Driving ZNE to Scale in California State Buildings

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ABSTRACT

Opinion Dynamics is working on a seminal study with the California Public Utilities Commission (CPUC) to identify barriers to achieving zero net energy (ZNE) in state buildings, both at the individual facility level and at scale to meet the State of California's ambitious ZNE goals. Buildings are a primary solution for meeting worldwide energy and climate change goals, as buildings consume almost half of the energy produced and greenhouse gases (GHG) emitted in the United States. Despite common assumptions that primary barriers may be related to cost premiums or technology challenges, our work focused on state agencies has refuted both. Our research indicates that ZNE buildings can be built for the same cost as standard buildings in specific geographies for specific building types. Our research also indicates that ZNE can be and has been achieved with current "off the shelf" technologies and building construction practices. Barriers to large-scale adoption are systemic in nature: a grid not designed to be dynamic, tariff structures that reward existing technologies and the status quo, challenging funding and procurement processes, and legislation and policies that are at odds with the required speed of change in this industry. In this paper, we discuss our findings from in-depth interviews with over 80 stakeholders. Using this research as a foundation, we outline a pathway to address these challenges going forward to make highly efficient ZNE buildings more pervasive, and more relevant in addressing climate change moving forward.

Introduction

On December 12, 2015, the twenty-first Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) adopted the Paris Agreement, which brings 195 nations together with a common cause to undertake ambitious efforts to combat climate change. The Agreement calls for reducing worldwide GHG emissions by 1.5% by 2050 to maintain the world's temperature increase below 2°C. The Paris Agreement entered into force on November 4, 2016, thirty days after the date on which at least 55 Parties to the Convention, collectively accounting for 55% of total worldwide greenhouse gas emissions, ratified the agreement. The Agreement sets a vital, not-to-exceed threshold beyond which carbon saturation in the atmosphere would be difficult, if not impossible, to reverse. While the political winds of climate change may be changing direction at the federal level in the United States, neighborhoods, communities, state governments and many of the 143 Parties that have ratified the Agreement are reaffirming their commitment to tackling climate change.

Buildings are a primary solution for meeting worldwide energy and climate change goals, as buildings consume almost half of energy produced in the United States and 45% of all GHG emissions. While "green buildings" has been a common term in the climate change vernacular for some time, a new focus – Zero Net Energy (ZNE) Buildings – is evolving how we think about new construction and existing building retrofits to manage building energy use today and into the future. A ZNE building, also referred to as a zero energy building or a zero energy ready building, is defined as one that produces as much energy as it consumes over the course of a year through combining high levels of efficiency, renewable generation, and effective maintenance and operation procedures.

The state of California is committed to "the development of a robust and self-sustaining ZNE market" (CEC & CPUC, 2015). ZNE was introduced into state policies as a strategy to reduce greenhouse gas emissions, conserve state energy resources, and lead the state by example. Statewide ZNE goals include:

- By 2020, all new homes are ZNE (California Energy Efficiency Strategic Plan, January 2011);
- By 2030, all new commercial building starts are ZNE (California Energy Efficiency Strategic Plan, January 2011);
- By 2025, state agencies should also take measures toward achieving ZNE for 50% of all existing state-owned building square footage (Executive Order B-18-12, April 2012);
- 50% of all new state buildings beginning design after 2020 be ZNE (Executive Order B-18-12, April 2012);
- 100% of all new state buildings beginning design after 2025 be ZNE (Executive Order B-18-12, April 2012).

As of September 2016, there were 53 ZNE verified buildings and another 279 ZNE emerging buildings in North America (NBI 2016). This represents an increase of 74% over 2015. These, however, represent a mere fraction of the new buildings constructed each year. Further, there are millions of buildings already in place. While this progress is tangible, at the current pace, highly efficient ZNE buildings needs to become reality at a much faster pace to reach statewide ZNE goals and global COP 21 goals.

