Delivering on Equity by Decarbonizing Low-Income Homes as part of a Multi-project Approach for Resilient and Healthy Communities: Stories from the Field

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ABSTRACT

Despite incentives, tax breaks, and unprecedented federal and state funding, efficiency and electrification upgrades are not accessible to low-income families. This paper shares the story of local nonprofits and community-based organizations working to achieve equitable energy transformation - a timely case study helping deliver the vision of shared prosperity for all.

With funding from the California Energy Commission (CEC), local nonprofits created a turnkey Advanced Homes program that leverages multiple funding sources and incentives for a no-cost offering. This Advanced Homes offering covers efficiency and weatherization, solar, battery storage, heat pump water heaters, and induction stoves. A case management approach ensures participants are fully supported, from screening for eligibility and coordination of technology installations to education and training. It was designed through a community-based approach and collaboration that has continued through implementation.

In addition to CEC funding for climate-ready Advanced Homes, the team braided together California ratepayer-funded Energy Savings Assistance, DAC-SASH,[1] SGIP,[2] and TECH Clean California programs. The program also has funding from a Quick Start Grant and the Los Angeles Cleantech Incubator. The program also accessed private financing by establishing a residential bridge financing program to overcome the reimbursement obstacle of SGIP.

Advanced Homes is part of a larger advanced energy community (AEC) project that incorporates community solar, a community resilience center, air quality monitoring, electric vehicle charging infrastructure, electric carsharing, and incentives for grid services. The paper will highlight how a locally-focused interdisciplinary approach can achieve greater support, reach scale, meet equity goals, create shared prosperity, and transform communities.

Introduction

In 2016, the California Energy Commission (CEC) launched its Advanced Energy Communities (AEC) challenge to fund the design (phase I) and implementation (phase II) of projects across the state (Lew et al. 2023). This paper is a case study of the Bassett Avocado Heights Advanced Energy Community (BAAEC) project's implementation phase, which builds on the work from its initial design phase (Federico, Pincetl, and Fournier 2019). BAAEC was one of four phase II awards granted by the CEC and the only project to address community-scale retrofits of low-income single-family homes.

BAAEC is a competitively awarded project that follows the EPIC 2018-2020 Triennial Investment Plan, specifically subtheme 2.4: "Incentivize Distributed Energy Resource (DER) Adoption through Innovative Strategies at the Local Levels." The project funding for

[1]DAC-SASH: The Disadvantaged Communities - Single-family Solar Homes Program

[2]SGIP: Self-Generation Incentive Program; TECH

implementation (phase II) is part of a competitive solicitation (CEC GFO-15-312) from the CEC and builds from a previously competitively awarded design grant (Phase I). BAAEC focuses on low-income and under-resourced communities to support equity and justice in the energy transition. By putting people at the center of the project design and incorporating new clean energy technologies, financing, business models, policy considerations, and a holistic view of community transformation, the project has overcome barriers and identified best practices for scalable energy solutions.

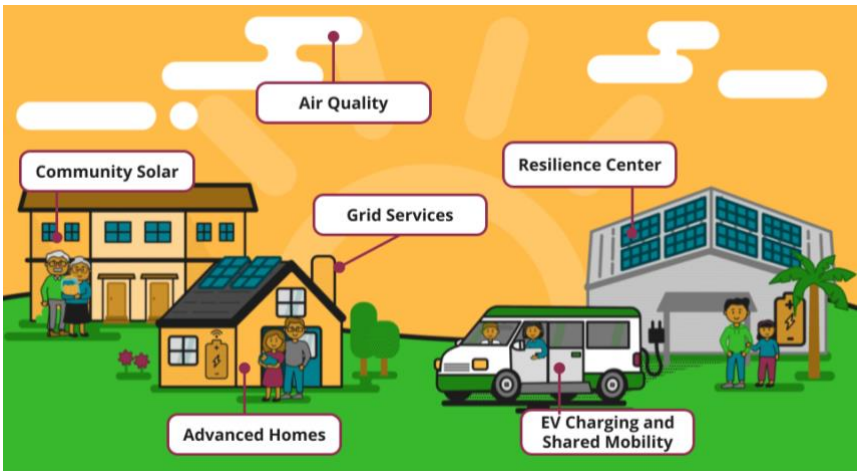

Figure 1. Elements of the BAAEC project.

