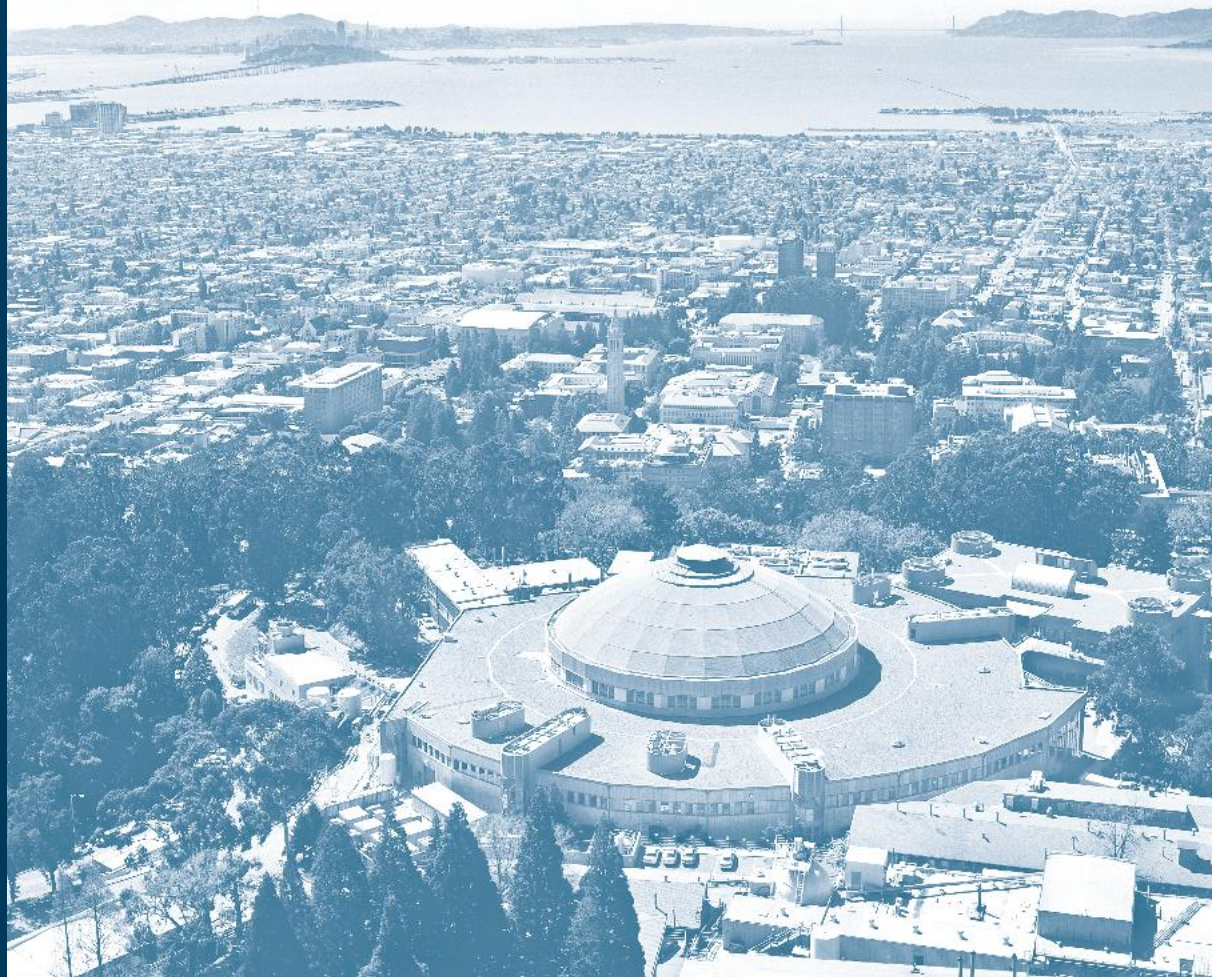# Lawrence Berkeley National Laboratory

Cal-OP ACE Task 2.2.3

Cal-OP ACE Buyer Survey:
Barriers & Opportunities Memorandum

California Energy Commission Group 3
June 10, 2019

Executive Summary

The two main goals of the California Opportunities for Procurement to Accelerate Clean Energy (Cal-OP ACE) Program are to 1) increase the uptake of Distributed Energy Resource[1] (DER) technologies and 2) increase opportunities for in-state DER sellers to gain access to the institutional marketplace. To inform the design of the Cal-OP ACE program (hereinafter referred to as "the program"), the project team at the Lawrence Berkeley National Laboratory (LBNL) conducted a Buyer Survey assessing the needs, barriers, and opportunities for DER technologies procurement amongst California organizations across the state's major sectors (e.g., healthcare, higher education, K-12 schools, state and local government, retail, tech, etc.) Data from this survey provides information that will help shape intervention strategies that the program deploys.

Key findings

Overall findings:

- Based on the 108 responses obtained, there is not enough evidence to show statistically significant differences in overall institutional procurement behavior and DER procurement barriers between public and private organizations.
- A minor difference in public and private organizations was shown in the ranking of procurement priorities (Figure 19). While the majority of respondents chose the lowest first cost and lowest lifecycle cost as the highest priority, public organizations prioritized social attributes (e.g., minority-owned business) higher than private organizations.
- Another minor difference between public and private organizations is seen in procurement process influencers. Although the top three major influencers in public and private organizations are similar, the rank ordering is different. Respondents in the private organizations indicated Chief Financial Officers has the most influence, whereas respondents in the public organizations indicated facilities manager/engineer and energy manager have the most influence (Figure 18).
- Furthermore, while both public and private organizations find all potential program service options to be useful, there are slight differences in their ranking (Figure 25). Close to 50% of public organization respondents indicated technical specifications for DER products and facilitation of group purchasing opportunities to be most useful, while only 33% and 20% of private organization respondents find those support most useful respectively. A majority of

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[1] Distributed energy resources (DER) - DER includes distribution connected-generation resources (e.g., solar, wind), energy efficiency, energy storage, electric vehicles, and demand response (DR) technologies.

private organization respondents indicated networking and training events, and an online database of DER products most useful.

Barriers:
- A majority of respondents reported gaining approvals is a common bottleneck in the procurement process, followed by developing contract documents and undergoing legal review (Figure 9).
- Over 50% of respondents indicated it is be difficult for their organization to purchase new DER products using current procurement tools. The usage of preferred vendors does not affect the difficulty level of procuring new DER technologies (Figure 8).
- The top three most frequently cited barriers to purchasing DER technologies are the high-cost / long-term return on investment, lack of financing options, interoperability with existing equipment, and lack of top management support (Figure 15).

Opportunities:
- In respondent's organization five-year budget planning, the top three most highly prioritized products were HVAC equipment, distributed generation, and lighting & lighting controls, which suggests the product categories Cal-OP ACE program should focus on (Figure 14).
- About 50% of the respondents indicated they 'sometimes' or 'never' use preferred vendors, suggesting flexibility during the procurement process to introducing different vendors and a potential opportunity for the program to integrate DER sellers into the institutional procurement process (Figure 8).
- Respondents indicated that technical specification for DER products and "Cut and Paste" language for contracting documents would be very useful forms of additional support regardless of organizational sector or product category. (Figure 10).

Program implications:
- Given the limitations of existing procurement tools indicated by California buyers, there is a demand for the program to provide new and improved tools directed explicitly at helping organizations purchase DER technologies. In particular, there seems to be a need for (a) improved standardized contract templates, (b) facilitations of group purchasing opportunities, and (c) the creation of an e-procurement platform that provides DER product specifications.
- Since respondents cited high cost and interoperability issues as major prevention factors to purchasing DER products, the program should (a) emphasize the cost-effectiveness (e.g., lifecycle cost savings) of DER products and (b) provide more information and case studies about the successful integration of DER products into existing equipment.
- Survey data supported the assumption that (a) top-management roles (e.g., CFOs, facility managers) exert significant influence over the procurement process, and (b) a lack of top-

level support is a barrier to DER purchasing. The program should address internal approval and executive policy setting processes needed to gain support from these key stakeholders.

Survey and Data Limitations:
- With a sample size of 108 respondents, it was possible to reach a confidence level of 95% with a 10% margin of error, which is relatively high error margin for statistical testing. While still able to obtain valuable overall insights (such as common major procurement influencers and highly prioritized product categories), the ability to examine the difference in institutional procurement behavior between sectors, products, and roles was limited.
- Additionally, the small sample size limited the type of statistical test used. Fisher's exact test was used to determine statistical significance because it is designed for smaller datasets. However, this test has been criticized as too conservative potentially leading to results that underestimate differences between populations (e.g., differences in responses based on sector, roles within the organization, and procurement processes), which made it difficult to make definitive conclusions about whether specific characteristics led to differences in procurement.
- The distribution of respondent from sectors was highly skewed, which impacted the results as well. A significant majority of respondents were from the K-12 schools and the higher education sector. A more evenly distribution of respondents from across all sectors would have greatly enhanced the strength of the conclusions.

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1. Background

The two main goals of the California Opportunities for Procurement to Accelerate Clean Energy (Cal-OP ACE) Program are to 1) increase the uptake of Distributed Energy Resource[2] (DER) technologies and 2) increase opportunities for in-state DER sellers to gain access to institutional buyers. These are goals taken from the California Energy Commission Triennial Electric Program Investment Charge (EPIC) Plan and are a core part of the scope of work for this effort. To inform the design of this program, the project team at the Lawrence Berkeley National Laboratory (LBNL) surveyed California-based buyers and procurement influencers ("Buyer Survey). This survey assessed the needs, barriers, and opportunities for the purchase of DER technologies amongst California organizations across major non-residential sectors (e.g., healthcare, higher education, state and local government, retail, tech, etc.) Data from this survey provides information that can help shape meaningful intervention strategies of Cal-OP ACE program (hereinafter referred to as "the program") offerings.

1.1 Survey Objectives

This survey had three main objectives related to the Roles, Rules, or Tools that impact procurement, and was structured as groups of questions corresponding to these areas. The first objective was to solicit information about those that influence procurements; sustainability and energy managers, facility personnel, financial and senior executives and procurement officers (Roles). The second objective was to examine common practices and procedures guiding procurement decisions (Rules). The third examined the systems and resources (Tools) commonly used to support procurements. Understanding these organizational characteristics provides useful insights into how California institutions undertake purchasing. This information also helps identify the differences in barriers or opportunities between sectors. The survey is designed to identify the procurement priorities of different California organizations. This would include what types of products are purchased, what product attributes (e.g., Made in America, ENERGY STAR) are valued most, and what categories of products will be prioritized over the next five years. This information can identify product types to target for program offerings and inform effective strategies in promoting these tools and services.

1.2 Survey Assumptions

The target respondent population was defined to be any organization large enough to have formal procurement staff, policies and or tools. The target respondent pool includes not only procurement professionals but also key influencers (e.g., Facilities, Energy and Sustainability

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[2] Distributed energy resources (DER) - DER includes distribution connected-generation resources (e.g., solar, wind), energy efficiency, energy storage, electric vehicles, and demand response (DR) technologies.

Managers). There are about 150,000 people with job related to procurement within the state of California (based on California labor data with some keyword job title searches such as procurement, purchasing, facility, sustainability/energy manager). With this population number, the survey team aimed to get 100 responses to achieve 95% confidence level with a 10% margin of error (~350 sample size for 5% margin of error).

1.3 Assumed Barriers

Before conducting the survey, the survey team hypothesized four main barriers make DER product procurement a challenge for institutions. These assumptions were based on evidence collected in the *Draft Hub User Interview Summary Report* and the Task 2 User Survey beta test, as well as previous research conducted by LBNL. First, many organizations face competing social and environmental procurement policies (e.g., minority-owned businesses versus sustainable materials) and competing organizational priorities, which may force a choice between energy-saving goals and other goals. Second, a lack of financing models may make it difficult for organizations to justify the procurement of new clean energy products. Third, decision-makers may lack internal management support and incentives needed to not only expend the time and effort required to procure energy-saving products but also undertake wide-ranging DER-focused procurement initiatives. Finally, the misalignment of motivations between key stakeholders (e.g., the specifiers who are aware of the benefits of energy efficient products and procurement specialists tasked with carrying out purchases) can create a significant barrier to adoption of DER products. These assumptions about barriers to DER adoption helped inform the design of survey questions and the tests the survey team applied to the data.

2. Survey Design Methods

Based on hypotheses about differentiation factors and assumptions about barriers in procurement, the survey was organized into questions about demographics, procurement roles, rules and procedures, tools related to procurement and specific product types. Additionally, to gain consistent responses, the survey team set definitions for two frequently used key terms, "DER" and "organization", at the beginning of the survey.

2.1. Demographics

The survey team developed the following two questions to understand the characteristics of the target population:
- Q1: "What is the name of your organization?"
- Q2: "Which of the following best describes your organization's sector?"

Local government	State government	Federal government	K-12 schools
Higher education	Healthcare	Retail	Technology
Business/financial services	Commercial real estate	A&E firms	Manufacturing
Agriculture	Other (the survey team asked respondents to specify)		

These questions provided the needed background information to test whether the type of sector or size effect an organization's procurement structure and decision-making process concerning DER technology procurement. The survey team developed sector options based on market research of California's economic activities, top 50 employers, and sectors with high procurement activities.

Additionally, as discussed in Task 2.2: *Procurement Resources Summary Memo*, the survey team may consider different programmatic approaches for public versus private sectors due to differences in the source of funding, purpose and governing rules and behavior of actors involved. Results from this survey made it possible to partially test that hypothesis.

2.2. Roles

Q3, Q4, Q5 and Q7 were aimed at understanding the different procurement roles within California organizations and how they impacted the purchase of DER products. In Q3, the survey team asked respondents to select the functions that best described their role in the procurement process: developing contract documents, approving expenditures, specifying attributes of the item purchased, managing/developing projects, reviewing proposals, and other (respondents were allowed to specify).

In Q4-5, the survey team asked respondents to indicate the types of products and services (respectively) that they were responsible for purchasing for their organization. Respondents were given the following options:

Products	Services
IT products (e.g., computers, imaging equipment, network components)	IT services
Non-IT appliance products (e.g., window air	Non-IT appliance services (e.g., food service,

conditioners, refrigerators)	vending, laundry)
Laboratory / medical equipment	Laboratory / medical equipment services
Products for maintenance, repair & operations (e.g., filters, replacement light bulbs)	Maintenance & repair services
Fleet products (e.g., vehicles, EV chargers)	Energy retrofit contracting (e.g., Energy Savings Performance Contracts, Utilities Service Contracts)
None or N/A	New construction & major renovation services
Other (the survey team asked respondents to specify)	Transportation services
	None or N/a
	Other (the survey team asked respondents to specify)

This question was meant to determine what products and services a majority of California organizations are buying, and which roles were responsible for buying different products or services.

Finally, Q7 asked respondents to identify what roles had the most influence over DER purchasing decisions at their organizations. Respondents were given a list of the following roles to select from:

Chief Financial Officer	Legal Counsel
Sustainability Manager	Energy Manager
Facilities Manager / Engineer	IT Managers
Contract Officer (CO)	Fleet Manager
External Consultants (e.g., A&E firms)	Additional roles (respondents were asked to list)

These options were presented on a matrix where respondents had to indicate the level of influence for each role, with the choices of minor influence (i.e., mostly assigned tasks with little input), moderate input (i.e., assigned some tasks but also granted some input/decision-making powers), and major influence (i.e., significant input/decision-making powers, including budget control and agenda-setting abilities). The purpose of this question was to determine whether there was a hierarchy of procurement roles within the organization and which stakeholders had the greatest influence over purchasing decisions. This would give the program some indication of which stakeholders to target for interventions.

2.3. Rules

The following two questions aim to understand the formal and informal rules and practices institutions follow:
- Q11: "How often do you use pre-defined vendors in purchasing?"
- Q12: "Please rank the following goals in order of importance to your organization during purchasing:

Lowest lifecycle cost	Lowest first cost
Made in America	Provided by small/veteran-owned business
Provided by local business	Provided by woman/minority-owned business
Preferable environmental attributes	

These questions sought to understand the constraining and supporting DER policies within organizations to better inform the development effective program services. Q11 indicates the prevalence of pre-defined vendors used by California organizations. The frequency of using preferred vendors reveals the degree of flexibility toward new vendors. When creating pathways to integrate new, and sometimes small California-based DER sellers into complex and rigid procurement systems, it is important to consider an organization's flexibility toward new suppliers.

Q12 is designed to reveal the order of importance for common procurement priorities, providing an understanding toward product attribute preferences.

2.4. Tools

The tools along with internal policies have an important effect on how organizations identify, specify, contract with vendors and determine the attributes of the products they wish to buy. Understanding what tools are currently used and how effective each is in identifying product attributes, yields useful insights in designing the program support systems and services aimed at increasing the uptake of DER technologies.

A considerable portion of the survey focused on determining types of tools that California organizations use in procurements and how effective each is in enabling the purchase of new and unfamiliar DER technologies. In Q13, Q15, and Q16, the survey team asked respondents to identify which procurement tools are currently in place for purchasing at their respective organizations. In Q13 respondents were given the following options:

Standardized contract templates	E-procurement systems
Standardized specification templates	Purchase order requisition forms
Software tools for contract development	Do not know
Other (respondents were asked to specify)	

Q15 asked respondents to list the names of specific e-procurement systems used at their organization, with the option to respond with 'N/A' if unknown. Q16 asked respondents to list the names of specific contracting software tools used, with the option to respond with 'N/A' if unknown. These questions were designed to determine the most popular tools and platforms used by California buyers.

Q14 asks respondents how easy the purchase of new DER products using their current procurement tools. Respondents were asked to choose between 'Very difficult,' 'Somewhat difficult,' 'Somewhat easy' and 'Very easy.' This question was designed to gauge whether current procurement tools were acting as a barrier to the uptake of new DER products. The question could also indicate whether additional tools or resources for purchasing DER technologies would be a useful program offering.

In Q8, respondents were presented with a matrix and asked to indicate which, if any, of the procurement phases often pose a bottleneck. Respondents could choose from the following:

Specifying and selecting products	Developing contract documents

Legal review process	Gaining approvals
Ordering process	Shipping
Other (respondents were asked to specify)	

Within the question matrix, respondents were asked to rate the degree to which each phase posed a bottleneck by indicating 'Never,' 'Sometimes,' 'Often,' 'Always,' or 'N/A.' Answers indicate where in the process challenges or difficulties are experienced. In addition to providing insight into the efficacy of existing tools and systems in, this question is intended to highlight phases in the procurement process where the program could effectively target efforts.

Finally, in Q18 the survey team asked respondents which tools and services provided by the Program would be most useful in assisting their organizations. Respondents were asked to rank the tools and services from a scale of 1 to 8 (1 = most useful, 8 = least useful). The goal of this question was to determine which program offerings are perceived to be of greatest value to the respondents. Responses to Q18 also provided useful data when overlaid with other questions to test the desirability of different program services by sector, role and product categories.

2.5. Products

Q6, Q10 and Q17 were designed to understand the type of DER products/services both currently purchased and planned for in the future:

- Q6: "How much does your organization spend annually on the following procurement categories (the survey team provided spending amounts of under $500K, up to $1 million, up to $25 million, over $25 million and don't know for each category)?"

Transportation products & services	Energy retrofit
Non-IT appliance products & services	Laboratory / medical products & services
MR&O	IT products & services
New construction & renovation	

- Q10: "How many internal combustion vehicles (ICE) or electric vehicles (EVs)/plug-in hybrid electric vehicle (PHEV) are in your fleet?" (fill in the blank format)

- Q17: "In your budget-planning process for the next five years, which of the following product categories will be a priority (the survey team provided high priority, medium priority, low priority, and not a priority as options for each category)?"