The state of California is a large real estate holder and a major consumer of energy within the state. The state building square footage totals approximately 112 million square feet; thus 50% of the state building area would equal approximately 56 million square feet (DGS 2016). The 2015 grid purchases of energy for state facilities were approximately 9.9 billion kBtu; and 2015 on-site renewable energy generation was approximately 78.41 million KWh (267.4 million kBtu) (DGS 2016). Since California Governor Jerry Brown issued Executive Order B-18-12 in 2012, only eight of the 35 California State agencies have made tangible progress towards ZNE source status for at least one of their buildings. These agencies include the California Department of Motor Vehicles (DMV), the California Lottery, California Department of Transportation (CALTRANS), California Conservation Corps (CCC), Air Resources Board (ARB), California Department of Corrections and Rehabilitation (CDCR), California Office of Emergency Services (OES) and the California Department of Public Health (DPH). Given such limited progress to date, the California Public Utilities (CPUC) commissioned a study in 2016 to characterizes state agencies on their "road to ZNE" identifying the nuanced barriers that state agencies face in meeting California ZNE state building goals.

Methodology

To characterize barriers to ZNE, the study team conducted (1) an extensive secondary data review, (2) an assessment of building level ESPM data, and (3) 80 in-depth interviews. To better explore and understand how buildings achieved ZNE, Opinion Dynamics completed in-depth interviews with designers, architects, owners and/or managers of current ZNE buildings. These interviews explored contractual, financial and interconnection arrangements for their projects, barriers they encountered, the role of energy efficiency in the design, and whether they achieved ZNE status via a new construction or a retrofit project. The study team also interviewed several ZNE experts and decision-makers within the state agencies, regulatory agencies, utilities, research think thanks and the private sector to understand the

context for ZNE in California, ascertain their experiences on their pathway to ZNE, understand barriers they perceive or they have encountered, and to assess the current activities associated with ZNE both in the public and government sector.

To ensure the rigor of this predominantly qualitative study, the study team utilized NVIVO, a powerful qualitative analysis tool to manage the resulting large qualitative dataset, effectively and efficiently mine for relationships in the data, and develop evidence-based qualitative insights. Given the complexity of analyzing qualitative data, the study team utilized both pre-determined coding schemas and emergent coding structures to identify thematic patterns and trends. For this study, thematic synthesis had four stages: coding of the text line-by-line (secondary data and interview transcripts), appending quantitative data to the unit of analysis (i.e. Energy Use Intensity (EUI) ranges for specific state agency building portfolios), development of descriptive themes (i.e. patterns of data related to the research questions) and the generation of analytical themes. (i.e. themes that extend beyond the actual data, generating additional concepts and understandings.)

In addition, the research team formed an Advisory Group to engage stakeholders at state agencies and utilities that are actively involved in ZNE within their respective organizations. The Advisory Group's primary role was to advise the Study Team on the context of ZNE in the state of California, provide information about specific state processes and utility efforts that support ZNE, to identify contacts within state agencies for interviews, and to provide overall guidance on the study. The Advisory Group included State Agency representatives and utility representatives with key knowledge and experience specific to ZNE.

Results

To understand agency challenges in pursuing ZNE, we first characterized the typical pathway to achieving ZNE. Through our interviews and secondary research, we have identified four distinct phases: Consensus Building, Planning, Execution, and Monitoring and Verification (Figure 1). As illustrated in Figure 1 below, each phase is iterative. Given the range of hurdles that agencies face while working towards ZNE, stakeholders may need to revisit certain steps. For example, if a space within a newly constructed building is used differently from how it was originally modeled, the building may require retro-commissioning to achieve ZNE status.

Because achieving ZNE is so complex -- requiring collaboration between multiple parties and the integration of many types of technologies and building improvements – the first step is to identify and align internal stakeholders and build consensus around specific goals and a commitment to make a concerted effort to attain ZNE. This Consensus Building phase would typically involve an agency's sustainability manager engaging with the Department of General Services (DGS) and rallying other agency decision makers to the cause, all with the goal of obtaining buy-in and commitment to pursue ZNE from all relevant staff. At this stage, having an in-agency champion is extremely valuable for generating momentum, leadership and direction on what steps need to be taken to achieve ZNE.