BAAEC's project design contrasts with traditional incentive programs, where a small portion of the cost of a single technology is incentivized. The traditional incentive-only approach makes funds available after a project is completed and does not fund the total cost or the soft costs of an energy project. BAAEC's approach is to cover all project costs and fund meaningful community participation in community outreach, education, and engagement. The project is an example of how to invest in a community and provides a case study for the federal Justice40 Initiative.

As of early 2024, communities are still waiting for funding and full benefits from the Justice40 Initiative, in which the federal government committed to have "40 percent of the overall benefits of certain federal investments flow to disadvantaged communities that are marginalized, underserved, and overburdened by pollution" (The White House n.d.). California has some of the country's most generous state incentives for clean energy. Still, while stimulating the general market, incentives are insufficient for low-income homeowners and the renter population.

As an example, the Self Generation Incentive Program (SGIP) deployed 5,784 general market residential batteries in 2022 but only 21 under the equity category for low-income residents. In the first half of 2023, 2,758 SGIP battery deployments went to the general market, with only 61 of them going to low-income households (SGIP 2023).

Some pilot programs funded by ratepayers and administered by the California Public Utilities Commission (CPUC), namely the Energy Savings Assistance (ESA) Building Electrification (BE) pilot program, offer no-cost building electrification to low-income homeowners. Still, pilot programs like ESA alone cannot drive low-income residential electrification at the speed and scale needed to meet state policy goals. Even with these types of

programs available, it is difficult for the average resident to navigate multiple applications and contractor interactions to complete comprehensive home energy retrofits.

This paper shares best practices and recommendations based on years of BAAEC implementation and numerous design iterations. Based on our experiences, we recommend wraparound services, case management support, and a multidisciplinary and multi-benefit approach to the energy transition. Our findings are organized into four chapters: (1) our community-based approach to project design and structure, (2) a deep dive into why we believe decarbonizing single-family low-income homes should be the cornerstone for community transformation in the energy transition, (3) an overview of the features that make up an advanced energy community, and (4) conclusions and recommendations for replicating successful strategies from the Bassett Avocado Heights Advanced Energy Community project.

Chapter 1: Community-Based Approach

The BAAEC project is a story of local nonprofits and community-based organizations working to achieve an equitable energy transformation for low-income families. BAAEC's implementation partners developed a community-based approach that is driven by the following principles: (1) communities are active participants engaged both early and throughout programs and projects, (2) diverse but coordinated clean energy strategies are optimized for both community and personal benefits, (3) community-based organizations are implementation partners who are adequately compensated and supported so they have sustainable capacity, and (4) workforce development is embedded throughout with an emphasis on economic development and shared prosperity for all.

BAAEC is in the unincorporated Los Angeles County neighborhoods of Bassett, Avocado Heights, and adjacent cities. The project area's east Los Angeles community is 84% Hispanic, has a median annual income of $60,000, and is surrounded by freeways, commercial warehouses, and the only lead-acid battery recycler in the western US. BAAEC's programs and projects were informed by community planning during the phase I planning grant. In phase II, the implementation grant, communities actively participated via a community survey and a Community Advisory Committee. The project team built community trust by engaging the local community choice aggregator (CCA), the school district, community-based organizations, and local government leadership. Input from these stakeholders complemented the 74 BAAEC community outreach events to build community trust. We found that establishing trust and collaborative governance for a community-based approach was slow but necessary for success. Despite the need to speed up and scale the energy transition, investing time in authentic engagement and tailored solutions for each community is the only way to ensure an equitable transition. Moreover, the approach is a blueprint, as depicted in Figure 2, that community stakeholders can adopt for scalable transformation.