HVAC equipment	Distributed generation
Lighting & Lighting Controls	EVs
Building envelopes	Appliances (plug-loads)
Distributed storage technologies	C&I refrigeration
Water heating appliances	Other (please specify)
EV charging technologies	

Besides revealing what products California organizations are most interested in, responses to Q6, 10 and 17 provide a useful product prioritization for both the program and the California Energy Product Evaluation "Hub" (Group 2). The specific product categories options were developed partially based on discussions with the Group 2 survey design team.

Q9 and Q19 reveal the level of executive support respondents face, factors preventing procurement of new DER technologies, and types of additional program services respondents might find useful:

- Q9: "How often do any of the following factors prevent your organization from purchasing new DER products (the survey team provided "Always," "Often," "Sometimes," "Never," and "N/A" as options for each factor)?"

High cost / long-return on investment	Lack of financing options
Lack of staff buy-in	Operational reliability
Maintenance of the product	Need to retrain staff
Lack of top management support	Security
Interoperability with existing equipment	Availability of repair parts

- Q19: "For which product categories would your organization find this additional support most useful (the survey team provided very useful, somewhat useful, not at all useful, and not applicable as options for each product categories)?"

EV charging technologies	Distributed generation
Lighting equipment and lighting controls	Distributed storage technologies
HVAC equipment	Building envelopes
Building controls	Appliances
Electric vehicles	Commercial & industrial refrigeration upgrades
Water heating appliances	

Responses to Q9 give insight into the specific factors often preventing organizations from purchasing new DER technologies and allow the program to more effectively formulate intervention strategies to address those prevention factors. The question factor options are created based on literature review and feedback received during the beta-test phase. Responses to Q19 identify specific product categories that organizations may support with.

2.6. Outreach & Data Collection

The survey was distributed directly and indirectly via email and shared across personal and professional social media platforms (e.g., LinkedIn). After drafting the recruitment language (see Appendix II), the survey team created a list of potential survey takers grouped into 17 target sectors: A/E Firms, Agriculture, Business/Financial, Commercial Real Estate, Entertainment, Federal Government, State Government, Local Government, Healthcare, Higher Education, K-12 Schools, Local Government, Manufacturing, Retail, Tech, Utilities, and Other. A contact list was generated by the survey team, starting with 'warm' contacts taken from personal or professional networks, and then building out to include 'cold' contacts identified via online searches. The survey link was emailed directly to 436 contacts from this main contact list. The Survey team partnered with sympathetic associations and individuals that acted to distribute the survey to their established networks. Based on tracking estimates, the survey was circulated to an additional 2,680 individuals through these partner distributors.

In total, the survey was sent to approximately 3,116 individuals. The survey was opened on 3/20/2019. Results in this updated Memorandum were obtained from a data collected up until 5/28/2019. As of this date, 108 responses had been recorded, for a response rate of 0.03%. This

was an increase in responses from the initial version submitted on 5/17/2019 which summarized responses collected up until on 5/15/2019. This updated version reflects the changes in key findings that resulted from the subsequent increase in responses. The Buyer Survey will remain open with the intent of collecting additional responses in order to continue to build a more robust dataset, though recruitment efforts past this date will be minimal.

Respondents were given the option to be contacted for a follow-up interview after completing the survey. Fifty-three (53) respondents indicated interest in participating in a follow-up interview and were contacted by the survey team. As of 6/4/2019, eight interviews have been scheduled, of which five have been completed. These interviews were recorded and transcribed and will be uploaded to NVIVO for coding and thematic analysis. Should the analysis produce any novel findings, they will be made available in a later report document.

2.7. Lessons for Future Study

Several limitations qualify the results of this research. First, the low response rate resulted in the inability to sufficiently prove statistical strength of some of the hypotheses. With a low number of responses, the survey team chose to use the Fisher's exact test to determine statistical significance as it is designed for smaller datasets. This test has been criticized as too conservative in predicting interrelation between two groups (e.g., differences in responses based on sector, roles within the organization, and procurement processes). As a result, when conducting the analysis of survey data, it was difficult to prove the level of statistical significance necessary to make definitive conclusions about relationships between certain variables. Additionally, the distribution of responses was highly skewed. A significant majority of respondents were from the K-12 schools sector, while there was a very low number of respondents from Commercial Real Estate, Healthcare, and Retail sectors. No responses were received from Business/Financial Services sector. A more even distribution of respondents from across all sectors would have enhanced the generalizability of the findings. After early results showed a low participation in certain sectors, the survey team provided gift card-type incentives to potential respondents in an attempt to increase response rates and increase representation from under-represented sectors. The benefit of the gift card incentive in increasing response rates is unclear.

Second, outreach efforts may have skewed to certain types of roles within different organizations. Because the contact list was built from personal and professional networks, it is possible that many of the respondents reached were mostly sustainability and energy management professionals. However, this cannot be verified because respondents were not asked specifically for job title. Respondents were instead only asked to indicate job functions. Future studies would benefit from evenly distributed effort on each target role or undertake other efforts to ensure a randomized sample of respondents.

3. Results & Analysis

3.1 Demographics

In total, 108 responses to the survey from organizations representing 13 different sectors types were received. A majority (18%) respondents identified themselves as part of the K-12 schools sector, followed by higher education (16%), local government (13%) and agriculture (9%) (Figure 1). The survey team conducted market research to classify respondent into public or private organizations.
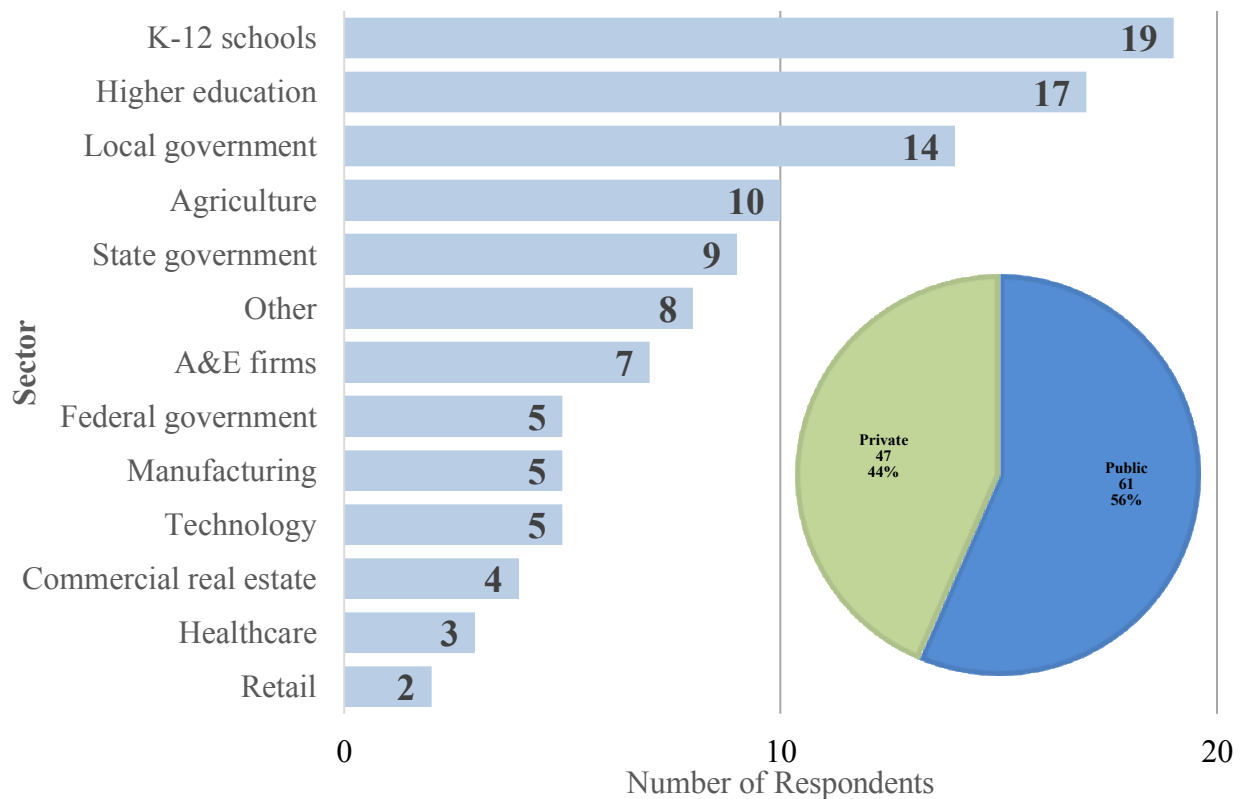

Figure 1. Majority of respondents are in public organizations

Since most of the respondents are from K-12 schools, the results and analysis conducted may be skewed to that sector. This may suggest either that the procurement and energy community in the K-12 schools are more active and engaged than in other sectors or the outreach effort was more effective in the K-12 schools sector.

3.2. Roles

Procurement roles

In Q3, a majority of respondents indicated that the functions that best described their role within their organizations were managing and developing projects and reviewing proposals.

Of the total respondents polled, 72% selected 'Managing and developing projects' as the function that best described their role and 49% selected 'Reviewing proposals'. 'Specifying the attributes of the item purchased' polled at 37%, followed by 'Developing contract documents' at 35%. Of the respondents that selected 'Other' (18%), functions such as 'Education and Advocacy,' 'Overseeing operations for eCommerce procurement channel,' 'Sourcing and monitoring cost,' 'Design engineer,' 'Administrative/financial manager' and 'Internal advising.' were indicated.
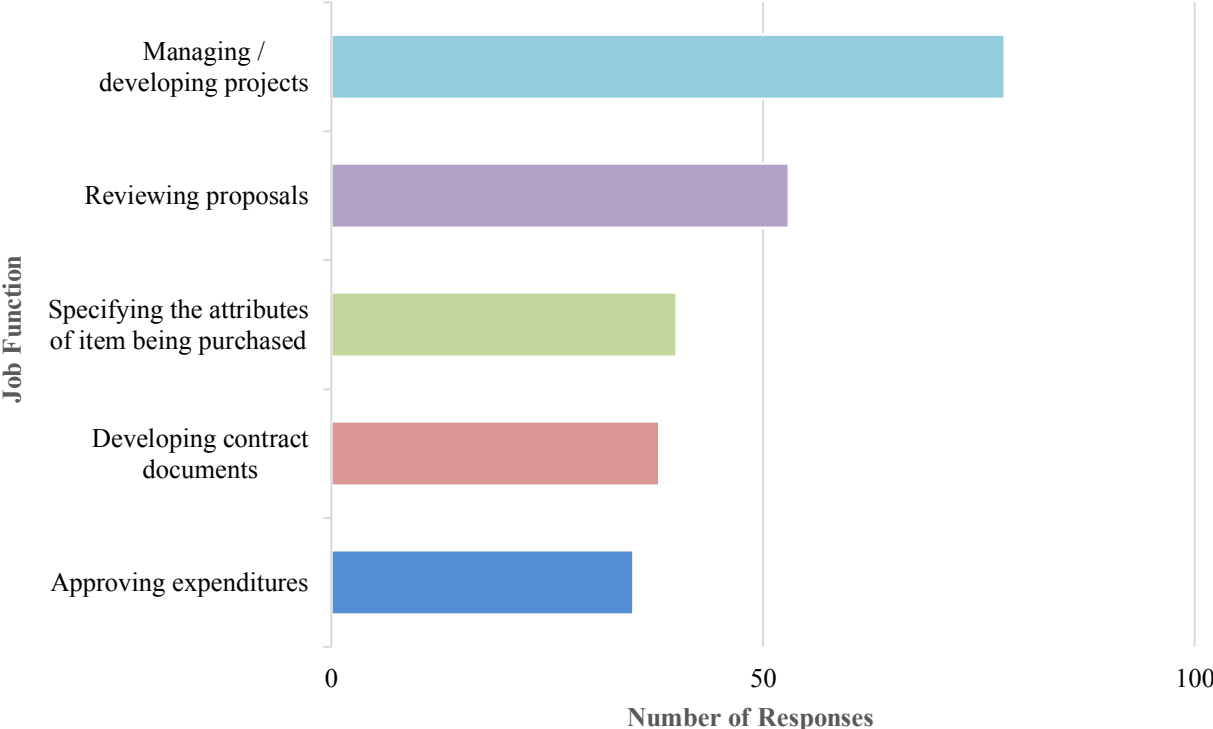
Figure 2. Majority of respondents are responsible for managing/developing projects

The fact that a majority of respondents suggested 'Managing and developing projects' seems to suggest that many of the people who answered the survey were in management roles (e.g., Sustainability Manager, Energy Managers, Facilities Managers). This may be the result of outreach efforts skewing largely towards respondents in these roles.

Products and services being purchased

In Q4 and Q5, respondents were asked to select the products and services they were responsible for buying. Of the total respondents polled, 45% indicated that they were responsible for purchasing products for maintenance, repair and operations (e.g., filters, replacement light bulbs), followed by 31% who selected fleet products (e.g., vehicles, EV chargers) and 'Other'. In terms of services, 60% of respondents said they were responsible for purchasing energy retrofit contracting services (e.g., Energy Savings Performance Contracts, utilities services contracts), followed by 44% who selected maintenance and repair services, and 37% who selected new construction and major renovation services.
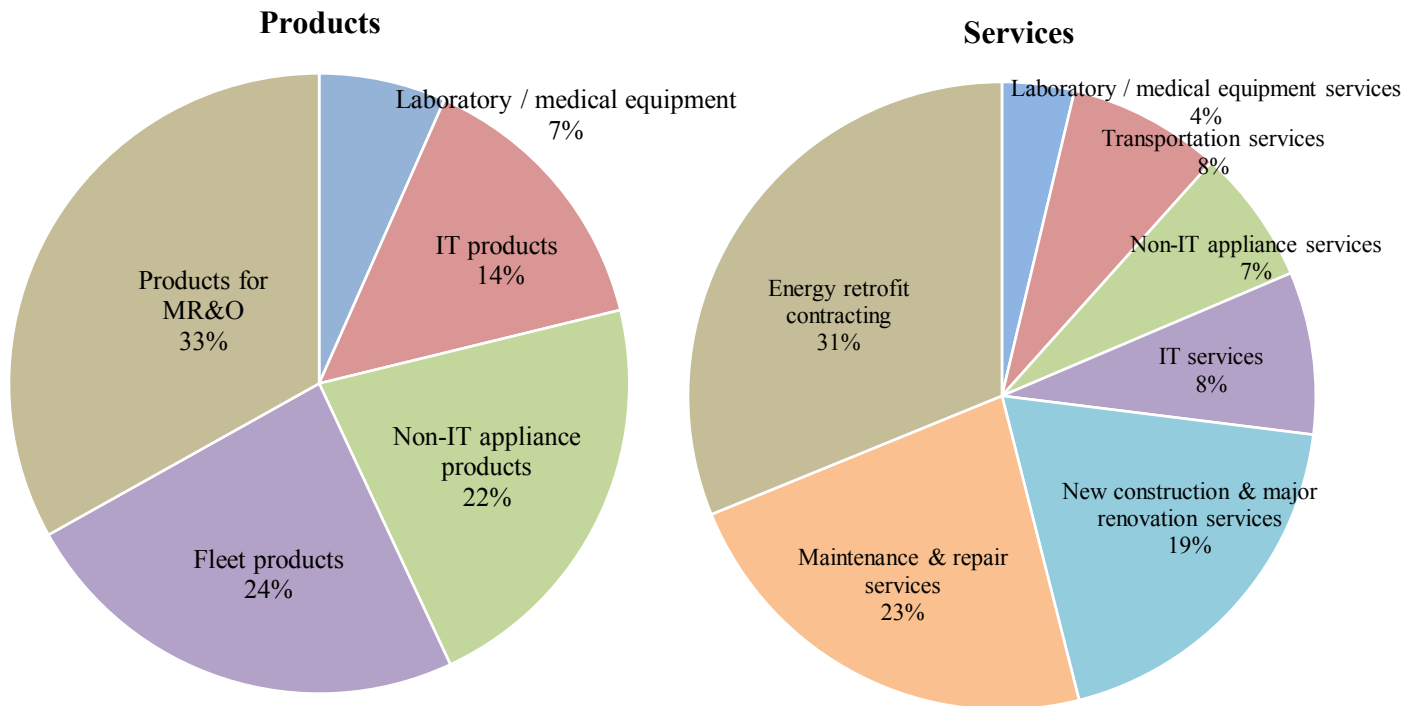
Figure 3. the total number of respondents responsible for purchasing each type of product and services

Those selected 'Other' under types of products responsible for purchasing gave the following responses: 'Energy efficiency equipment', 'Solar photovoltaic systems', 'Electricity', 'Natural gas', 'Capital project equipment', and 'Building automation.' The answers given for 'Other' under types of services included: 'Marketing', 'Consulting', and 'ROI determinations'.

Data from Q4 and Q5 show that most of the respondents polled are responsible for purchasing MR&O products and energy retrofit contracting services, findings that are consistent with the prior assumptions about what California organizations are buying. However, a large portion of respondents indicated responsibility for purchasing fleet products was not anticipated by the survey team.

Major influencers

In Q7, respondents were asked to indicate influence level the different roles have within their respective organizations, with 'Major influence' representing the greatest level of agency and input into procurement related decision-making processes. A majority of respondents selected 'Chief Financial Officer' as the role with the most influence, followed by 'Facilities Manager/Engineer' and 'Energy Manager' (Figure 4).
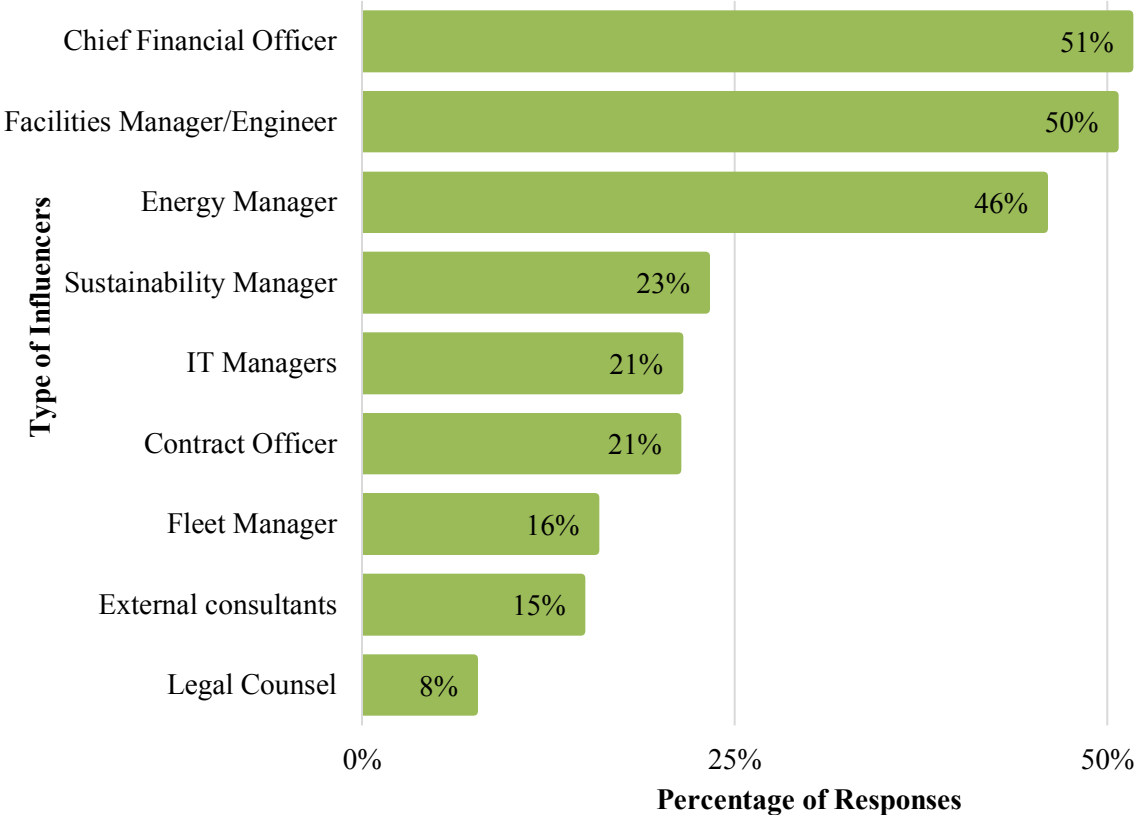

Figure 4. Chief financial officer is the most commonly selected major influencer

Respondents also noted other roles that had a major influence in the procurement process. This included 'Board of Directors,' 'General Manager,' 'AGMs,' 'CEO,' and' 'Landowner.' These findings uphold the prior assumptions that top-level management roles have a significant impact on the procurement process. Buy-in from senior management is clearly important in encouraging the uptake of DER technologies within California organizations. These findings also reveal that Facilities Managers/Engineers play a significant role in the procurement process. Market research and prior studies indicate that facilities managers/engineers are tasked with identifying and specifying the types of products needed for a particular facility or project, which is an essential part of the procurement process.