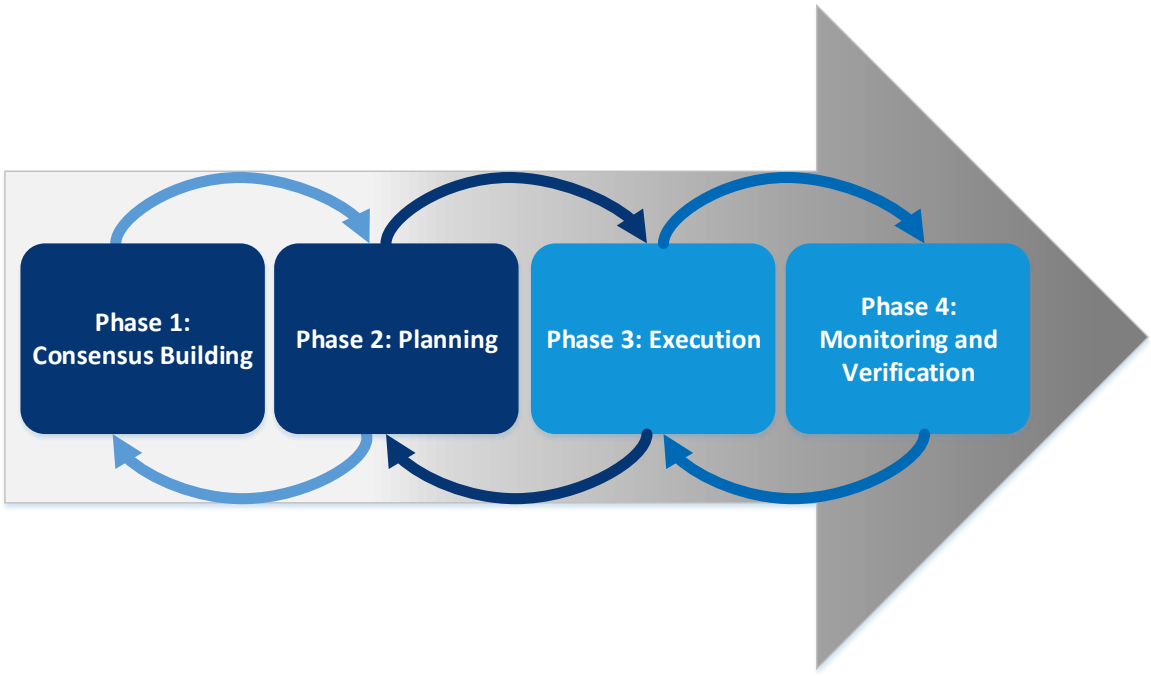

Figure 1. Path to ZNE

During the Planning phase, agency stakeholders are finding out how to operationalize ZNE and developing strategies to achieve their goals. This phase requires input from building science professionals to determine the technical feasibility of efficiency and renewable energy projects, and model system performance to decide on which specific strategies to pursue (e.g., HVAC system retrofit, networked lighting systems, retro-commissioning, etc.). In concert with technical planning, stakeholders are determining the cost of the various efficiency and renewable measures, identifying funding opportunities, planning procurement processes and project timelines, and weighing the various tradeoffs associated with pursuing certain strategies over others. During this non-technical planning process, agency leadership is in constant communication with local utilities, and other external stakeholders, to determine energy efficient rebate opportunities, include those offered for building energy assessments, and rules about distributed renewable energy system net metering and interconnection..

The Execution phase is where specific projects are implemented, which may occur over the course of a longer period of time depending on the outcomes of the previous two phases and on the type of project (i.e., retrofit or new construction). ZNE retrofit projects, in particular, take longer as they are more building modeling and capital intensive as the existing building systems were not typically designed with ZNE energy goals in mind. Additionally, retrofit projects take more planning as the construction required is generally extensive and may disrupt normal building operation conditions or displace agency staff. Regardless of the type of project, during this phase it is critical to consider the final Monitoring and Verification (M&V) phase and add any metering, or other M&V infrastructure required to measure system performance for its useful life.