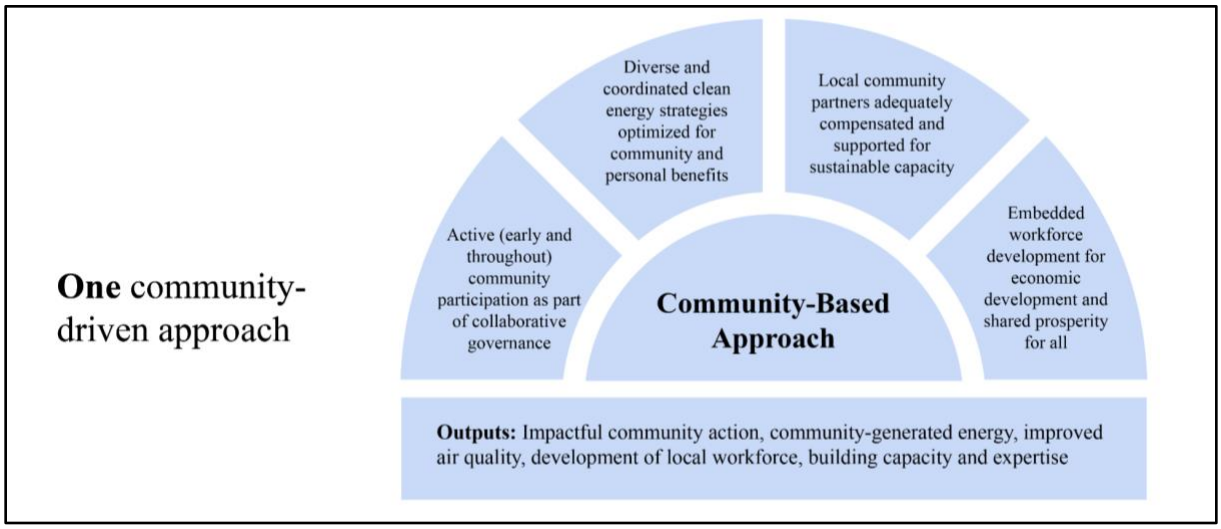

Figure 2. The BAAEC community-based approach. With this model, speed and scale are not at odds with intentional and authentic community engagement.

Chapter 2: Decarbonizing Low-Income Single-Family Homes

Figure 3. Spanish outreach banner used to advertise the program at high-traffic community locations such as schools and parks.

One component of BAAEC was the Advanced Homes project, which aimed to install a suite of electrification and onsite distributed energy resources in low-income single-family homes. Advanced Homes included rooftop solar panels, battery storage, heat pump water heaters, induction stoves, energy efficiency, weatherization, and grid services to participating households. The project was designed to offer electrification and DERs at no cost and with zero debt for participating customers.

The BAAEC Advanced Homes project launched during the peak of the COVID-19 pandemic, which created an outreach and enrollment challenge. Still, project partners worked to establish trust within the community via authentic and ethnically sensitive outreach strategies, as depicted in Figure 3. Soon after launch, BAAEC recognized that effective engagement would require a case management approach: BAAEC's lead implementer, a nonprofit organization, coordinated every DER installation and served as a constant resource for homeowners from initial screening through commissioning, education, and training on every technology installed in

participating homes. Even though BAAEC provided a no-cost direct install offering, home upgrades like those in the BAAEC project can require a significant investment of residents' time. We believed it was unrealistic to expect that low-income households would have the time to review and understand all the details or have the resources to hire experts for personal guidance—in fact, this is true for the majority of residential customers. The key to successful enrollment was BAAEC's community-based organization (CBO) partners, Active San Gabriel Valley and Day One, who were engaged in the project in Phase I. These familiar faces were the appropriate stakeholders to communicate the benefits of clean energy technologies and were able to provide families with wraparound support for other social and health services.

BAAEC's outreach strategies generated 535 leads, of which 46% were nonresponsive, 38% were ineligible, and 9% responded with a firm "not interested." A total of 38 households (the roughly 7% remaining) moved forward with enrollment. The high customer acquisition cost is a consistent challenge with residential DER deployment and its decentralized nature. BAAEC's 7% enrollment conversion shows that even no-cost offers are not easy to "sell." If we exclude people who were disqualified because they were outside the project area, the conversion rate is slightly better than the solar industry standard (based on discussions with solar providers). Only 9% of leads were "not interested," but willing customers faced barriers to participation beyond their control, as shown in Table 1.