3.3. Rules

Use of Preferred vendors

In Q11, the survey team asked respondents to indicate how often they used pre-defined (i.e., preferred, pre-qualified) vendors for purchasing. A majority of respondents (41%) indicated 'Sometimes,' while 38% indicated 'Often' (Figure 5).
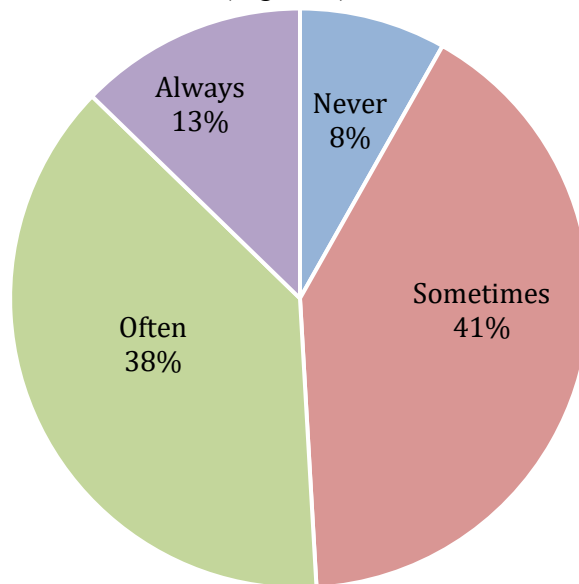

Figure 5. Frequency of using preferred vendor

This data suggests that when it comes to the use of preferred vendors, California organizations exhibit a considerable degree of flexibility. While use of preferred vendors seems common across public and private sectors, only a relatively small portion of respondents (13%) indicated that they 'Always' use pre-qualified or pre-defined sellers. This may indicate that organizations are more open to working with new sellers than previously assumed which implies a potential opportunity for new DER sellers to contract with California buyers.

Procurement Priorities

Q12 addressed the fact that organizations often have multiple competing priorities when making purchasing decisions. It presented respondents with a list of procurement objectives and asked them to rank the goals in order of importance (1=most important, 7=least important). The highest-ranking choices for a majority of organizations, regardless of sector, were 'Lowest first cost' and 'Lowest life cycle cost' (Figure 6). 'Preferable environmental attributes' was ranked third. Medium ranked were social attributes 'Made in America' and 'Provided by local business.' The lowest priority product attributes were 'Provided by small/veteran-owned business' and 'Provided by women/minority-owned business.'
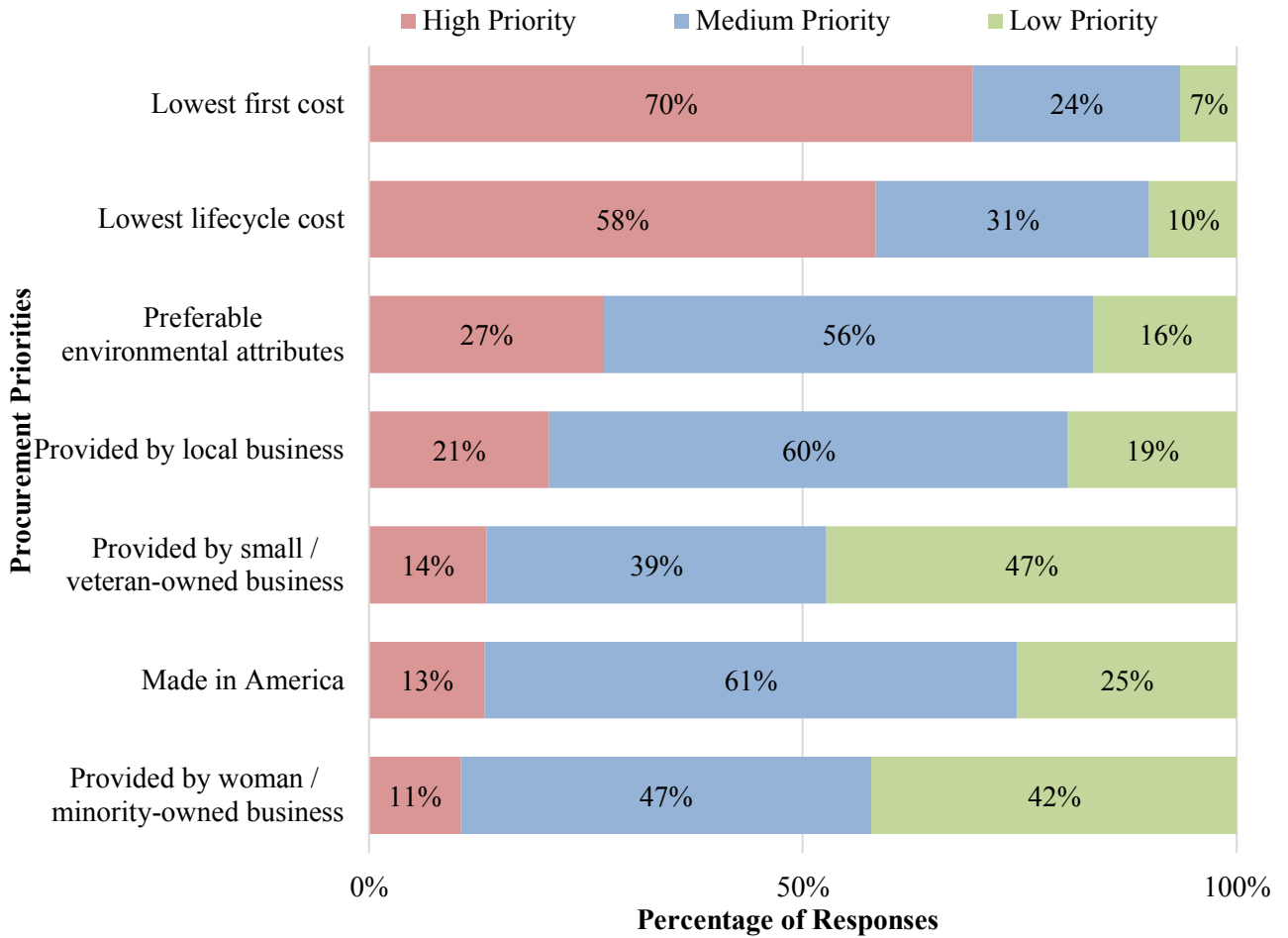
Figure 6. Priority level for each procurement attribute.

This data suggests that product costs considerations (first and lifecycle) are the primary product attributes in procurements. This represents both a barrier and an opportunity for the adoption of DER products. Some DER products have high first cost with low lifecycle cost, which means organizations may prioritize selections that result in low first but high lifecycle cost. On the other hand, DER products are often the most cost-effective in terms of lifecycle cost.

One respondent expanded on this question in an additional comment, noting that:

> ... *different stakeholders within each organization will prioritize these goals very differently. If the sustainability team is leading an initiative, you would see a very different emphasis and prioritization than most of the rest of the organization. Also, 'Made in America' becomes priority #1 if the project funding comes from state or federal agencies as that becomes a prerequisite to receive the funding. However, on non-state or federally funded projects, that goal becomes much less a priority.*

This response suggests that – unless there are formalized rules within the organization that stipulate certain priorities for purchasing – different roles within the organization may impact how priorities are acted upon and made. Further investigation into the extent to which procurement priorities vary based on roles within an organization might make an interesting topic for future study.

3.4. Tools

Current use of procurement tools

In Q13, the survey team asked respondents to indicate what procurement tools they currently had in place for purchasing. The most common tool among respondents (75%) was standardized contract templates, followed by purchase order requisition forms (66%). Less than half of respondents reported using standardized specification templates, while roughly a third of respondents reported that they were currently using E-procurement systems and software tools for contract development (Figure 7). 7% of respondents selected 'Do not know.'
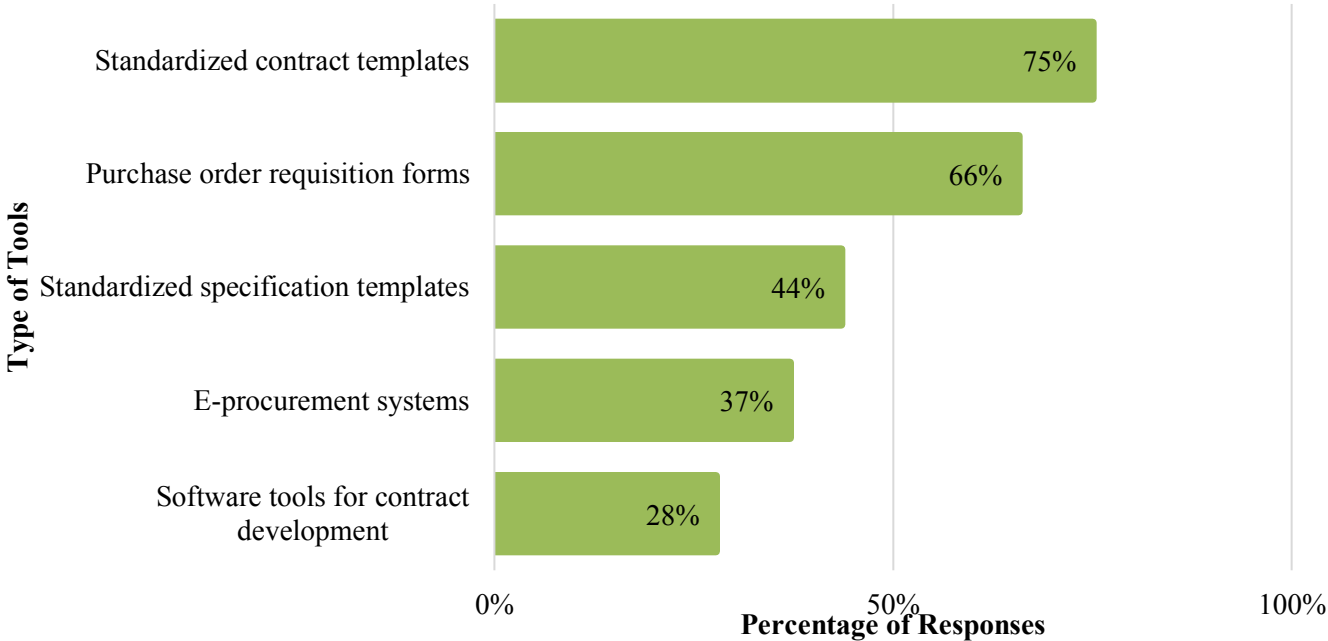

Figure 7. Type of tools respondents currently use for procurement

These results largely support the assumptions that organizations have some form of standardized tool currently in place to assist with procurement – particularly in the public sector, where organizations may be required to follow a more regulated procedure for procurement. It is interesting to note that E-procurement systems polled relatively low across both sectors. These findings might suggest a need for new E-procurement systems, particularly those that list DER products and sellers.

In Q15 and Q16, respondents were asked to list the names of specific e-procurement systems and contracting software tools used in their organization. Respondents listed the following:

- eGordian
- Coupa
- Jaggaer
- Smart by GEP
- Perfect Commerce
- Agency's ORACLE System
- CMAS
- GSA's eBuy System
- Ariba
- Ivalua
- PeopleSoft
- Galaxy
- Scout RFP
- Planet Bids
- Business Plus
- Colbi
- Docusign

Some respondents replied that they did not wish to list the name of their specific procurement tools, preferring to keep them confidential. This could be attributed to the fact that organizations see certain procurement tools as providing competitive advantage, perhaps by allowing them access to certain product discounts or vendors.

Limitations of current procurement tools

Q14 asked respondents how easy it would be to use their current procurement tools to buy a new unfamiliar DER product. A majority of respondents (44%) reported that it would be 'Somewhat difficult' to buy a new DER product using existing tools (Figure 8).
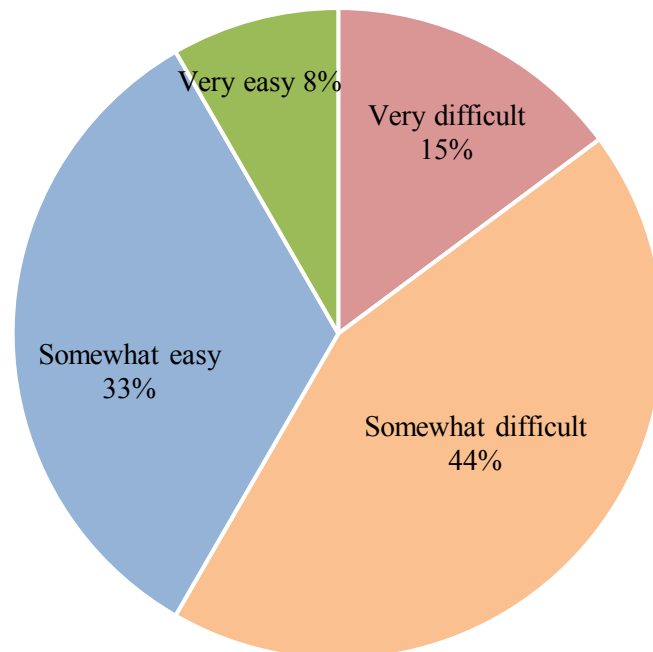

Figure 8. Difficulty of procuring DER technologies

These responses uphold the prior assumption that existing procurement tools do not make it easy for organizations to specify and purchase DER technologies and may act as a potential barrier to the uptake of DER products. Current contracting tools or E-procurement systems often do not provide enough information or contract language specific to DER products, which means they can be overlooked during the contracting or purchasing process. These results suggest there may be a need for a more specialized procurement tool that automatically includes or even prioritizes DER products for users.

Procurement phases bottleneck

To identify the areas in the procurement process where organizations faced the greatest difficulty, respondents were asked in Q8 to select the phases of procurement that most frequently created a bottleneck for their organization. A majority of respondents named 'Specifying and selecting products' as the phase most likely to become a bottleneck, and of those, 30% of respondents noted that this occurred 'Always' and 59% of respondents reported that this occurred 'Often.' 'Gaining approvals' was the next most commonly selected likely bottleneck phase, followed by 'Developing contract documents' (Figure 9).
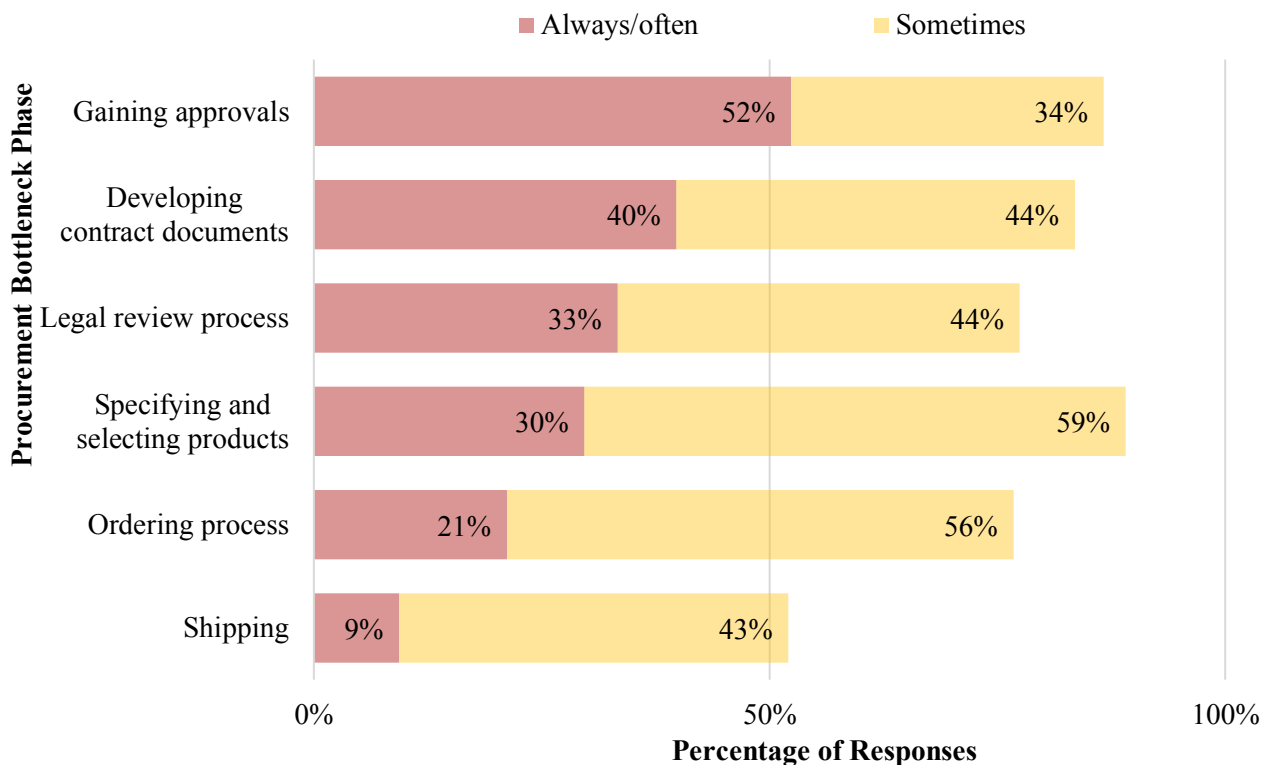

Figure 9. Gaining Approval and developing contract documents are the most common bottleneck

The high ranking of 'Specifying and selecting products' indicates that California organizations are struggling to find products or get accurate information about products they wish to buy. This

could suggest an insufficiency or lack of existing tools to help buyers specify products. Tools that provide better product information and are easier to navigate might help address this barrier.

A majority of respondents indicated 'Gaining approvals' as the most common bottleneck during procurement. This suggests that many respondents encounter challenges getting buy-in from top management when trying to make purchases for their organization. Lack of buy-in from these roles represent a significant barrier to the procurement of DER products.

Additionally, 'Developing contract documents' is ranked as the second most common bottleneck, which offers further evidence of limitations with existing procurement tools at California organizations. A majority of respondents reported they use standardized contract templates and purchase order requisition forms, which should make it easier to develop contract documents. However, 'Developing contract documents' was still reported as a frequent bottleneck by a majority of respondents. This could imply that the current contracting tools in use are not effective procurement aids. These findings reiterate the assumption that existing tools might current act as barriers to the DER purchasing process.