The final phase, (M&V), is required to verify that the building does, in fact, achieve zero-net-energy for an entire calendar year. Actual performance of building and renewable systems can differ substantially from modeled performance, so M&V is critical to ensure that building systems are operating as intended and controls are calibrated accordingly. Additionally, M&V is required to measure renewable generation capacity and identify underperformance. Given the range of factors that may affect building performance—occupancy behavior, weather, number of occupants, type of building usage to name a few—models cannot predict load with full accuracy. Therefore, building managers must constantly

measure and monitor building performance and renewable energy production over time, with the goal of proving net zero energy over one full year. ZNE building managers have said the post-construction commissioning period can last between one to three years to fully optimize building performance.

Barriers to ZNE – What's Blocking Progress?

While the path outlined above characterizes the typical phases, the path to ZNE for state agencies can take varied and overlapping forms. Most state agencies are somewhere in either Phase 1 or Phase 2. Our interviews identified a number of system barriers that state agencies are wrestling with, including: (1) managing competing priorities; (2) beginning the ZNE journey; (3) securing funding; and, (4) planning and installing renewables.

Managing Competing Priorities

While agencies generally want to achieve both EE and ZNE goals, the respondents have all stated that their agency's primary purpose is to fulfill the agency's mission. As such, achieving EE and ZNE mandates happens in the context of facility management for mission delivery, and mandates alone (especially unfunded ones) are often insufficient to trigger building upgrades. Agencies are focused on activities pertaining to keeping them operational, such as roof leaks or HVAC repairs, or other agency-specific activities. ZNE upgrades are not urgent and do not affect them doing business, so they are typically relegated to lower priority. As one state agency stated,

> *"It's not that we're not fans of the administration's energy policies, but faced with building closures due to water penetration, potential for mold and those kind of things, those projects always command the limited dollars. I won't say always, but 90% of the time we have to address those first, and energy efficiency projects fall below health and safety and building occupancy. There's a giant drive here at [our agency] not to close facilities. I mean that is our first order of business -- do not close! So when we get roof leaks or we get HVAC repairs, those are our top two [concerns], because those are the things that can shut us down. We have a baseline budget for scheduled repairs. Just so you get some sense of this, think about almost 100 buildings statewide, and our baseline for scheduled repair and maintenance budget is about $4.6 million a year. If you do the math on that it tells you how much money you've got to spend on a building a year, which is nothing."*

In addition, state agencies have multiple legislative and regulatory mandates, including many green initiatives, to consider when making decisions. Every two years state agencies are required to complete and submit a *Road Map to Achieving Executive Orders B-18-12, B-16-12, B-29-15, & B-30-15.* Figure 2, adapted from the template the DGS developed for these road maps, outlines the many green Executive Order milestones and their associated timelines.