Table 1. Top Four Reasons for Ineligibility and Corresponding Percentage

Reason	%	Description	Recommendations
Outside of BAAEC Project Area	41%	Not within the CEC-approved project census tracts	Enact similar projects across all low-income communities to expand eligible areas
Not Income Qualified	27%	Based on the number of households not meeting the income criteria of 250% of the federal poverty level	Simplify income verification by standardizing certification across as many programs as possible and allow enrollment in one program to satisfy verification for others
Permit	8.5%	Unpermitted home improvements	Work with building officials to limit the inspection to the clean energy work being done
Roof	8.5%	Roofs requiring structure reinforcement, not a like-for-like replacement	Future program can include a cost-sharing model where the customer contributes to the cost of roof repairs

Community outreach for BAAEC's Advanced Homes project prepared participants for a 12-month journey, from the initial screening to completing installation and reaping the benefits of all their home upgrades. Typical time requirements for intake processes, contracting, site visits, installations, inspections, and closeouts were combined to create a one-year program. *Nothing* happened faster than expected. And, while the average installation period was around 16 months, completing all the homes in the project's portfolio will take years, given that few projects can be done in parallel due to the implementation capacity of trade partners. Table 2 shows where most of the delays have occurred.

Table 2. Areas of Significant Delays in Advanced Homes Program Implementation

Bottleneck	Description	Recommendations
Finding eligible homes	A 7% enrollment conversion with low-income, single-family, and BAAEC area criteria	Improve data sharing across all income-qualified programs in CA and standardize income verification
Main service panels and roofs	We relied on two electricians and one roofing contractor, but 62% of roofs had to be replaced and 74% of main service panels had to be upgraded, creating a project bottleneck.	Bulk purchasing and itemized invoicing can help with cost controls and allow for higher contractor participation
Solar installs	By design, we relied on one installation partner with access to state incentives. This meant projects were often in a queue, waiting for installation crews to become available.	Create options and build capacity to scale up state incentive program
Coordination and contracting	Site assessment and implementation work from eight contractors/partners, with multiple design and permitting workflows.	Design and permit one job and include a general contractor for packaged upgrades.
Utility and permitting	Utility delays in meter spot-checks and permissions to operate (PTO) and delays from permit inspections	Increase staff and training for standardization and streamlining of applications at utilities and local governments.

From the start, the project set out to leverage existing incentives to maximize the impact of the CEC funding and maximize customer benefits. We stacked funding sources and combined multiple incentives. Table 3 lists the incentives that were combined to make Advanced Homes a no-cost offering for participating homeowners.

Table 3. Layering of State Incentives Used in BAAEC's Advanced Homes Program

Incentive	Incentive Amount	Description	Income Qualification	Administration / Implementer / Funder
Disadvantaged Communities - Single-family Solar Homes (DAC-SASH)	$3/Watt	Upfront incentive for rooftop solar via third-party owned (TPO) model	Up to 250% of federal poverty guideline	CPUC / GRID Alternatives / investor-owned utility (IOU) GHG auction proceeds, revenues, and IOU ratepayers
Self-Generation Incentive Program (SGIP)	$0.85/ Wh (equity)	Funds battery energy storage	≤80% of area median income	CPUC / IOUs / IOU ratepayers

Incentive	Incentive Amount	Description	Income Qualification	Administration / Implementer / Funder
TECH Clean California	$3,100 / unit	Gas tank to heat pump water heaters retrofits	None (at time of securing)	CPUC / Energy Solutions / State ratepayers and taxpayers
Energy Savings Assistance Program (ESA)	No-cost, direct install	Energy efficiency upgrades	Up to 250% of federal poverty guideline	CPUC / IOUs / ratepayers

Beyond the CEC funding and state incentives listed in Table 3 above, two additional grants supported Advanced Homes electrification measures.

- TECH Clean California Quick Start Grant (QSG). Funding from this Quick Start Grant was combined with the TECH Clean California heat pump water heater incentive to offer heat pumps at no cost and have funds for outreach, administration, reporting, and best practices sharing.
- Los Angeles Cleantech Incubator (LACI). LACI funded no-cost induction stoves, including electrical infrastructure assessment and air quality monitoring. LACI also provided funds for outreach, administration, reporting, and best practices sharing.