Cal-OP ACE offerings of tools and services
In Q18, the respondents were asked to select which tools and services they would find useful. All options were selected as useful regardless of respondents' sector or product category they procure. The tools and services ranked most useful were technical specifications for DER products, an online portal for connecting with DER vendors, networking and training events, and an online database of DER products (Figure 10). Among the 99 respondents that selected 'Technical specifications for DER products,' 48% indicated that this tool would be most useful to their organization. Ninety-nine (99) respondents also selected 'Online database of DER products,' of which 39% of respondents indicated as most useful. Following these top two most commonly selected offerings, 98 respondents selected both 'Networking and training events' and 'Online portal for connecting with DER vendors.'
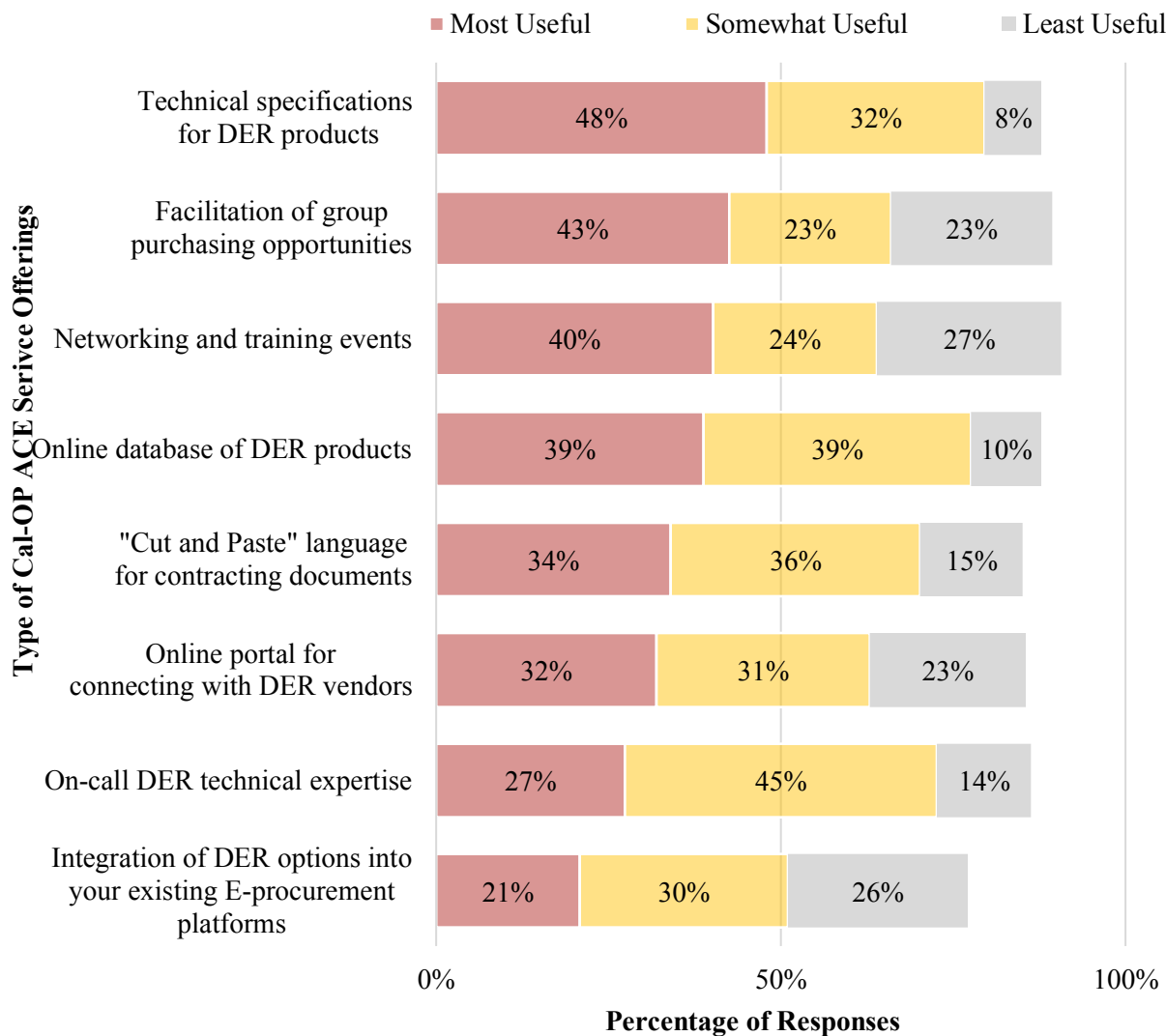
Figure 10. Ranking of Cal-OP ACE Program offerings

One notable exception would be 'Integration of DER options into your existing e-procurement platforms,' for which 23% of respondents selected 'N/A.' This finding is consistent with results from Q13, which showed a smaller number of respondents have E-procurement systems currently in place. They would therefore not require this particular program offering.

Data from Q18 suggest that California organizations have a clear need for better tools. The fact that 'Facilitation of group purchasing opportunities' ranked among the top three most useful tools and services could relate to findings from Q9 indicating California organizations may be concerned with the high cost of new DER technologies. Services that help offset these costs, such as joining a purchasing group, may thus be highly useful to buyers.

Additional data on desirable services was obtained from Q20, where respondents were asked to leave any additional comments for the Cal-OP ACE research team. Several respondents further reiterated that 'help with cost' would be useful to their organization. As one respondent wrote:

> *The more [the program] can demonstrate a good life-cycle cost for the more sustainable options, the more successful [the program] can be. For many DER products business case development happens by a small team of energy SMEs and any support they can get is helpful. Traditional procurement professionals in corporate real estate often have no idea how to evaluate DERs and so the success depends on the small team of SMEs or energy managers to make a successful business case to the procurement managers. The impulse for traditional procurement organizations seems to always be first cost, and so, strong corporate goals in sustainability can help cut across these divisions, to shift to life-cycle cost perspective.*

Another respondent replied that they would like to see 'Energy auditing services' added to the list of program offerings. Finally, one respondent noted that 'Having a non-vendor space to discuss products and outcomes where [buyers] are not being sold is extremely useful." These comments provide some interesting directions for further study, perhaps in the form of in-depth interviews.

3.5. Products

Organization's Annual Spend on DER technologies
In Q6, respondents were asked what products and services they procure and to then assign a dollar value to each category. The top four most common budget spending categories were products and services related to MR&O, energy retrofit, and new construction & renovation (Figure 11). However, ranking by dollar value spending, the top four spending categories changes to products & services related to New Construction & renovation, MR&O, IT appliances, and energy retrofit (Figure 12). Only 30% of respondents indicated they procure laboratory/medical products & services. This may be skewed due to the respondent make-up as discussed in the "Demographic" section.
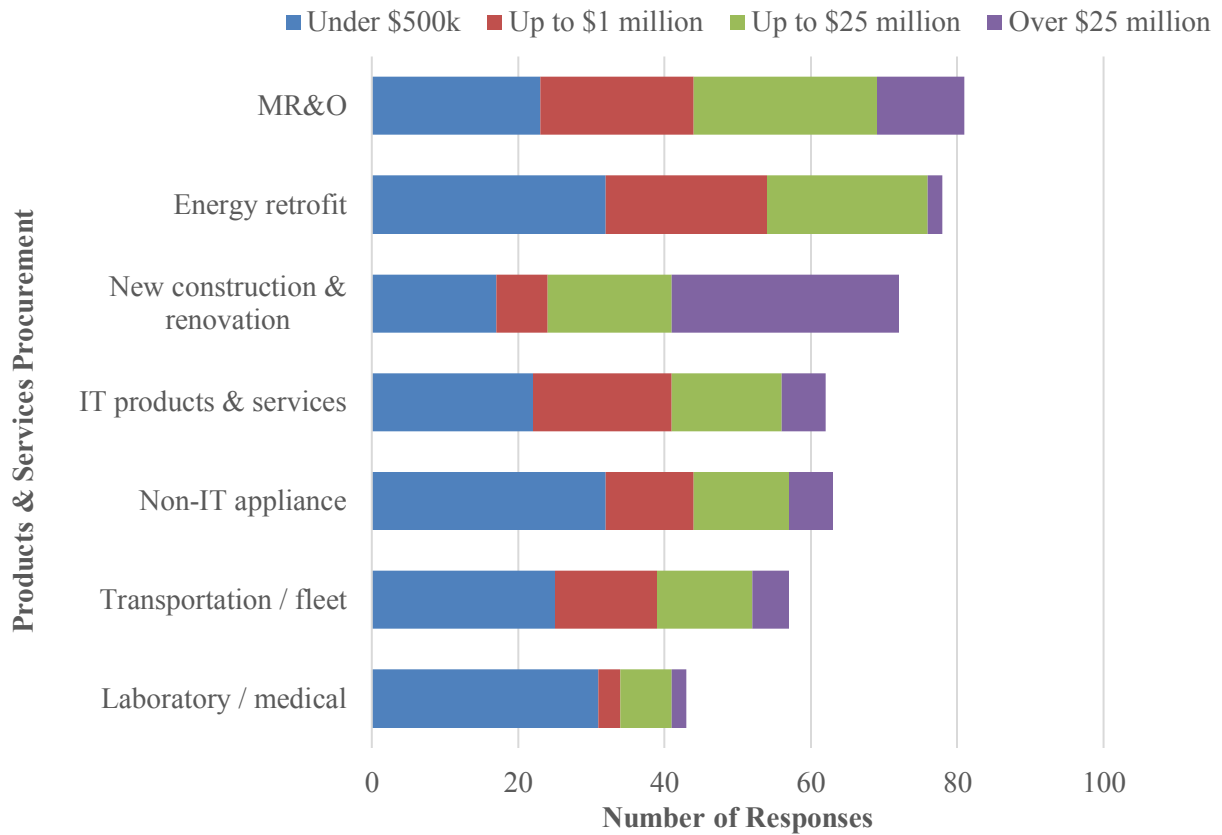
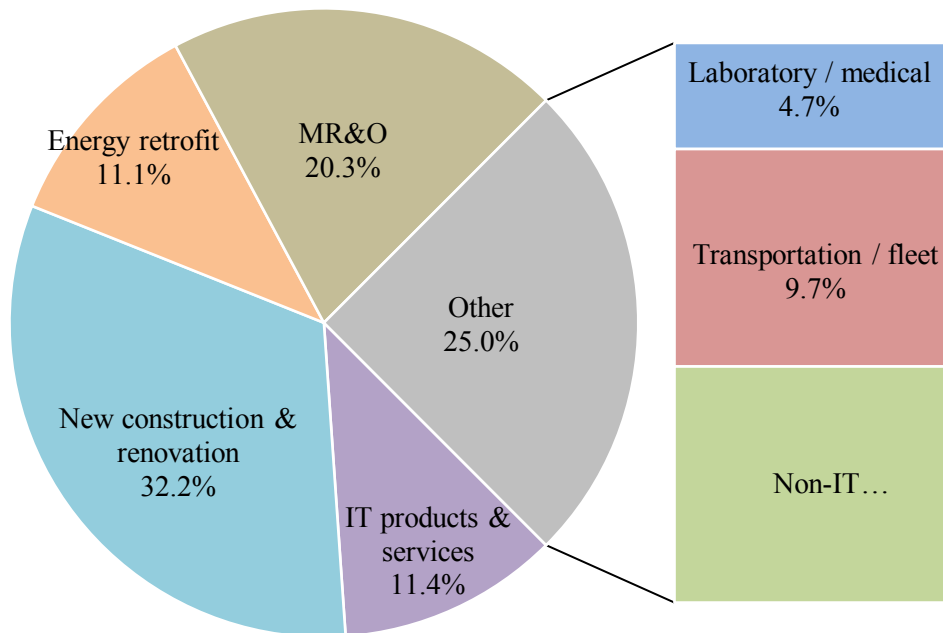Figure 11. Annual Budget Spending per procurement category

Figure 12. Converting responses to dollar value, which shows organizations are allocating more budget on new construction & renovation

Five-year Budget Planning

Respondents were asked in Q17 what products will be a purchasing priority in the next five years. The top five most commonly selected product categories were 1) HVAC equipment, 2) Lighting equipment & lighting controls, 3) building envelopes, 4) distributed storage technology, and 5) distributed generation (Figure 13). When ask to indicate which would be a high priority, the top five prioritized products were 1) HVAC equipment, 2) distributed generation, 3) lighting & lighting controls, 4) EV charging technologies, and 5) distributed storage technologies (Figure 14).
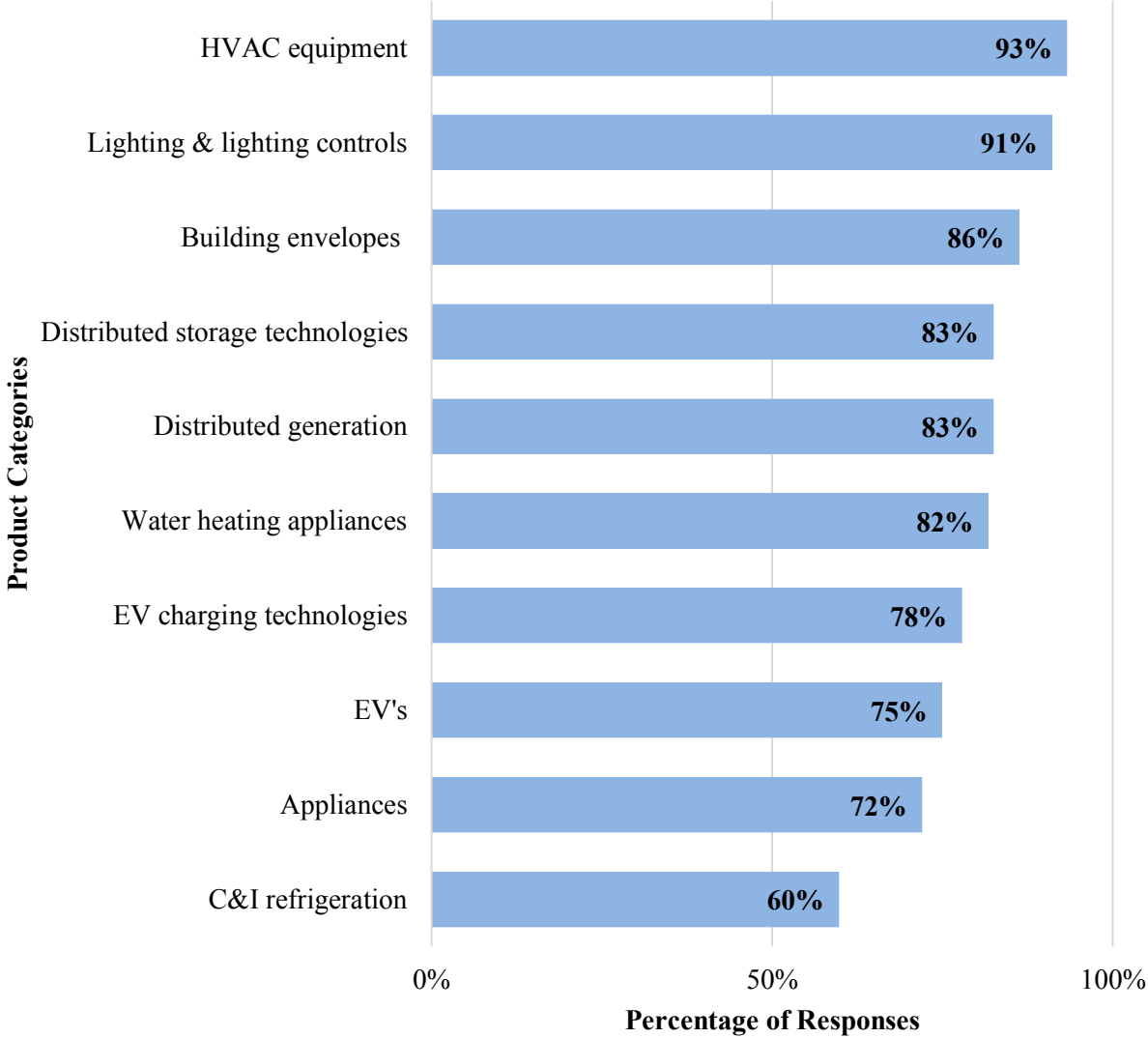
Figure 13. 93% of respondents indicate their organizations will procurement HVAC equipment in the next five years
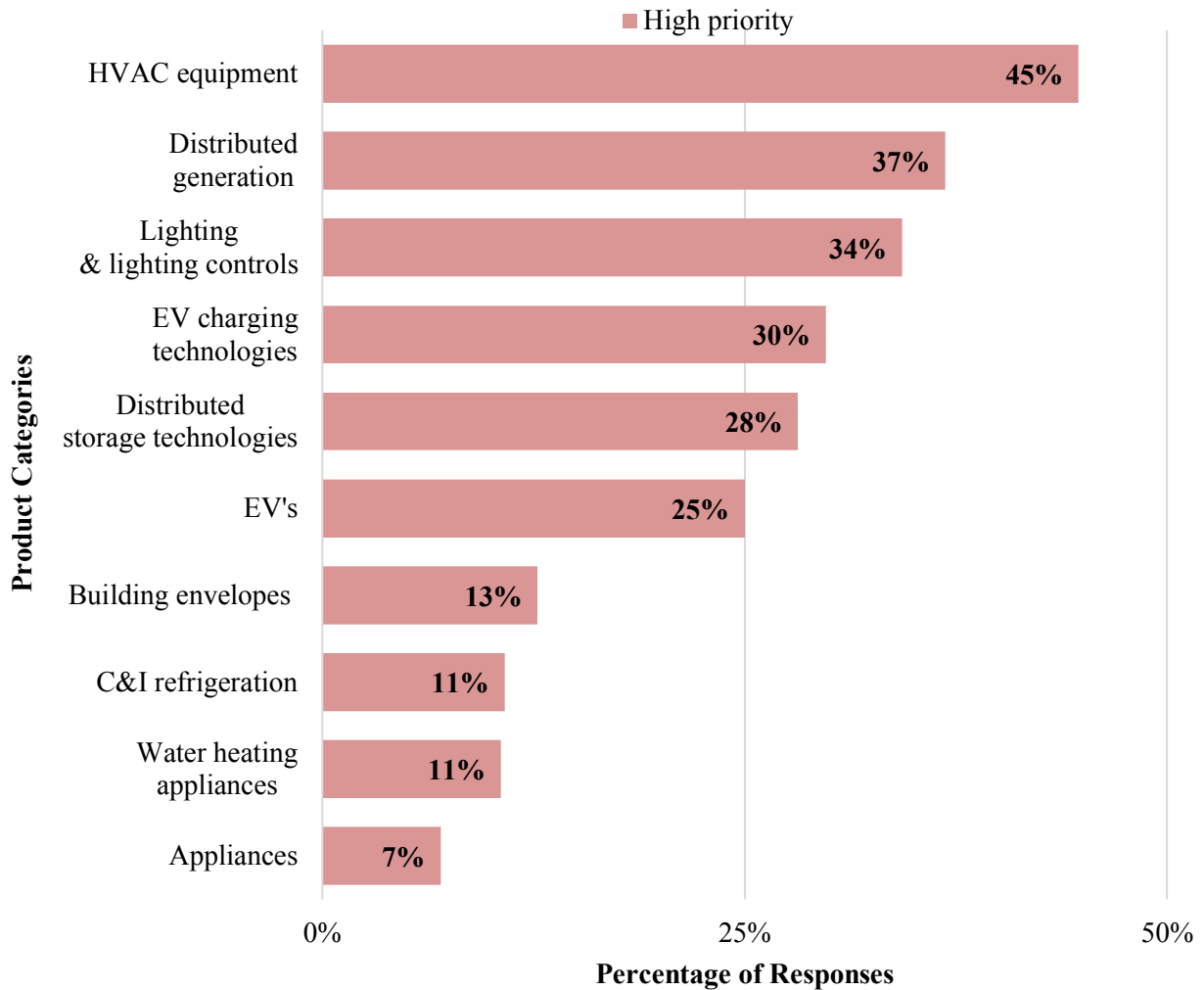
Figure 14. Over 1/3 of organizations highly prioritize HVAC equipment, distributed generation, lighting & lighting controls technologies in their five-year budget planning

This indicates that organization in California are both planning to buy and prioritizing HVAC equipment, lighting and lighting controls, and distributed storage technologies. Even though many organizations are purchasing building envelopes, they are not high priority products. Moreover, only 83% of respondents indicated they will procure distributed generation technologies in the next year, close to half of those respondents (or 37% of overall respondents) indicated it is a high priority product. This suggests organizations that are interested in distributed generation are ramping up their effort rapidly and may need additional procurement support.