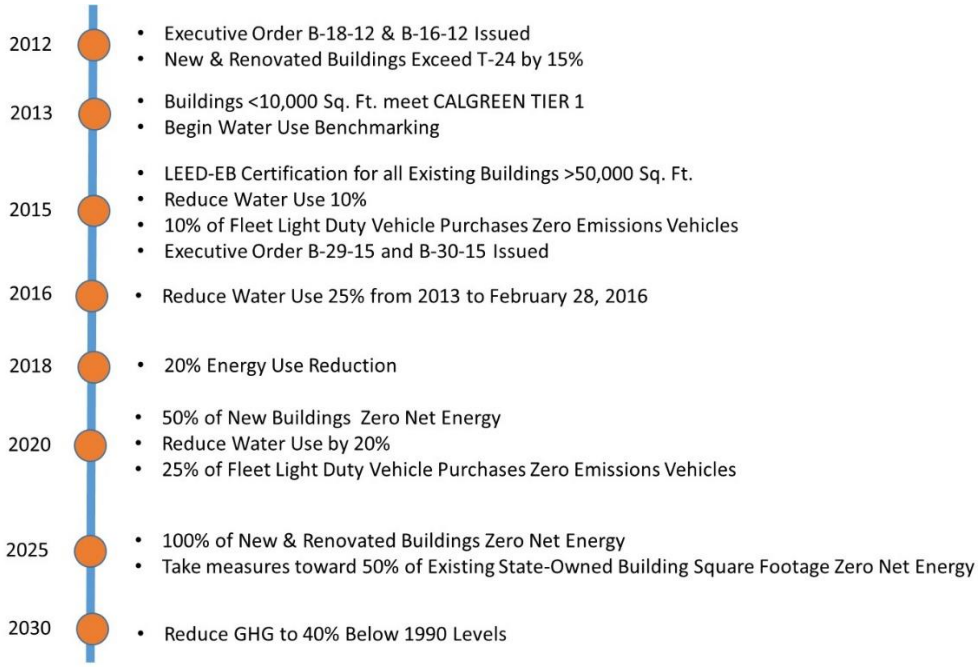

Figure 2. Green Executive Order Milestones and Timeline

These Executive Orders address ZNE as well as many other green initiatives including greenhouse gas emissions, energy conservation, building design and construction, water efficiency and conservation, and zero emission vehicle purchases. Through our interviews, we discovered that many state agencies are struggling to balance these initiatives with their mission and operational commitments. As one agency representative stated,

> *"Well for me with the new Executive Order and the new sustainability rules and regulations, it's just it's coming down so hard and fast on us that it's difficult to find staff time to acquire all this information. You know -- like the climate adaptation, the zero emission vehicles, the energy, the water conservation, the green operations to our buildings -- these are all these required benchmarking tools that we have to provide to the governor's office. …I know it has been a while [since] 2012 [when] it came out and we're just now starting to get into it. You know trying to get our team really involved with it. It's just our shortsightedness as a department not seeing how this was going to expand has caused a problem with staffing and getting things. But overall I think it's good, but just sometimes we move a little slow."*

Some agencies spoke specifically about balancing the mandate to meet energy consumption reduction targets with ZNE mandates. By 2018, State agencies are required to reduce grid-based energy purchases by 20% below a 2003 baseline[1]. Given that the timeline for the EE goals is sooner, some state agencies have understandably focused on meeting the EE goals first. At a high level, EE and ZNE goals appear to be aligned, as much of the current philosophy of achieving ZNE focuses on reducing energy consumption first. However, unless these purposes are expressly linked, decisions

[1] http://database.aceee.org/state/california

made to meet EE goals may not be optimal for an eventual ZNE project. The nature of these conflicts stem from various sources including:

- **Breadth vs. depth:** ZNE projects often require analysis of tradeoffs within a single building. However, agencies appear to be focused on meeting mandated Energy Efficiency Goals set for 2018. While EE and ZNE goals are not necessarily mutually exclusive, the flexibility afforded in meeting EE goals (agencies get to choose the projects and approaches to meet goals) allows for agencies to make decisions in the context of EE goals, which may not align with the most optimal approaches and/or technologies for support a future ZNE goals. For example, EE goals may support replacing an HVAC system with a more efficient system, while ZNE goals may support changing the HVAC technology altogether.
- **Bottleneck in staff resources:** For agencies who work with DGS for procurement, bottlenecks are a challenge as project reviews and approvals can only move as fast as procurement resources permit. This not only increases the length of the procurement process but also exacerbates the incentive to focus, approve, and implement smaller projects.
- **Priority in Goals:** In light of the near-term nature of the 2018 EE goal, agencies report a sizeable backlog of EE projects, the completions of which often take precedence over the planning and/or execution of future ZNE projects. As noted above, while EE projects will likely support eventual ZNE projects, the focus on EE tends to be on broader, systemic portfolio (i.e. multi-building) projects, whereas ZNE projects require sustained and focused attention on a single facility. This may shift attention and focus away from ZNE, at least in the short term.