To make Advanced Homes available at no cost and with zero debt to the customer, the team cataloged all applicable programs and determined which ones allowed overlapping funding. Table 3 lists successful statewide programs that have been and will likely continue to be re-funded in years to come. BAAEC leveraged these programs and learned to align with their equipment and contractor requirements. It is imperative that new funding opportunities strive for standardization and simplification to make this process less cumbersome for future advanced energy community projects.

As an industry, we are committed to GHG-reducing strategies and work tirelessly to speed up and scale up the clean energy transition. However, solar + storage and electrification is costly, especially for single-family households. Upgrading BAAEC's low-income homes to Advanced Homes required an average CEC investment per home of $28,000, not including incentives, other grant funding cited above, and match funding from implementing partners. This cost included two Tesla PowerWalls for whole-home backup, an average solar array size of 3.93 KW, an average cost for roof replacements of $16,700, and $5,300 for main service panel upgrades. It is also important to note that smaller-sized projects are more expensive on a solar-per-watt basis.

The industry needs innovative ways to achieve healthy and resilient homes for everyone. Through our experiences on the BAAEC project, we discovered the following key insights for increasing access and affordability of Advanced Homes for low-income homeowners:

- **Rooftop solar + battery storage before electrification:** Because electricity rates are higher than fossil gas prices in California, it is important to start with rooftop solar and battery storage before electrification. This protects homeowners against utility bill increases, which is especially important for low-income households. BAAEC coordinated

with the utility's Energy Savings Assistance (ESA) program for energy efficiency and weatherization measures. Energy efficiency must be part of decarbonization.

- **Offer bridge financing or upfront incentives:** BAAEC unsuccessfully attempted to work with the CEC's Disadvantaged Community Advisory Group (DAC-AG) to give low-income households access to a state-funded revolving loan fund to front the SGIP battery incentive (CEC 2024a). Consequently, BAAEC created the state's first private financing facility so that we could offer SGIP rebate bridge financing (Wengroff 2023). Not every project implementer has the ability to create private bridge financing offerings, so for projects like BAAEC's Advanced Homes to achieve scale, incentives must be offered upfront. Upfront incentives will remove the barrier of homeowners or contractors having to contribute upfront funds and restrict potentially limited cashflows.
- **Third-party ownership (TPO):** customers struggle to cover upfront costs, find the time and resources to secure incentives, and they may not have the tax liability to take advantage of tax credits. They may also have poor credit that prevents them from obtaining project financing. A TPO model can simplify the transaction and increase the ways in which a contractor or financing partner can bring down project costs. For example, a roof replacement could be funded by including the cost as part of a solar install, leveraging investment tax credits, and spreading repayment over 20 years via a solar power purchase agreement. A TPO model could underwrite the project based on anticipated energy bill savings and the potential for grid services revenue. With this approach, the project is not reliant on the homeowner's creditworthiness.
- **Evolve DAC-SASH:** BAAEC leveraged the $3/watt incentive from DAC-SASH for rooftop solar installations. However, as mentioned earlier, the program's shortcoming is that it is limited to a single implementer (Grid Alternatives) and a single provider (Sunrun) of a third-party-owned (TPO) model. Moreover, DAC SASH does not offer battery storage (Evergreen Economics 2023). BAAEC's projects were delayed due to the reliance on Grid Alternatives as the single implementer. Projects were also delayed because battery storage could not be "bundled" with the solar installation and had to go through a separate design and permitting process. The CPUC should evolve DAC-SASH to meet new market conditions—especially with new Net Energy Metering 3.0 (NEM) rules that force rooftop solar to be paired with battery storage—and create a framework for more than one implementer.
- **Electrification-ready incentives:** BAAEC found that we needed to invest grant funds in remediation work to prepare homes for electrification technology. Our experience showed a clear need for programs to help low-income households prepare their homes to electrify. For DER and appliance electrification programs to be scalable in low-income communities, they will require utility and/or state programs and incentives to cover the costs for electrical wiring, remediation, roof repairs, panel upsizing, and other work associated with DERs and appliance electrification.
- **Be intentional in addressing the renter population:** Since "51 percent [of people] live in single-family homes" (Evergreen Economics 2022a), we need a landlord outreach strategy to improve homes and provide much-needed health, reliability, and protection against extreme weather for renters. It will be essential to ensure anti-displacement policies are in place to avoid increased rents that push people out of their homes. While only homeowners were eligible for BAAEC's Advanced Homes offering, we identified

the need for a rental solution through community outreach and engagement for Advanced Homes.