Prevention factors when procuring new DER technologies
In Q9, the survey team sought to understand what is preventing organizations from procuring new DER technologies they have never bought before. Sixty-six (66%) of the respondents

selected high cost/long return on investment is "Always/Often" a factor preventing their organizations from procuring new DER technologies (Figure 15). Followed by lack of financing options, lack of top management support, interoperability with existing equipment, and operational reliability. This result aligns with the hypothesized barriers stated in the "Procurement Resources Summary" developed by LBNL as mentioned in section 1.3 of this document.
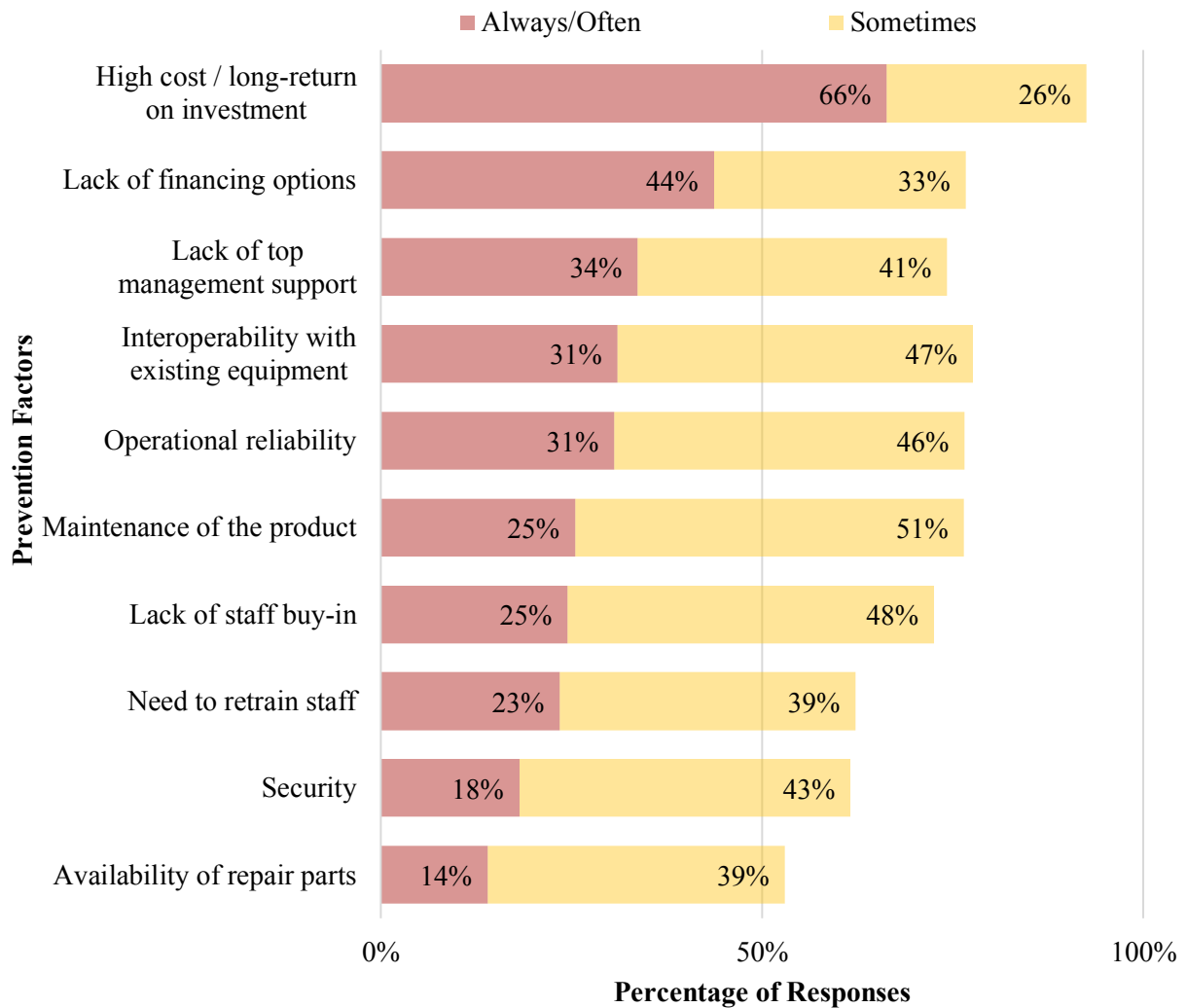

Figure 15. High cost/long return on investment and lack of financing options are the most common prevention factors when procuring new DER technologies

The significant level of concern regarding high initial cost and long return on investment suggests that innovative financing options would be an effective tool in helping organizations procure new DER technologies. The lack of top management support suggests cohesive stakeholder engagement is needed in developing buy-in and implementing energy strategies. Concerns with operational reliability and interoperability with existing equipment suggest DER sellers need to produce accurate testing results, demonstrations and product information to reassure potential buyers.

Need for additional support per product category

In Q19, the survey team sought to determine for which product categories buyers would find procurement support services useful. The top two most commonly procured product categories from the five-year budgetary planning horizon (Q17) are HVAC equipment and lighting and lighting controls (Figure 13), however, those are not the product categories where additional program support resources are indicated to be most useful by respondents.

Organizations might find additional support very helpful for distributed storage and building controls technologies (Figure 16).
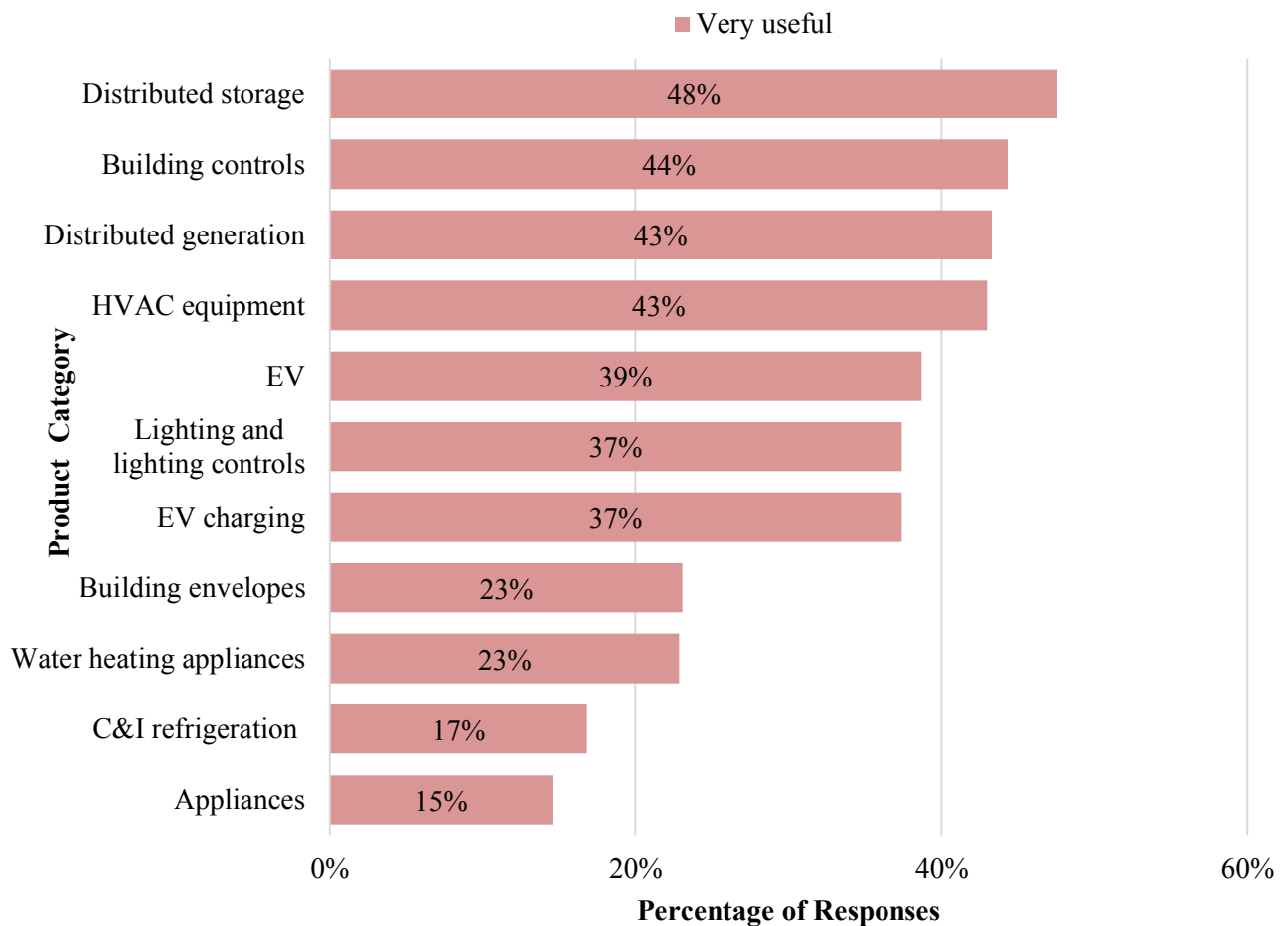
Figure 16. Close to half of respondents indicated additional support in building controls and distributed storage technologies would be very useful.

Responses to this question suggest that organizations need more support in relatively new DER technologies such as building controls, distributed storage, distributed generation, and EVs.

3.6. In-depth Analysis: One-way analysis of variance (ANOVA)

Building on these initial findings, a one-way analysis of variance (ANOVA) tests was conducted to reveal more in-depth relationships and trends. Statistical significance was tested for differences between independent groups (e.g., sector, product category, etc.). The goal of these tests is to answer the following questions:

1) Do different sectors have the same institutional procurement behavior?
2) Do different sectors face the same barriers when procuring DER products?
3) Do different roles within organizations have the same perceived organizational behavior?
4) Do different roles within an organization have the same perceived organizational barriers when procuring new DER Products?
5) Do organizations that often use preferred vendors have more difficulty when purchasing new DER products?
6) Are unique support initiatives needed for different DER technologies?

Due to the limited responses currently, the Fisher's exact test was used to test for independence and calculate p-value[3]. At 108 responses, it was possible to achieve a confidence level of 95% with a 10% margin of error in conducting the data analysis[4]. Below is a discussion of the potential for statistical significance and an interpretation of what the results implicate for each category of question listed below.

Differences in Sectors (Public vs. Private Organizations)
This section shows the results for ANOVA tests regarding differences and similarities (i.e. independence) between public and private sectors. The proxy questions for institutional procurement behavior revolves around the "Roles, Rules, Tools" questions:

1. The type of roles the respondents take on,
2. Perceived major influencers in procurement,
3. Prioritized procurement goals,
4. What product categories are prioritized in five-year budget planning,
5. What are the procurement bottlenecks,
6. The type of tools used in procurement

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[3] P-value is a measure of the strength of evidence against the null hypothesis tested. Null hypothesis always assumes there are no differences between testing groups (i.e., it is assumed that both public and private sectors have the same major influencers).

[4] A significance level (alpha) of 0.05 was used. Resulting p-value less than 0.05 suggests statistically significant differences between the groups

Another series of test was conducted to see if sectors have different barriers when procuring DER products. The proxy questions for barriers are questions regarding the level of difficulty in procuring new DER technologies and prevention factors in purchasing new DER technologies.

The overall findings suggest there is not enough evidence to conclude a statistically significant difference in the institutional behavior and procurement barriers between public and private sector institutions. However, the data collected and analyzed exhibit some slight differences between public and private organizations on specific questions that is worth noting.

Roles in public and private organizations

When comparing the different types of major procurement influencers found in each sector, there is similar results to that shown in Section 3.2. The most common type of influencer found in both public and private sectors is managing/developing projects (Figure 17). This similarity suggests both public and private sector organizations are comparable in overall procurement process and in staff roles seen in the procurement process[5].
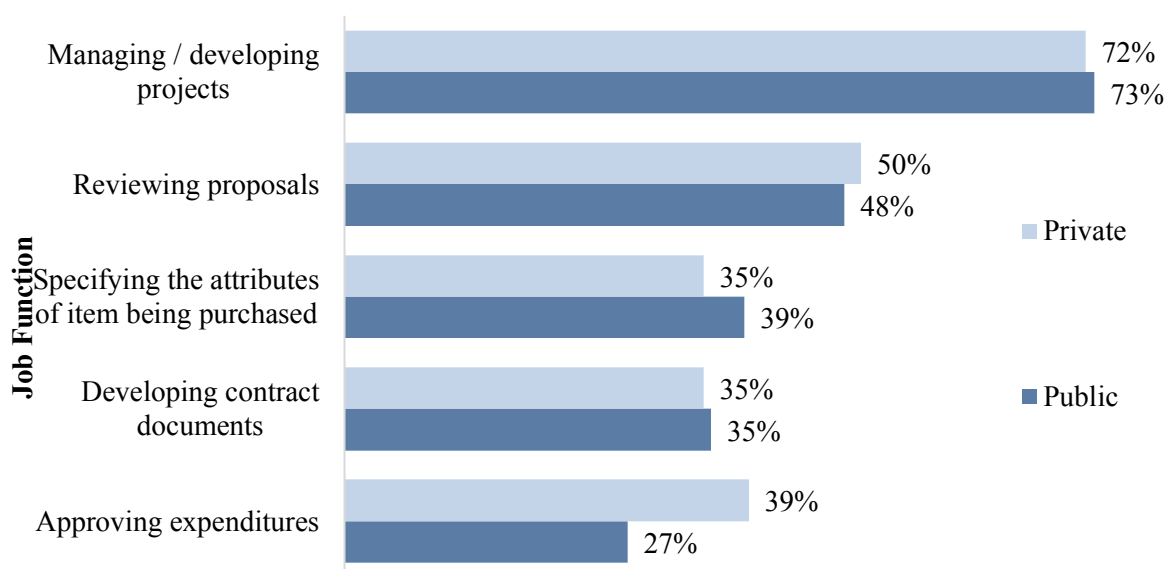
Figure 17. The similar distribution of roles per sector suggest similar roles are needed across sectors

Major Influencer in public and private organizations

The top three major influencers in public and private organizations are the same – facilities manager/engineer, energy manager, and chief financial officer. However, the ordering is different. Respondents in the private organizations seem to indicate Chief Financial Officer is the most influential, whereas respondents in the public organizations indicate facilities

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[5] Fisher's exact test yield a P-value of 0.4

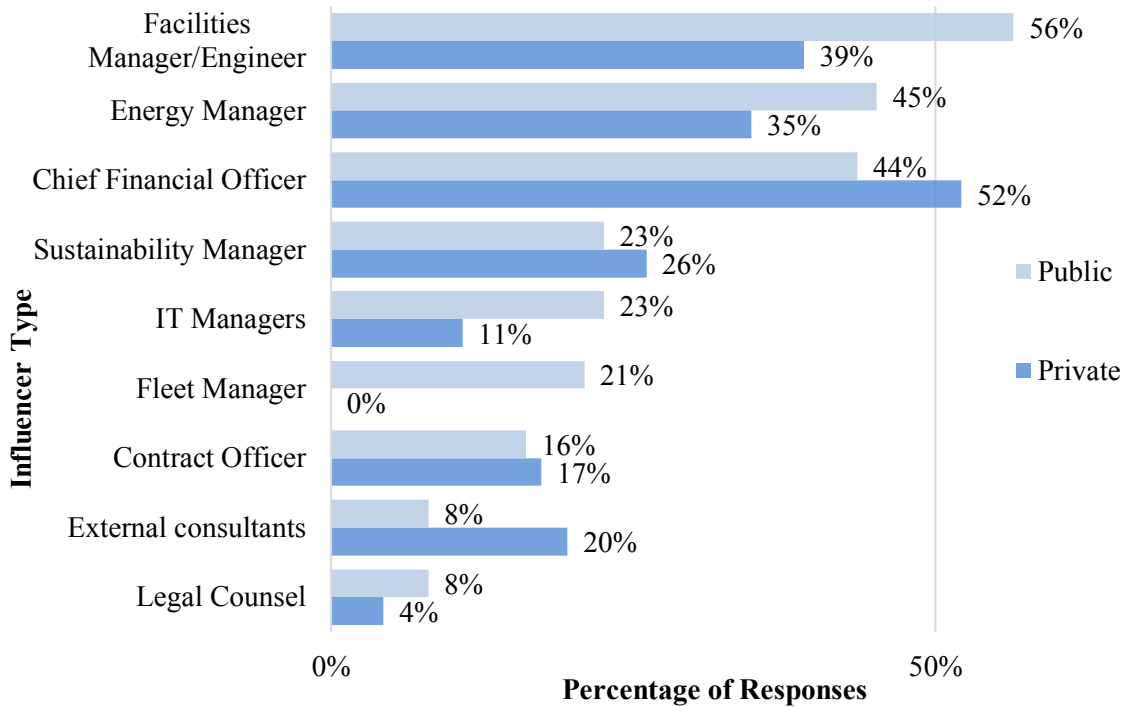manager/engineer and energy manager are most influential (Figure 18).

Figure 18. Public and private sectors seem to have different major influencers

Analysis revealed a statistically significant difference in major influencers between the public and private sectors[6]. However, this may change with a more robust dataset. These differences indicate a need for the program to frame DER technology adoption based on who the major influencers are in an organization by emphasizing how program tools and services will address their respective needs and goals.