Beginning the ZNE Journey

Many state agency representatives reported that they were unclear as to how to begin the ZNE journey. Achieving ZNE requires a series of systematic actions and ZNE expertise from building architects, engineers, sustainability managers, and other key stakeholders. Executive Order B-18-12 is almost too high level and agencies do not know what the first step should be. For example, one agency interviewee commented:

> *"I know we have those [ZNE] goals, and it's completely unclear to me how we ought to be moving towards trying to achieve them…I think one of the things that would be helpful for me, anyway, is if somebody said, "Here, start with this. Start working through this checklist." I've got a project checklist. I see all the ones for core and shell, I see the ones for mechanical. But is there some more systematic way to be approaching this?"*

Other "green" executive orders are very specific in their requirements. For example, Executive Order B-16-2012 requires that 25% of an agency's fleet purchases of light-duty vehicles be zero-emission by 2020. This is a very specific order that agencies understand how to achieve as compared to ZNE mandates, which have many moving parts and no clear direction on how to begin. Additionally, with Order B-16-2012, agencies are not allowed to purchase new vehicles unless they first meet this Executive Order.

Thus, not complying directly affects the agency being able to conduct business. The repercussions of not achieving ZNE are unclear.

In addition, our interviews uncovered misperceptions regarding cost premiums for constructing ZNE buildings and the need for specialized technology. Our research indicates that ZNE buildings can often be built for the same cost as standard buildings using "state-of-the-shelf" technologies in specific geographies for specific building types. The construction costs for ZNE facilities seem to be at parity with standard construction costs in climate zones that allow for natural ventilation at night or have generally cooler climates, such as coastal properties. Costs can also be similar to standard construction costs depending on building mass, with smaller, narrower buildings matching standard construction costs. In contrast, multi-story, dense urban buildings often carry a cost premium due to the necessary use of new technologies and/ or construction practices such as mounting solar PV on walls. The architects we interviewed also indicated that costs for ZNE retrofits are higher than new construction, due to having to work in occupied buildings and around business schedules.

Securing Funding

While misperceptions regarding cost premiums exist, state agency stakeholders report that funding is their largest barrier to meeting ZNE goals. Executive Order B-18-12 is an unfunded mandate and as such, availability of capital is a significant challenge. Funding for retrofits is especially limited. Given the complications associated with securing financing for select projects, funding currently goes through unsecured mechanisms such as no/low cost (solar) Power Purchase Agreements (PPAs), Energy Service Companies (ESCO's), and On-Bill Financing (OBF) arrangements that have limited funding amounts and other restrictions. In addition, many ZNE projects to date have relied on utility incentives, and similar resources, though these typically cover only a small portion of construction costs. Generally, EE system upgrades are more likely to be financed through ESCOs, whereas funding for major renovations is more difficult to obtain, since that funding comes from capital budgets. Like other major capital projects, ZNE projects are also funded through California's Capital Outlay process. However, it may take multiple years to make it through the state's budget process, particularly as priority is generally given to maintenance, fire, and life safety upgrades (seismic, public safety and ADA).

The Department of General Services (DGS) is the primary contracting channel for most agencies and, as such, there is a dollar limit on the services that said agencies are able to obtain without DGS authorization. This dollar limit is typically much lower than any ZNE-related project requires and therefore agencies must to go through DGS, which can add considerably to a project's timeline. In addition, requirements for prescriptive scopes in RFPs reduce the flexibility needed for energy efficiency (EE) and ZNE project design. Legal considerations and RFP award disputes lead to delays and sometimes cancellations of projects. The procurement structure does not seem to support design-build or integrated design processes. In the case of construction services, working with DGS typically also adds substantially to the overall cost of the project as DGS assigns an in-house project management team.

While this process does provide some benefits in that DGS plays a key role integrating sustainability, building design, and quality construction, it also exacerbates other barriers, such as the cost of these projects and the timeline it takes to complete them. One state agency described the issues in the following terms.