These strategies, in combination, are highly recommended for state energy offices, program designers and implementers, and industry stakeholders to consider when planning for equitable decarbonization. If clean energy incentives continue to ignore the ancillary costs of decarbonization for low-income households, and if the industry does not move towards covering upfront costs and maintenance, low-income communities will miss out on the savings, health benefits, reliability, and resiliency of the clean energy transition.

Chapter 3: Clean Energy Strategies of an Advanced Energy Community

The Advanced Homes project was just one component of the BAAEC project. BAAEC also included community solar, a resilience center, electric vehicle (EV) chargers, and zero-emissions shared mobility to complement single-family home retrofits. Together, they are clean energy strategies that come together to create an advanced energy community.

Advanced Energy Communities go beyond just clean energy strategies. The BAAEC project includes air quality monitoring to connect environmental and health concerns to local clean energy projects. Advanced Energy Communities must also include grid support services. As we decentralize the grid and increase its size via electrification, DERs will offer grid support services and demand flexibility, critical to keeping rates low for everyone and to building in-home reliability and resilience to protect against heat and power outages. An advanced energy community builds community identity and engagement to increase access, awareness, and adoption of clean energy technologies. Studies show that community identity and engagement in community activities increase motivation for sustainable energy initiatives (Goedkoop et al. 2022). Using a community-based approach for sustainable energy initiatives brings community identity and early and consistent participation. Figure 4 is a visual of these elements that come together to create an advanced energy community—showing how a community can mobilize around clean energy to achieve equity outcomes.

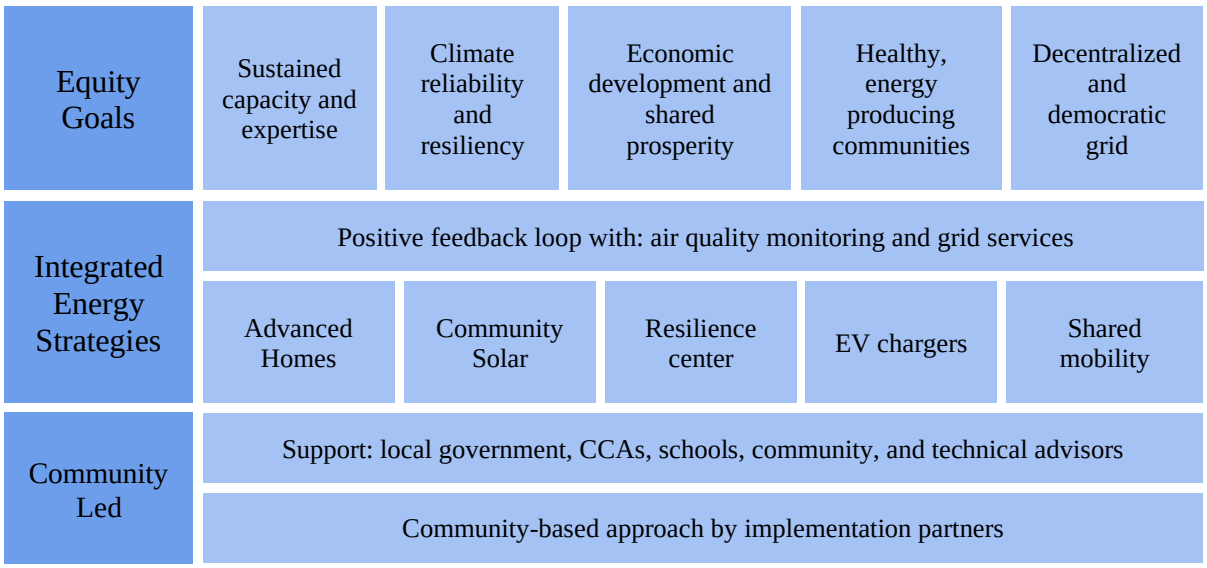

Figure 4. Elements of an advanced energy community.