Procurement priority in public and private organizations
Both the public and private organizations have the same top three procurement priorities - lowest lifecycle cost, lowest first cost, and preferable environmental attributes (Figure 19). There seems to be slightly different emphasizes on lowest first cost in the public compared to private organizations. This may be due to the nature of public procurement. For example, the federal procurement community widely uses "Lowest Price Technically Acceptable" solicitation method which inherently favors cost factors. In California state procurement, "lowest responsible bidder" (LRB) approach in vendor selection is widely used also inherently biasing cost factors. Based on a California's Legislative Analyst's Office (LAO) report from 2017, California's Department of General Services created pilot programs authorizing the use of best value (BV) evaluation instead of LRB approach in the procurement of goods and services on a demonstration at the

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[6] Fisher's exact test produced a p-value of 0.015

California Community Colleges (CCC) and the University of California (UC) campuses. However, the assessment showed the majority of BV contracts still awarded to the lowest bidder since the BV evaluation method still favors lowest priced bids.
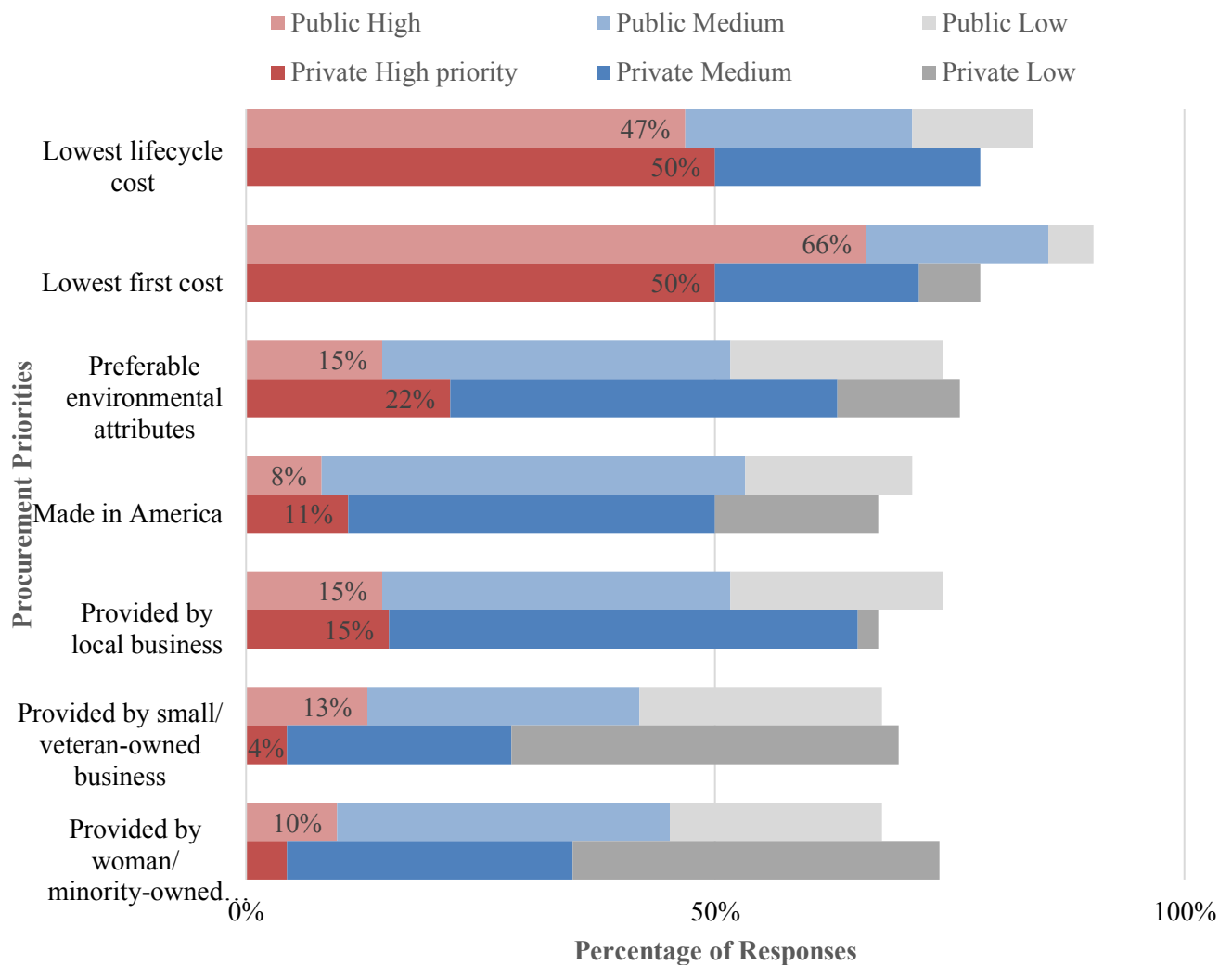

Figure 19. Both the public and private sectors have the same top 3 procurement priorities

The test showed no statistically significant differences in overall procurement priorities between the public and private organizations. However, there are different legal and regulatory requirements for public and private sectors that would affect how they prioritize certain purchasing factors[7]. In addition to the regulatory emphasis on lowest cost common in public sector procurements, there are other policy priorities which require a percentage of public procurement to be provided by small/veteran-owned businesses. This suggests DER sellers would benefit from marketing their technology based on the policies and regulations in place that constrain DER technology procurement.

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[7] Fisher's exact test produced a p-value of 0.105

Five-year product procurement planning in public and private organizations

Both the public and private sectors indicate HVAC equipment, distributed generation, lighting & lighting controls are the top three priority product categories in their five-year budget planning processes (Figure 20). There are slight differences in product category prioritization regarding EV charging, distributed storage, and C&I refrigeration technologies between public and private sector institutions.
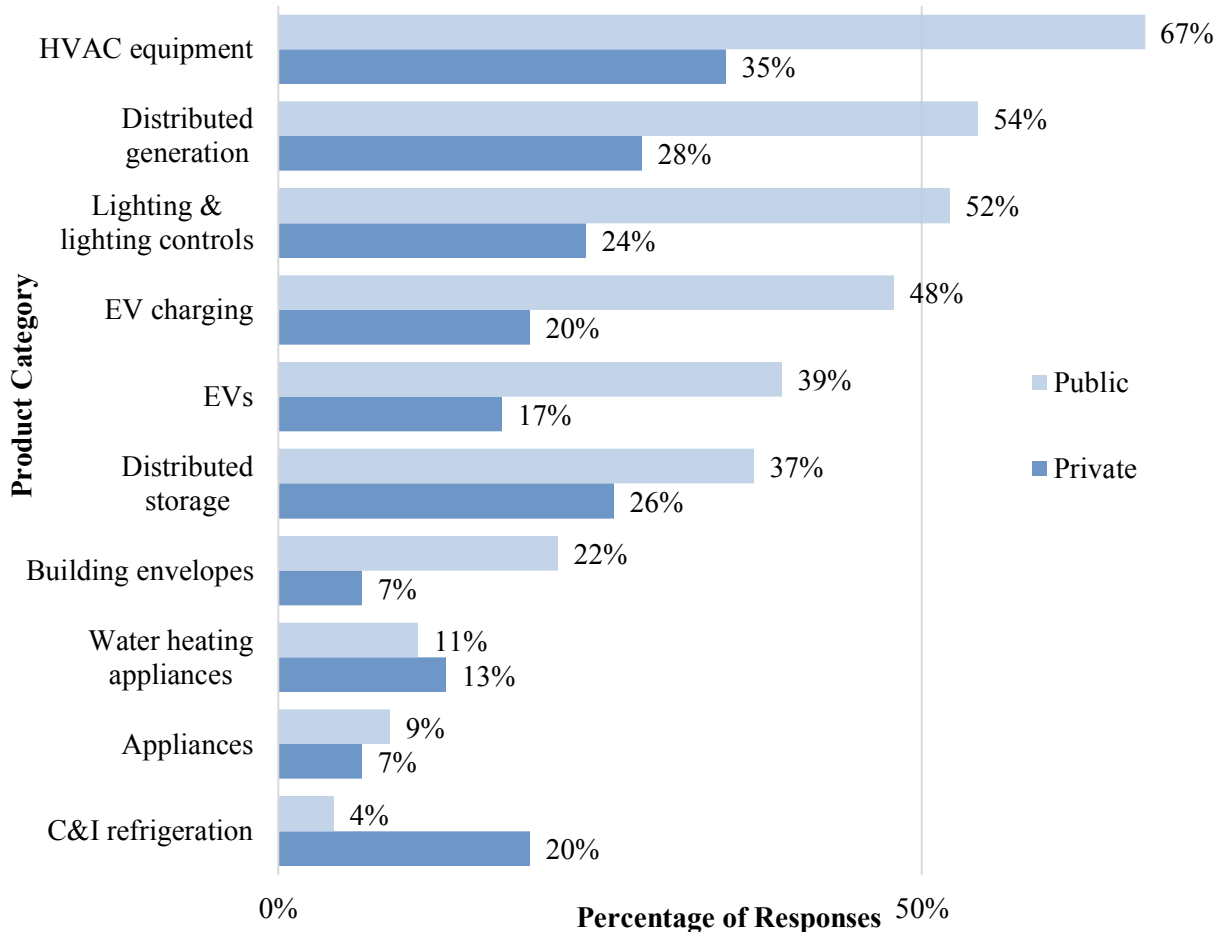

Figure 20. Both public and private organizations prioritize HVAC equipment, distributed generation, lighting & lighting controls in their five-year budget planning

There are no statistically significant differences in product prioritization between the public and private sectors[8]. However, this result shows three product areas that the program should prioritize – HVAC equipment, distributed generation, and lighting & lighting controls.

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[8] Fisher's exact test produced a p-value of 0.126

Tools used during procurement in public and private organizations

The percentage of responses and distribution of tools indicated in use during the procurement process is similar between public and private organizations (Figure 21). The similarity in tools use further add to the idea that procurement processes across public and private sector share many common elements.
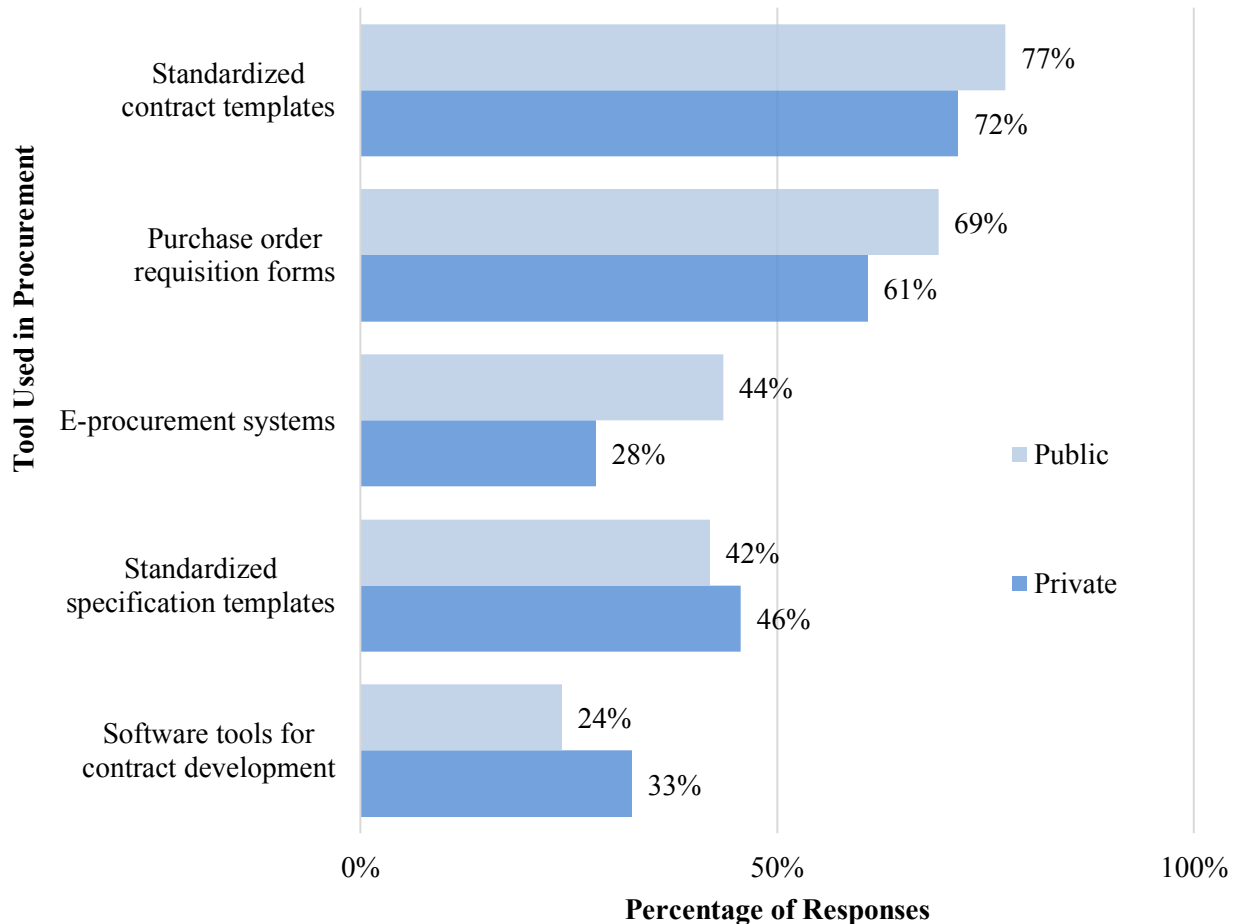

Figure 21. Public and private organizations use similar tools to procure DER technologies

There are no statistically significant differences in procurement tools used between the public and private sectors[9].

Procurement Bottleneck in public and private organizations

Both public and private sector organizations indicated gaining approval is the most common procurement bottleneck (Figure 22).

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[9] Fisher's exact test produced a p-value of 0.633
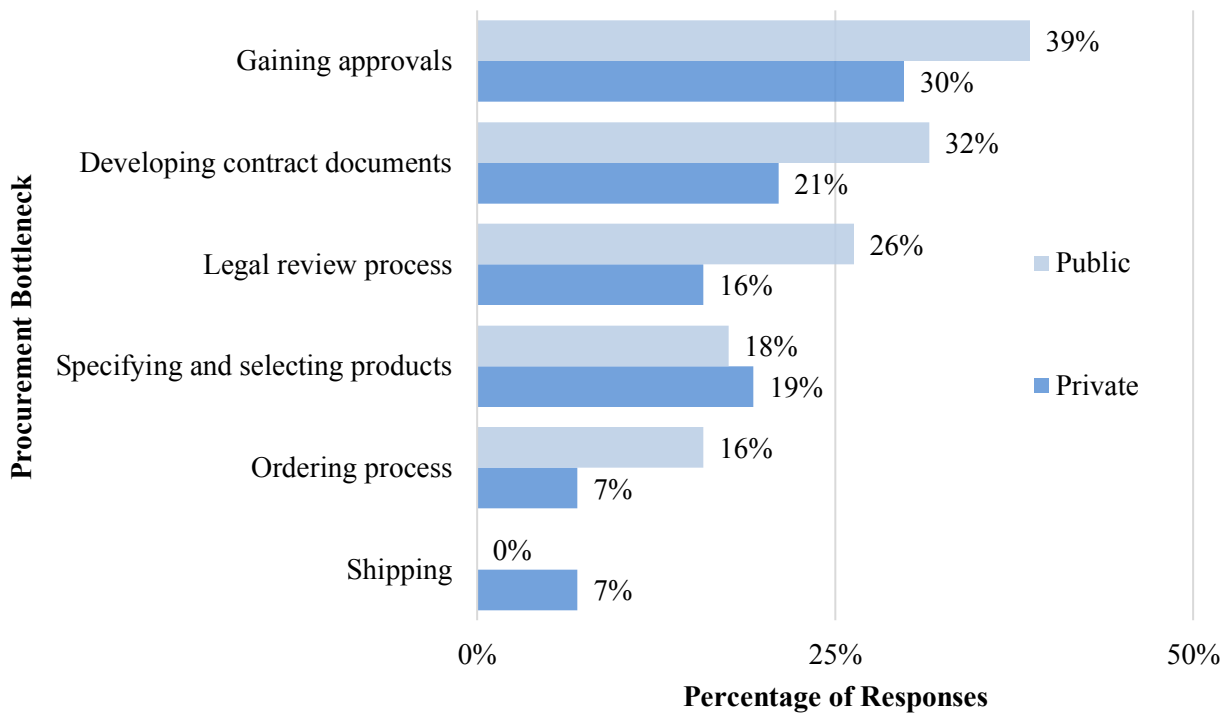
Figure 22. Both Public and private organization have similar bottlenecks during procurement of DER technologies

There are no statistically significant differences in procurement process bottlenecks between the public and private sectors[10]. This indicates that both sectors have similar procurement processes and face similar barriers. Resolving these bottlenecks would thus equally benefit organizations in both sectors.

Level of difficulty in procuring new DER for public and private organizations

Results show over 50% of respondents from both public and private organizations have difficulty procuring DER technologies (Figure 24). This suggests that challenges reside in both sectors and additional support is needed.
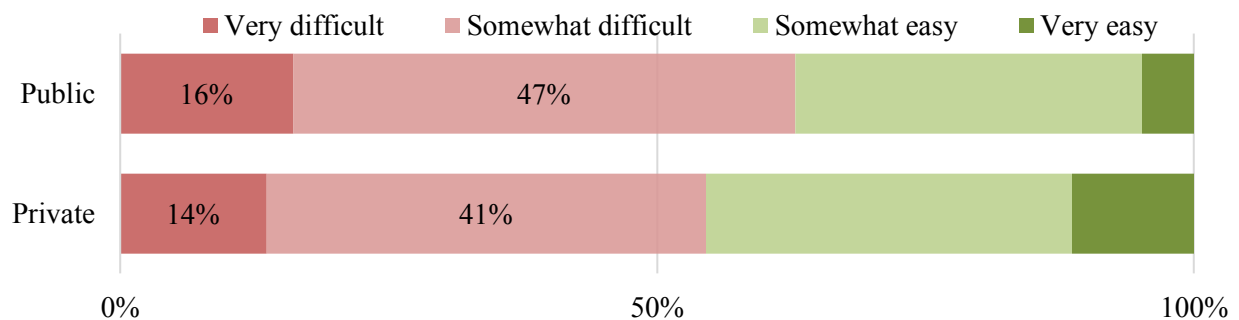
Figure 23. Both public and private sector organizations have difficulty procuring new DER technologies

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[10] Fisher's exact test produced a p-value of 0.185

Procurement Prevention factors in public and private organizations

High cost/long return on investment and lack of financing options are the most common prevention factors in both public and private sector organization for procuring new unfamiliar DER technologies (Figure 24). This is consistent with the result for procurement priorities in Q17 where both public and private organizations were shown to be highly concerned with the lowest lifecycle cost and lowest first cost (Figure 19).
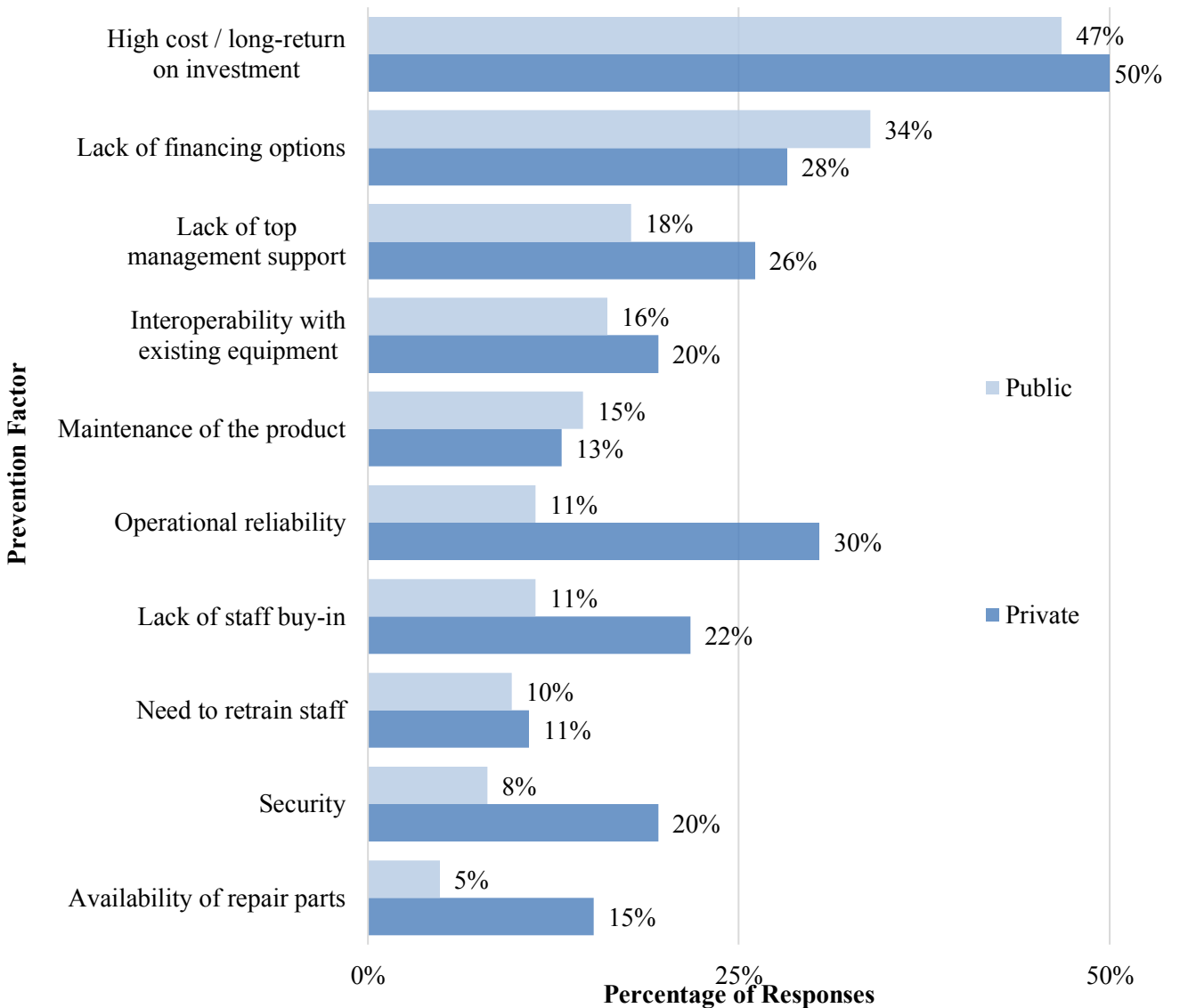

Figure 24. Both public and private sector organizations have similar procurement prevention factors

There are no statistically significant differences between public and private sectors regarding procurement prevention factors[11]. Based on the number and distribution of responses, the average private organization respondent selected three prevention factors, whereas the average

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[11] Fisher's exact test produced a p-value of 0.45

public organization respondent selected only two. This suggests that private organization respondents tend to face more prevention factors than public organizations respondents.