> *I mean being a state agency we have to go through the Department of General Services and we have to go through their construction management process. They have costs and fees that you would incur that you normally wouldn't occur in a leased facility…We put in a split HVAC system for a server room here at a leased facility…start to finish $15,000…wanted to do the same thing in a state owned building in Southern California, $185,000. Plus, it's more time consuming. Project*

number 1 for $15,000 here would take a year. Project number 2 at a state facility would take three years.

Some agencies do not face this hurdle. Of the eight agencies mentioned that have made some progress towards achieving ZNE source status in at least one building, four have special procurement authority and therefore are not required to go through these steps—the California Lottery, the Department of Public Health, California Department of Transportation, and the California Department of Corrections and Rehabilitation. Though the absences of these issues is not the sole reason for these four agencies' relative success, it does provide far greater flexibility in obtaining energy-related services. In other agencies dealing with centralized procurement, legal considerations and RFP award disputes lead to delays and sometimes the cancellation of projects altogether.

Planning and Installing Renewables

Installing renewables is a key part of the ZNE journey, after maximizing energy conservation, passive systems and whole-building integrated energy efficiency measures. Almost all state agencies are considering solar Photovoltaic (PV) installations. The ability to site sufficient capacity of renewables for state buildings are limited by a myriad of issues:

- **Space:** Limited availability of space to site renewables within premises (parking lot, rooftop, green space) located in urban areas.
- **Roof conditions/warranty**: Poor roof conditions hinder PV installation where (a) costly repairs need to occur to strengthen the roof to support the PV system, or (b) the roof must be repaired or replaced to align the PV expected life with the roof's useful life. For roofs in acceptable condition, installation is problematic when roof warranties are shorter than the PV system expected life.
- **Bond financing limitations:** Bond-financed facilities have an additional hurdle. There are typically contractual limitations on debt financing, because bond repayments have seniority. Thus, bond covenants typically restrict issuance of other secured bonds (or the issuance of liens) for any project in the building. As a result, financing for these facilities is challenging, if not altogether infeasible. There are often contractual limitations prohibiting mounting of PV systems on the roof as well.
- **Solar Installations via PPAs:** Solar PPAs are the most common funding vehicle utilized for PV. A solar PPA is a financial agreement where a developer arranges the design, permitting, financing and installation of a solar energy system on a customer's property with no upfront cost. The developer sells the power generated to the host customer at a fixed rate over a predefined period of time (frequently 20 years) (Solar Energy Industries Association 2016). If the PV system over-generates power, then the excess power is sold to the utilities who manage the electric grid through Net Energy Metering (NEM) agreements. Often, however, in instances of over-production, the price per kWh paid by utilities is lower than the PPA contracted cost per kWh to the building. Therefore, the building incurs an additional cost when the PV system generates power above what is used onsite. To avoid this scenario, PV systems installed via PPA agreements are often sized to meet 80% of a building's energy needs. While this minimizes the risk of over generation, it also limits the ability of a facility to meet ZNE targets through their PV installations. Successful ZNE projects oversize their PV system slightly. Additionally, renewable energy often will need to exceed the amount of electricity used to compensate for natural gas or other forms of energy that are utilized in the building.

Installation of PV at scale can create issues where substations are unable to absorb the additional intake of excess generation. Therefore, under current rules, utilities require an interconnection agreement with any premise that generates power through PV systems and plans to sell excess power to the grid. NEM rules limit the amount of connected PV systems to 1 MW or less. This size limitation enables the utility to control and prevent large unexpected amounts of power being sent to the grid from the customer, which can lead to challenges related to grid reliability and power management. This limitation may adversely impact the ability of larger facilities to size an adequate amount of renewables to power their sites to achieve ZNE. In addition, interconnection agreements typically place the liability associated with the PV installation on the premise. Indemnification language in the interconnection agreement requires the system owner to hold harmless the party receiving the power (i.e., the utility) for any loss, damage or legal liability that may arise under the agreement. Legally, state agencies cannot indemnify, therefore, the PPA provider absorbs that risk. However, this indemnification clause has surfaced as an issue for state buildings where the solar PV may be owned by multiple providers or when the state owns the PV system outright.