3.1 Community Solar

Community solar provides program participants with access to decentralized clean energy and discounts on utility bills. Community solar is not exclusively beneficial to low-income households; it is a great solution for the 44% of California residents who rent, do not have homes suitable for solar, or cannot afford rooftop solar (Davalos, Kimberlin, and Mesquita 2021). BAAEC built a front-of-the-meter rooftop community solar project within the community, with Clean Power Alliance (the local CCA) as the off-taker and scheduled for CAISO market participation as a Distributed Energy Resource Aggregation (DERA). This project is the first of its kind in California. It is the first time CAISO has worked with utilities to aggregate generation resources under 500KW. Under the CPUC's Community Solar Green Tariff (CS-GT), the project will serve 340 residential customers who will subscribe and receive their electricity from 626 KW of rooftop solar across two sites in nearby self-storage warehouses. Community solar is expected to grow in California with the passage of Assembly Bill 2316, enhancing existing programs and creating a new market across the state. To successfully replicate this project, consider BAAEC's challenges and recommendations.

Community solar challenges included (1) changes to the project site, (2) utility delays due to interconnection approval and required site infrastructure delays, (3) having to submit the project to the utility solicitations twice since the utility interconnection approval was delayed the first time, and (4) the learning curve for new aggregation processes at CAISO because of the small nature of the project. Based on BAAEC's experience, the industry should prioritize the following recommendations:

- **Policy and regulation to create a community solar market.** Heed the CPUC's third-party process evaluation recommendations (Evergreen Economics 2022b) for existing programs and ensure friendly and clear CPUC regulations for new bills, like AB 2316 (An Act 2022).
- **Work with industry and trade groups to develop contractor interest and capacity** for smaller-scale front-of-the meter solar projects. BAAEC found limited interest from contractors in a project of this size. Most contractors focused on either smaller, behind-the-meter private rooftop solar or the larger, transmission-connected utility-scale solar. For BAAEC, the original community solar project developer walked away from the project, saying the project size was not aligned with their strategic business priorities.
- **Find sites with large project sizes and committed property owners** who have strong financial incentives to participate. BAAEC struggled to find parcels that could host larger solar generation projects. Reaching out to potential project site property owners was a laborious endeavor. BAAEC leveraged UCLA's community solar mapping tool, which proved to be an invaluable asset by identifying 728 parcels with technical potential for community solar projects (UCLA n.d.). Scaling community solar in California requires continued investments in these types of tools.
- **Leverage federal funding and incentives.** BAAEC tapped into the Investment Tax Credit with the adder for Energy Community. However, initiatives like the $7B Solar for All opportunity (EPA 2023) or technical assistance from the Department of Energy (DOE) and the National Community Solar Partnership (DOE n.d.) are resources that California can leverage to open up the state's community solar market.

3.2 Resilience Center

BAAEC is developing a resilience center equipped with 103 KW carport solar and 125KW/496kWh (4-hour battery) of energy storage, capable of islanding and maintaining critical load operation in the facility when the electricity grid goes down. Community input identified ten potential sites, two of which went through technical and financial feasibility analysis, and based on the analysis, one project site was selected: LA County Bassett Park. As islandable solar + battery storage microgrids, resilience centers align with extreme heat, reliability, resilience, climate-readiness, and emergency preparedness local policies. They are great at hardening public-serving infrastructure. However, public agencies like school districts and local governments do not generally have the resources or expertise to support these projects. BAAEC approached the local Bassett Unified School District with a proposal to site a resilience center at one of the schools, but they declined. The new project site is at a Los Angeles County Bassett Park. BAAEC obtained buy-in from the County in December 2021 and has conducted ongoing collaboration to design and secure necessary development milestones like utility interconnection and an SGIP battery rebate. However, as of February 2024, the resilience center project is not yet under contract. Microgrids are an essential solution to increasing demand flexibility to keep the lights on when the grid is constrained (CEC 2023), and they are also paramount for community resiliency (Lou 2020).