Additional support needed for public and private organizations
While both public and private organizations find all services to be useful, there are slight differences in their needs. Close to 50% of public sector respondents indicated technical specifications for DER products and facilitation of group purchasing opportunities to be most useful, while only 33% and 20% of private respondents find those support services most useful respectively (Figure 25). The private sector respondents indicated that an online portal for connecting with DER vendors and an online database of DER products would be the most useful support.
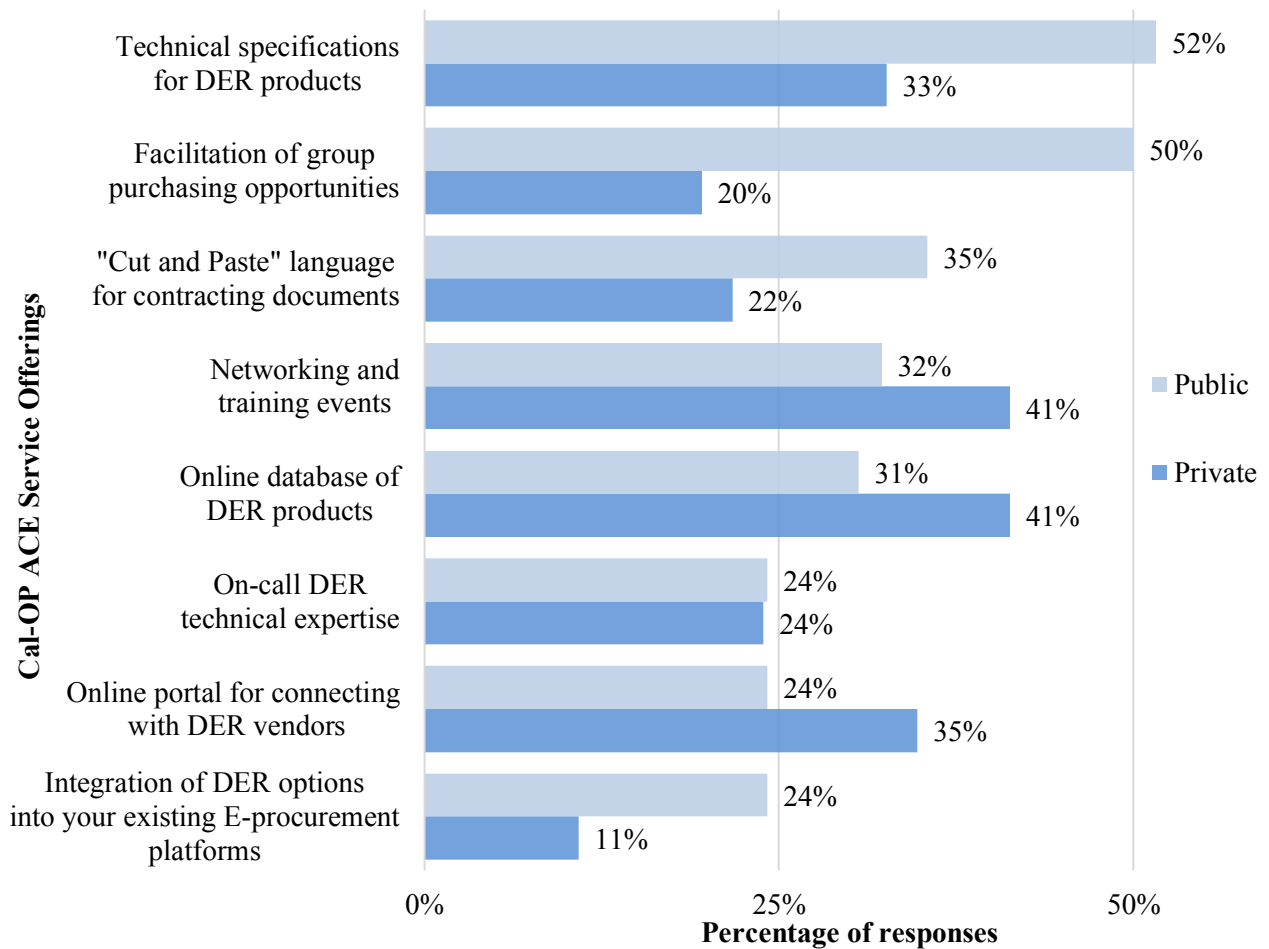
Figure 25. Ranking of most useful support is slightly different for public and private sector organizations

There were no statistically significant differences found in the additional support needed between public and private sector organizations[12]. The results were close to a level of statistical

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[12] Fisher's exact test produced a p-value of 0.067

significance, so the survey team conducted additional market research to supplement this finding. Market research suggests group purchasing is more common in public sector procurements, which may explain the difference between public and private sector respondents with regard to facilitation of group purchasing.

Differences in Roles and Rules

This section shows the results for ANOVA tests regarding differences and similarities between roles and rules in effect within organizations. The Fisher's exact test was conducted to determine differences in institutional procurement behavior between different procurement actors. The proxy questions for institutional procurement behavior revolves around the "Roles, Rules, Tools" questions:

1) Perceived major influencers in procurement (Q7)
2) Product categories prioritized in the five-year budget planning (Q17)
3) Procurement bottleneck (Q8)
4) Type of tools used in procurements (Q3)

Another series of tests was conducted to examine if organizations with different rules have the same barriers when procuring DER products. The proxy questions for barriers are questions related to the level of difficulty in procuring new DER technologies(Q14) and prevention factors to purchase new DER technologies(Q9).

The overall findings suggest there is not enough evidence to conclude a statistically significant difference in the institutional behavior and procurement barriers among the different actors within organizations. However, there are some insightful findings among the similarities discovered.

Perceived bottlenecks for different roles

Overall respondents indicated the two most common bottlenecks encountered are gaining approvals and developing contract documents. The survey team assessed respondents who may be responsible for approving procurement and developing contract documents to analyze what bottlenecks they most commonly experience. Results from Q3 where respondents indicated they are responsible for "approving expenditures" are interpreted as roles in place during the gaining approval process. About 50% of those respondents who are in charge of approving indicated that gaining approval is a bottleneck (Figure 26). Furthermore, 50% of the respondents who develop contracts indicated developing contract documents is a bottleneck. This suggests there are potentially institutional barriers in place that prevent these actors from performing their job efficiently.
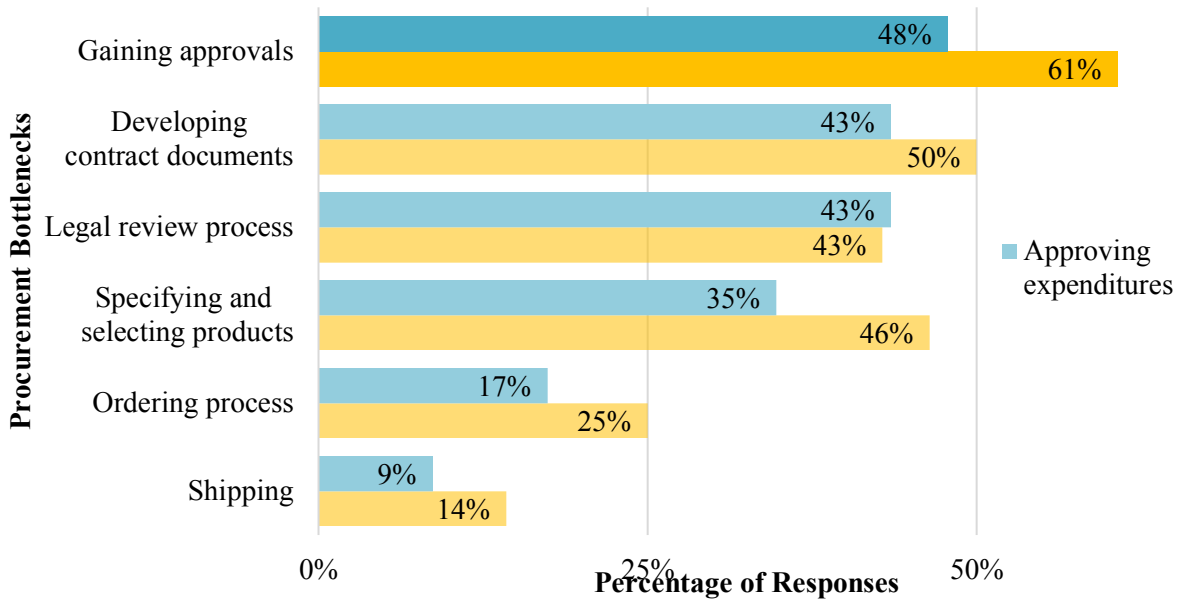
Figure 26. Different procurement actors indicated gaining approval as the most common bottleneck

There are no statistically significant differences in perceived bottlenecks for different roles[13]. This suggests that all actors in the procurement process experience similar bottlenecks – gaining approval and developing contracts. Better support, improved procurement tools, and increased transparency among different actors may help avoid continued delay during the approval and contract document development process.

Effect of using preferred vendors on the difficulty of purchasing new DER products
There is a general assumption that frequent use of preferred vendors may sometimes prevent organizations from working with new vendors, thus making purchasing new DER technologies difficult. This assumption was tested in the analysis by comparing different organizations that use preferred vendors at different frequencies. The result shows the level of difficulty of buying new DER does not correlate to the use of preferred vendors. Over 60% of respondents that never use preferred vendors indicated they still have difficulty procuring new DER technologies (Figure 27).
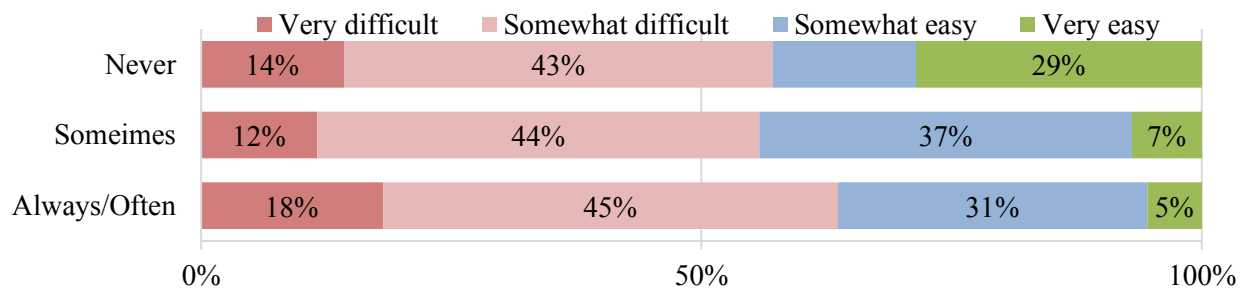

Figure 27. Use of Preferred vendor does not affect the difficulty of procuring new DER technologies

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[13] Fisher's exact test produced a p-value of 0.99

There is no statistically significant difference to suggest that using a preferred vendor would increase the difficulty level of procuring unfamiliar DER technologies. Other institutional barriers are likely more significant in preventing organizations from buying new DER technologies.

Differences in Product Procurement

This section shows the results for ANOVA tests to examine differences and similarities between procuring products. The questions examined were: 1) do organizations need additional support in the product types they prioritize in buying, and 2) would different product procurements benefit from different program support interventions?

Data on what products organizations prioritize in five-year budget planning (Q17), product categories where organization want more support (Q19), and what type of support would be most useful to organizations (Q18) were used to answered those questions.

Product category procurement and support needs

Results from Q17 indicated the top five highest priority product categories are: 1) HVAC equipment, 2) distributed generation, 3) lighting equipment and lighting controls, 4) electric vehicle charging technologies, and 5) distributed storage in their five-year budget planning. Results from Q19 showed that the top five product categories where organization would find additional support most useful are 1) distributed storage, 2) building controls, 3) distributed generation, 4) HVAC equipment, and 5) electric vehicles (EV's).

The product categories where there is overlap between the products organizations prioritize the highest and where they need the greatest support are HVAC equipment, distributed generation, distributed storage, and building controls[14]. These product categories were used to examine if the same type of support is needed across all technologies.

Support needed in different product categories

The four technologies mentioned above were assessed to examine what type of additional support would be most useful. The survey team extracted respondents who indicated additional support would be most useful for HVAC equipment (about 50% of overall respondents) and examined what those respondents ranked as the most useful Cal-OP ACE offerings. More than half of these respondents indicated that technical specifications for DER products would be most useful for HVAC equipment (Figure 29). The same analysis was conducted for distributed

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[14] "Building controls" was not provided as an option in Q17 because it is too similar to other procurement options – "HVAC equipment" and "Lighting and lighting controls". But it is a different technology option.

storage, distributed generation, and building controls. Technical specifications for DER products and "Cut and paste" language for contracting documents are highly desired services offerings for all products (Figure 29).
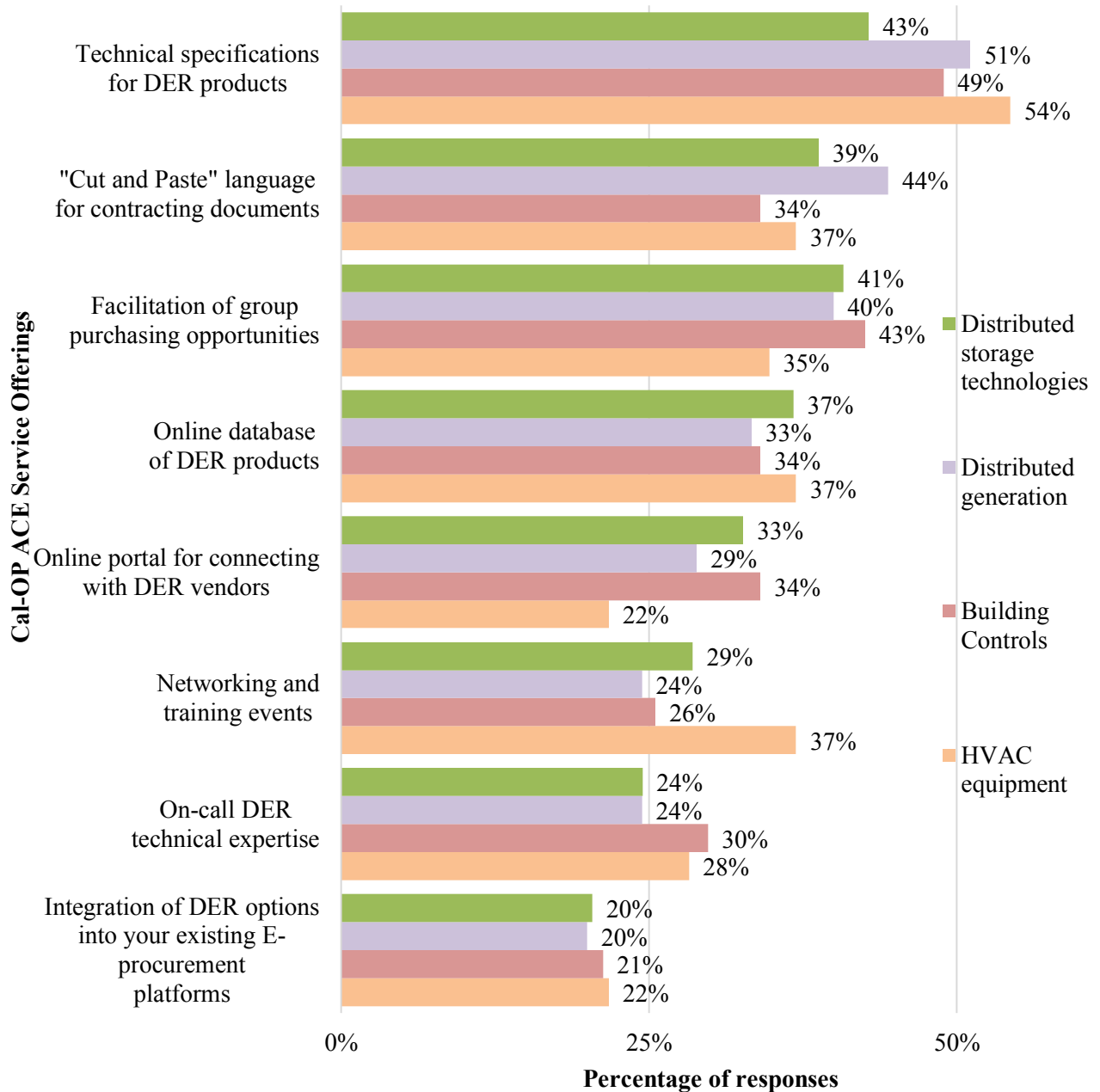

Figure 28. Respondents need similar additional support across all product categories.

There are no statistically significant differences in the type of additional support organizations need based on the products procured. This suggests all product procurement will benefit from the same type of support and all product procurement face similar institutional barrier during procurement.

4. Discussion

4.1 Barriers

Results from the survey provide evidence that competing priorities and lack of financing act as barriers to the adoption of DER products. This upholds two of the four prior assumptions about barriers[15]. In Q9, respondents were asked to select the most frequent DER procurement prevention factors which showed 'Lack of financing options' polled second highest regardless of organizational sector. Concern with the high cost of DER products was also evident in Q12, where respondents indicated that 'lowest first cost' was the top priority for purchasing. Because DER products may have high upfront costs, prioritizing lowest first cost could represent a barrier to the increased uptake of DER products.