Numerous state facilities are located in urban areas, are multi-story buildings, and/or have limited to no space for siting of PV. These characteristics limit the ability of such buildings to achieve ZNE within the premise boundaries. Therefore, the state is considering renewables installation at offsite locations to feed one or more buildings where installations within a premise boundary is not viable at sufficient levels. This approach however, faces barriers including:

- PURPA rules consider entities that generate electricity at an off-premise location to be a power generator. As the state agencies' missions do not include power delivery, this may represent an undesirable course of action.
- PURPA rules carry adverse economics for the project. At a basic level, these rules generally mean that, as a power generator, each kWh of energy sold back to the grid receives the generation portion of the rate only (rather than the full retail rate, which is more typical of a NEM agreement for generation of energy via renewables at a premise level).

Looking to the Future of ZNE in State Buildings – Breaking through the Barriers

Officially, the ZNE mandate for state agencies is to *take measures* toward achieving ZNE for 50% of all existing state-owned building square footage by 2025. Yet, many state agencies have taken this mandate to mean *achieving* ZNE for 50% of all state-owned building square footage. This mandate is an aspirational goal as it would require conversion of fifty plus buildings per month to ZNE (assuming an appropriate mix of smaller and larger sized buildings) to meet this goal. The state has a long way to go to achieve the Governor's ambitious ZNE goal, and substantive barriers continue to hinder progress for many agencies. While there is a common pathway to ZNE, consisting of four phases: Consensus Building, Planning, Execution, and Monitoring and Verification, state agency paths take varied and overlapping forms. While eight agencies have made tangible progress towards ZNE source status for at least one of their buildings, the remaining are still working through the first two phases. Key barriers to progress for these agencies include (1) managing competing priorities; (2) beginning the ZNE journey; (3) securing funding; and, (4) planning and installing renewables.

Despite these pervasive barriers, our research illuminates a number of potential solutions that can support state agencies on their road to ZNE. In terms of managing competing priorities and helping agencies begin the ZNE journey, making additional education and technical resources available to state agencies is essential to ensuring that opportunities are not forgone due to a singular focus on energy efficiency at the expense of a more strategic focus on ZNE. To this point, though agency decision makers know their building stock intimately, they may require additional guidance from building science professionals on where to focus their efforts and which buildings are simply not feasible to retrofit to

ZNE. Funding will likely continue to be a major barrier to ZNE achievement within state-owned buildings, which is compounded by deferred maintenance issues that exist in many of these buildings. Agencies should continue to seek alternative funding sources and DGS should continue to systematize processes for state agencies to utilize financing options, such as those offered through utility companies. The procurement process is a particularly challenging aspect of improving the energy efficiency of state-owned buildings and reaching ZNE goals as the process can often result in significant extensions to project timelines and added costs. Some progress in this area has been made with the passage of SB 840 in 2016 ("The Trailer Bill") that authorizes state agencies to assign projects to a pre-qualified ESCO. After establishing a most-qualified pool of ESCOs through a competitive Request for Qualifications (RFQ) process, the state agency would then assign projects on a rotational basis. This enables agencies to use a pre-approved single master contract, circumventing the need for legal review of individual contracts for each project, thus streamlining the selection and contracting processes. Finally, with regards to planning and installing renewables, one potential solution to interconnection challenges is for state agencies to continue to utilize PPAs, where agencies enter into long term agreements with private entities to provide renewable power. The private entity is then responsible for signing the interconnection agreements. In addition, some agencies have been successful in signing interconnection agreements and while the few instances were characterized as challenging and unable to be repeated, these lessons learned could be studied to introduce legislation to address the indemnification challenge, paving the way for agency-owned PV.

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