewide Savings

Savings assumed an average California school bus fleet size of approximately 30 school buses converting to 100percent electric school buses fueled by a 100percent carbon free electricity source. Fully adopting both PI initiatives could mitigate approximately 420,000 MTCo2e, and

[47] California HVIP Total Cost of Ownership Estimator

districts could save approximately $81,890,878 based on cost-saving data from the State's Hybrid Vehicle Incentive Program. Based on the study from the Union of Concerned Scientist (Houston, S. 2019), if fueled in such a manor each bus would result in mitigation of approximately 28 tons of CO_2/year in diesel emissions.

There are 1037 school districts in California.[48] Based on market understanding, the ZNE Alliance team estimates that 80percent of the school districts in California operate a school bus fleet. This assumption considers that several California school districts rely on public transit options to transport children to and from school.

[48] California Department of Education. Fingertip Facts on Education in California

Appendix H: M&V: Building Decarbonization for Local Governments

Statewide Savings

The team first estimated the improvement in energy efficiency by transitioning from gas space and water heating to Tier 3 heat pump units. They found an increase in per-unit efficiency from 77percent to 270percent, based on ENERGY STAR's requirements[49][and NEEA's Advanced Water Heater Specification (2022). Next, based on the GSA (2011) Workspace Utilization and Allocation Benchmark, they estimated roughly 190 square feet per employee and approximately 176,250,000 square feet of office space (large and small) state-wide in California's state and municipal buildings that currently require approximately 16.5 kBtu per square-foot.[50]

Assuming that 25percent of space heating, 50percent of small office water heating, and 28percent of large office water heating in California municipal buildings can easily be converted from gas to electric, around 760,000,000 kBtu is within the scope of this PI.

Projecting the relevant square footage and factoring CO2 tons per kWh and California's average gas and electric costs, the team projected that this PI would reduce approximately 28,511 MTCO_2e per year and save nearly $2 million per year.

[49] ENERGY STAR Water Heater Key Product Criteria

[50] State of California. *2006 California Commercial End-Use Survey*.