Survey data was less clear in providing evidence that lack of incentives and lack of cohesive stakeholder engagement constitute significant barriers to DER adoption, as these were not directly addressed by survey questions. In Q9, 'Lack of top management support' was noted as one of the most frequent prevention factors for the purchasing of new DER products. While this does not directly address the issue of cohesive stakeholder engagement, lack of buy-in from top management could be due to insufficient information exchange between those who wish to prioritize DER products (e.g., end-users, sustainability managers) and those with higher decision-making power within the organization (e.g., CFOs). However, 'Lack of top management support' could refer to several other factors as well. Further research would be required to determine the extent to which the lack of top management support is attributable to stakeholder disconnect. Future studies could also expand on the prevalence and impact of stakeholder disconnect during procurement processes within California organizations.

Beyond the four hypothesized barriers identified in the *Procurement Resource Summary Memo* and listed in Section 1.3, the results revealed that limitations in existing procurement tools might be a contributing factor in the uptake of DER technologies within California organizations. In Q14, respondents indicated how easy or difficult it would be to buy a new DER product using current tools. A majority indicated that it was 'Somewhat difficult' or 'Very difficult' to buy new DER products with existing tools. Additionally, in Q8, when respondents were asked to identify which phases of their procurement process often became a bottleneck, they noted that developing contract documents was a frequent barrier -- even though a majority also responded they were currently using such contracting tools. These findings suggest that procurement tools currently in use by California organizations may be ineffective in enabling them to purchase new DER

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[15] The fours hypothesized barriers from the "Procurement Resources Summary" are competing priorities, financial structure, lack of incentives, and cohesive stakeholder engagement

technologies or may even actively preventing them from doing so, thus representing a further barrier to those assumed before the survey.

4.2 Summarizing Validity of Hypotheses

Due to the limited responses received, the survey team was only able to test and offer programmatic insight into the following questions:

1- Do public and private organizations have different institutional procurement behavior?

The overall findings suggest there is not enough evidence to conclude a statistical difference in institutional behavior between public and private sector organizations. However, the data does show that public sector organizations prioritize lowest first cost and social buying factors slightly more than private sector organizations.

2- Do public and private organizations face different barriers when procuring DER products?

The overall findings suggest that there is not enough evidence to conclude a statistically significant difference in the barriers faced among public and private sector organizations. However, the data show more private sector respondents have more barrier-type factors than public organization respondents.

3- Do different roles within organizations have different perceived organizational behavior?

The overall findings suggest there is not enough evidence to conclude a statistically significant difference in the procurement barriers among different actors within organizations.

4- Do different roles within an organization have different perceived organizational barriers when procuring new DER Products?

The overall findings suggest there is not enough evidence to conclude a statistically significant difference in the institutional behavior among different actors within organizations.

5- Do organizations that often use preferred vendors have more difficulty when purchasing new DER products?

The overall findings suggest there is not enough evidence to conclude a statistically significant difference in the difficulty of procuring new, unfamiliar DER technologies and how often preferred vendors are used.

6- Are different support services needed for different DER technologies?

The overall findings suggest there is not enough evidence to conclude a statistically significant difference in the usefulness of each Cal-OP ACE support service offering between different products.

5. Program Implications

5.1 Opportunities

The survey provides some valuable findings and insights on key barriers and opportunities that should be used by the Program in developing and targeting tools and services to California organizations.

Offer improvements on existing tools
Despite having standardized contracting software currently in place, survey data suggest that California buyers are still facing challenges developing contracts and specifying products. The Program can address this need by offering new resources for standardized contract templates that help expedite the contract development process. Additionally, technical specifications for DER products and an online database of DER products polled amongst the top three most useful program offerings. Providing an online database that has detailed technical specifications on each DER product would help to meet this need by addressing challenges buyers face during the specifying process. Finally, only a small group of respondents indicated that they are currently using an e-procurement platform at their respective organizations. These findings suggest there is a gap in the procurement space that the program can fill by providing an e-procurement system focused on DER products. This online platform can help expedite the procurement process by providing easy-to-find technical specification for DER products.

Prioritize key product categories
According to the survey responses, the products that California organizations said they place the highest priority on purchasing were HVAC equipment. Distributed generation, lighting equipment and lighting control systems, distributed storage products, and EVs/EV charging products were also ranked as a high priority for purchasing in the next five years. This indicates an interest in newer and more innovative types of DER products among a majority of California

organizations, regardless of sectors. This data also suggests some key product areas to target for the Program offerings.

Flexibility to introduce new DER vendors
Survey responses to Q11 suggest that there is some degree of flexibility in the procurement process when it comes to use of preferred vendors. While it was expected to see frequent reliance on pre-defined or pre-qualified sellers, survey results showed that a majority of California organizations use these vendors only 'Sometimes'. This may imply an opportunity to introduce California buyers to new DER sellers with whom they had not previously contracted.

5.2 Insights on framing

In addition to providing evidence of what types of resources to offer and where to target them, findings from this survey also provide evidence that could be useful when considering how to market program offerings and undertake outreach efforts.

Provide more information about interoperability of DER products
Respondents cited interoperability issues as a major prevention factor with the uptake of new DER products. To address this issue, the program team should solicit better information from DER vendors about how their products can be integrated within existing facilities and building technologies. This information could be added to product pages on any e-procurement platforms or online databases that the program develops for California buyers. Additionally, including case studies of successful DER product integration with existing building technologies could address buyer concerns about operational reliability.

Emphasize economic arguments for DER
Respondents expressed concern about the high costs and lack of financing for DER products, and a majority of respondents selected the lowest life-cycle cost as one of their highest priorities for purchasing. Emphasizing the economic arguments for DER products (e.g., a lower life-cycle cost compared to inefficient products, etc.) would likely resonate strongly with California buyers who are focused on buying the most cost-effective products. Highlighting long-term cost-effectiveness of DER products when designing and marketing tools and services would be an effective strategy for framing.

Target top management
Survey data supported the assumption that top-level roles (e.g., CFOs, Facilities Managers) play an essential role in the procurement process. Survey results also indicated that the lack of support from top management was a significant preventative factor for DER purchasing. Additionally, in Q8, respondents cited 'Gaining approvals' as the phase that most frequently resulted in a

bottleneck during the procurement process. While there are several possibilities for why this approvals phase causes difficulties, one possibility is that lack of buy-in from top management makes it difficult to get sign-off from different procurement stakeholders. Moving forward, the Program team should think about how to gain support from these key stakeholders to encourage an increase in DER uptake.

6. Appendix

Appendix I. Definitions of DER provided in the survey

Definitions

1. Distributed energy resources (DER) - DER includes distribution connected-generation resources (e.g., solar, wind), energy efficiency, energy storage, electric vehicles, and demand response (DR) technologies.

2. "Your organization" refers to the business, group, and/or institution for which you have procurement decision-making influence. E.g., if you are employed by the University of California, but work on the UC Berkeley campus, "your organization" is UC Berkeley.

OK

Appendix II. Recruitment email template

SUBJECT: Seeking your insights for a research project funded by the California Energy Commission - $20 gift card included!

Hello _____,

My name is (x) and I am a researcher from Lawrence Berkeley National Laboratory. My team is currently investigating how organizations in California purchase clean energy technologies (e.g., renewable technologies, energy storage products, high efficient heating & cooling products, etc.) as part of the ***Cal-OP ACE ("California Opportunities for Procurement to Accelerate Clean Energy") Program***, funded by the California Energy Commission.

Our research aim is to make it easier for organizations like yours to find and purchase clean energy technologies that reduce costs and save energy. We are asking you to support this effort by taking our short research survey (~10min) at the link below:

bit.ly/Cal-OPsurvey

You will earn a $20 Amazon gift card for completing the survey, and be entered for a chance to win a $250 Amazon gift card!

Your feedback on this survey will help us to better understand how California organizations are purchasing cost-effective energy-related products. **The results of this survey will help us to develop a statewide program to help California organizations purchase clean energy technologies easier, cheaper and faster.** This can help your organization reduce its energy costs *and* its carbon footprint.

Please consider sharing the survey with any of your colleagues, particularly those who are involved in the purchasing process within your organization (e.g., procurement officers, facility managers, energy managers, sustainability managers, etc.)

I am happy to discuss our research with you further or answer any questions you may have. Thank you for your help with this project!

The Cal-OP ACE Program is supported by: CALIFORNIA ENERGY COMMISSION, PROSPECT Silicon Valley, ENERGY SOLUTIONS, BERKELEY LAB, ZNE Alliance, ecomedes, Local Government Commission, CSU The California State University, TerraVerde ENERGY, ProQure

Best regards,

Appendix III: List of Hypotheses

- Hypothesis 1: Public and private sector organizations have the same organizational behaviors

- Hypothesis 2: the public and private sector organizations have the same organizational barriers when procuring new DER Products

- Hypothesis 3: Different roles within an organization have the same perceived organizational behavior (Roles, Rules, Tools)

- Hypothesis 4: Different roles within an organization have the same perceived organizational barrier when procuring new DER Products

- Hypothesis 5**: Different sizes of organizations exhibit the same organizational behavior (Roles, Rules, and Tools)

- Hypothesis 6**: Different sizes of organizations exhibit the same organizational behavior when procuring new DER Products

- Hypothesis 7: Organizations in different sectors exhibit the same organizational behavior (Roles, Rules, and Tools)

- Hypothesis 8: Organizations in different sectors exhibit the same organizational barrier when procuring new DER Products

- Hypothesis 9: Buying different products/services lead to the same procurement behavior

- Hypothesis 10: Use of preferred vendors lead to the same procurement behavior and have the level of the same difficulty when procuring new DER products

*** these hypotheses cannot be tested due to small sample size.*

Appendix IV: Survey Instrument (SurveyMonkey Questions)

Thank you for participating in this survey!

The goal of this research is to increase uptake of cost-effective distributed energy resource (DER) technologies among California organizations. A key factor in increasing DER uptake is understanding how California organizations make purchasing decisions.

Your responses will contribute to our efforts to increase the adoption of DER technologies invented and manufactured within California, and will inform how we develop the program to support California organizations in adopting DER technologies. The following questions are aimed at identifying the barriers and opportunities that exist within the procurement process at your organization.

This survey was developed as part of the **Cal-OP ACE Program** ("California Opportunities for Procurement to Accelerate Clean Energy"), funded by the California Energy Commission. We anticipate it will take 10-15 minutes to complete the survey.

Definitions

1. Distributed energy resources (DER)- DER includes distribution connected-generation resources (e.g., solar, wind), energy efficiency, energy storage, electric vehicles, and demand response (DR) technologies.

2. "Your organization" refers to the business, group, and/or institution for which you have procurement decision-making influence. E.g., if you are employed by the University of California, but work on the UC Berkeley campus, "your organization" is UC Berkeley.

1. What is the name of your organization?

2. Which of the following best describes your organization's sector?

- [ ] Local government
- [ ] State government
- [ ] Federal government
- [ ] K-12 schools
- [ ] Higher education
- [ ] Healthcare
- [ ] Retail
- [ ] Other (please specify)

- [ ] Technology
- [ ] Business/financial services
- [ ] Commercial real estate
- [ ] Architectural & engineering (A&E) firms
- [ ] Manufacturing
- [ ] Agriculture

> [   ]

3. Which of these best describes your role in the procurement process at your organization?

- [ ] Developing contract documents
- [ ] Approving expenditures
- [ ] Specifying the attributes of item being purchased
- [ ] Other (please specify)

- [ ] Managing / developing projects
- [ ] Reviewing proposals

The following two questions are aimed at understanding how energy-consuming products are acquired by your organization. The first question focuses on direct purchase of energy-consuming products. The second question focuses on indirect purchases via service contracts through which the contractor provides the energy-consuming products.

4. What types of products are you responsible for purchasing?

- [ ] IT products (e.g. computers, imaging equipment, network components)
- [ ] Non-IT appliance products (e.g., window air conditioners, refrigerators)
- [ ] Laboratory / medical equipment
- [ ] Other (please specify)

- [ ] Products for maintenance, repair & operations (e.g., filters, replacement lightbulbs)
- [ ] Fleet products (e.g., vehicles, EV chargers)
- [ ] None or N/A

> [   ]

5. What types of services are you responsible for purchasing?

☐ IT services

☐ Non-IT appliance services (e.g. food service, vending, laundry service)

☐ Laboratory / medical equipment services

☐ Maintenance & repair services

☐ Energy retrofit contracting (e.g, Energy Savings Performance Contracts, Utilities Service Contracts)

☐ New construction & major renovation services

☐ Transportation services

☐ None or N/A

☐

Other (please specify)

[   ]

6. How much does your organization spend annually on the following procurement categories?

	Under $500k	Up to $1 million	Up to $25 million	Over $25 million	Don't know
IT products & services	○	○	○	○	○
Non-IT appliance products & services	○	○	○	○	○
Laboratory / medical products & services	○	○	○	○	○
Maintenance, repair & operations	○	○	○	○	○
Energy retrofit	○	○	○	○	○
New construction & renovation	○	○	○	○	○
Transportation / fleet products & services	○	○	○	○	○

Other (please specify procurement type and annual spend)

[   ]

7. Among those involved in procurement at your organization, which types of roles have the most influence over purchasing decisions related to energy / energy-consuming products?

	Minor influence i.e. mostly assigned tasks with little input	Moderate influence i.e. assigned some tasks but also granted input/decision-making powers	Major influence i.e. significant input/decision-making powers (e.g., budget control, agenda setting)
Chief Financial Officer	○	○	○
Legal Counsel	○	○	○
Sustainability Manager	○	○	○
Energy Manager	○	○	○
Facilities Manager/Engineer	○	○	○
IT Managers	○	○	○
Contract Officer (CO)	○	○	○
Fleet Manager	○	○	○
External consultants (e.g. A&E firms)	○	○	○

Please list any additional procurement roles and level of influence (e.g. minor, moderate or major)

[   ]

8. Which, if any, of your procurement phases often become a bottleneck?

	Never	Sometimes	Often	Always	N/A
Specifying and selecting products	○	○	○	○	○
Developing contract documents	○	○	○	○	○
Legal review process	○	○	○	○	○
Gaining approvals	○	○	○	○	○
Ordering process	○	○	○	○	○
Shipping	○	○	○	○	○

Other (please specify)

[   ]

In the following question, we are concerned about DER products. This includes distribution connected-generation resources (e.g., solar, wind), energy efficient products, energy storage products, electric vehicles, and demand response (DR) technologies.

9. How often do any of the following factors prevent your organization from purchasing new DER products?

	Never	Sometimes	Often	Always	N/A
High cost / long-return on investment	○	○	○	○	○
Need to retrain staff	○	○	○	○	○
Lack of financing options	○	○	○	○	○
Maintenance of the product	○	○	○	○	○
Availability of repair parts	○	○	○	○	○
Security (e.g., with internet-connected devices)	○	○	○	○	○
Interoperability with existing equipment	○	○	○	○	○
Lack of top management support	○	○	○	○	○
Lack of staff buy-in	○	○	○	○	○
Operational reliability	○	○	○	○	○

Other (please specify)

[   ]

10. How many internal combustion vehicles (ICE) or electric vehicles (EVs)/plug-in hybrid electric vehicle (PHEV) are in your fleet? *If not applicable, enter "0".*

Light-duty ICE
(e.g., passenger car)   [   ]

Light-duty EV/PHEV   [   ]

Medium-duty ICE
(e.g., step or cargo van)   [   ]

Medium-duty EV/PHEV
(e.g., electric buses)   [   ]

Heavy-duty
(e.g. tractor trailers)   [   ]

11. How often do you use pre-defined vendors (e.g., preferred vendors, pre-qualified vendors) for purchasing?

○ Never

○ Sometimes

○ Often

○ Always

12. Organizations often have competing priorities when making procurement decisions. Please rank the following goals in order of importance to your organization. *1 = most important, 7 = least important.*

[ ] Products with preferable environmental attributes	☐ N/A
[ ] Products provided by local business	☐ N/A
[ ] Products provided by small / veteran-owned business	☐ N/A
[ ] Products provided by woman / minority-owned business	☐ N/A
[ ] Products made in America	☐ N/A
[ ] Products with lowest first cost	☐ N/A
[ ] Products with lowest lifecycle cost	☐ N/A

Tools (i.e. the specific business processes and systems that are used to implement purchasing decisions) play an important role in procurement outcomes. **This next section collects data on your organization's use of these tools in purchasing.**

13. What procurement tools do you currently have in place for purchasing?

☐ Standardized contract templates　　　　　☐ E-procurement systems

☐ Standardized specification templates　　　☐ Purchase order requisition forms

☐ Software tools for contract development　　☐ Do not know

☐

　Other (please specify)

14. If your organization needed to buy a new DER product that it had never bought before, how easy would it be to do that with your current procurement tools?

◯ Very difficult

◯ Somewhat difficult

◯ Somewhat easy

　Very easy

15. Please list the names of specific e-procurement systems that you use at your organization. *'N/A' if unknown.*

16. Please list the names of specific contracting software tools that you use at your organization. *'N/A' if unknown.*

17. In your budget-planning process for the next five years, which of the following product categories (i.e., types of technologies) will be a priority?

	Not a priority	Low priority	Medium priority	High priority
Heating, air conditioning, & ventilation (HVAC) equipment (heat pumps, chillers, rooftop units)	○	○	○	○
Water heating appliances	○	○	○	○
Lighting equipment & lighting controls	○	○	○	○
Building envelopes (windows, roofing, insulation)	○	○	○	○
Commercial & industrial refrigeration	○	○	○	○
Appliances (plug-loads)	○	○	○	○
Electric vehicle charging technologies	○	○	○	○
Electric vehicles	○	○	○	○
Distributed generation (solar, wind)	○	○	○	○
Distributed storage technologies (batteries)	○	○	○	○

Other (please specify)

18. The Cal-OP project will provide the following tools and services to California organizations to assist with DER procurement. Please rank the following in order of greatest use to your organization. *1 = most useful, 8 = least useful.*

Technical specifications for DER products	☐ N/A
"Cut and Paste" language for contracting documents	☐ N/A
Integration of DER options into your existing E-procurement platforms	☐ N/A
Online portal for connecting with DER vendors	☐ N/A
Facilitation of group purchasing opportunities	☐ N/A
On-call DER technical expertise	☐ N/A
Networking and training events	☐ N/A
Online database of DER products	☐ N/A

19. For which product categories would your organization find this additional support most useful?

	Very useful	Somewhat useful	Not at all useful	Not applicable
Heating, air conditioning, & ventilation (HVAC) equipment	○	○	○	○
Water heating appliances	○	○	○	○
Lighting equipment and lighting controls	○	○	○	○
Building envelopes	○	○	○	○
Building controls	○	○	○	○
Commercial & industrial refrigeration upgrades	○	○	○	○
Appliances (plug-loads)	○	○	○	○
Electric vehicle charging technologies	○	○	○	○
Electric vehicles	○	○	○	○
Distributed generation	○	○	○	○
Distributed storage technologies	○	○	○	○

Other (please specify)

[   ]

20. Please use space below to provide any additional comments or information you feel would be useful for the Cal-OP ACE research team (related to procurement, DER, etc.)

[   ]

21. If you would like to have survey results shared with you or participate in our future programs, please leave your contact info below.

Name [   ]

Organization (must be located in California) [   ]

Email Address [   ]

Phone Number [   ]

22. Are you willing to be contacted for a follow-up interview?

- [ ] Yes
- [ ] No