The resilience center challenges include (1) local government capacity and resources to approve and support solar + storage projects, including unfamiliarity with contracting for the project, (2) utility delays, (3) siting the battery and switchgear within the facility, and (4) creating economically viable projects. Based on BAAEC's experience, the industry should prioritize the following recommendations:

- Regulation that enables community microgrids to power multiple sites.
- State energy resource planning that incorporates the role of urban land use in the siting of clean energy generation.
- Building local government capacity to develop microgrid projects by normalizing the project developer agreements. This would help local government staff to understand project risks and benefits better and to streamline approvals.
- Standardization of financing and contracting vehicles to make it easier for project developers and host sites to rapidly agree on project terms. For example, energy savings agreements (ESAs) and power purchase agreements.
- Financing mechanisms that allow solar project developers to accept smaller projects with reasonable financing costs.
- Tools to streamline vetting of project interconnection with utilities.

3.3 Electric Vehicle (EV) Chargers

BAAEC is adding electric vehicle (EV) charging stations in the project area, which is an EV charging 'desert.' We will significantly improve access to public charging infrastructure in the area by installing thirty Level 2 chargers across three Bassett Unified School District (BUSD) school sites, with ten ports at each site, and two additional Level 3 (Direct Current Fast Chargers) ports at a fourth school site. Under-resourced communities are falling behind on EV charging infrastructure, which hinders access to charging for low-income households. Since BUSD could not contribute financially to these installations, BAAEC found a way to provide

turnkey support for the district through a third-party-owned (TPO) model by EV charger network provider.

Challenges with BAAEC's EV charger installation include (1) hosts without the ability to contribute financial resources to the project, (2) as the early adopters in their community, hosts did not have a strong financial motivation to provide EV chargers (i.e., not enough EV drivers in the area yet to regularly use the new chargers), (3) incentives that only partially cover costs, (4) host concerns around maintenance, (5) paying for added utility costs, and (6) uncertainty in charger utilization. Based on BAAEC's experience, the industry should prioritize the following recommendations to increase EV charging infrastructure in low-income communities:

- Ensure incentives are paid upfront for public agency hosts. This is particularly important for public agencies because of their unique budget and approval processes.
- Develop turnkey models for hassle-free installation that cover maintenance, warranties, and network fees. BAAEC switched implementation partners twice as we struggled to front the utility incentive and cover maintenance and network fees. The third partner we eventually settled on went beyond addressing these challenges and included a revenue-sharing opportunity for the district.

3.4 Shared Mobility

While electrifying transportation gets internal combustion engine (ICE) vehicles off the road, we must also work to reduce the total number of cars on the road—whatever their power source. BAAEC was unsuccessful in establishing a vanpooling program or a microtransit service to address the shared mobility component of Advanced Energy Communities. Finding people within the BAAEC area with similar work destinations was a barrier. Then, when an existing carpool group was identified, the use of the medium-duty electric van was a dealbreaker; they did not want to deal with charging or driving and parking a larger vehicle.

Based on thirteen interviews with BAAEC-adjacent city transportation departments and local transit authorities, BAAEC sought to prioritize creating a microtransit offering as part of our shared mobility efforts. However, there were no viable partners who could comply with CEC budget and grant terms. As of March 2023, BAAEC is working with a car-sharing program operator and will seek CEC approval.

Challenges with shared mobility for BAAEC were (1) the restricted project geography, (2) grant-related constraints like budget and payment terms which were impossible for partners to comply with, and (3) the limited existing charging infrastructure. Based on BAAEC's experience, the industry should prioritize the following recommendations:

- Work with existing transportation services to enhance or innovate their offering. Shared mobility aligns well with public transportation services, so the community's incumbent city or transit authority is best suited to innovate on zero-emission options that increase access and transportation options to everyone.
- Invest in community education, emphasizing the complete cost of ownership (things like insurance, maintenance, and car depreciation) to create a closer apples-to-apples comparison between shared mobility and vehicle ownership costs.

- Increase investment in existing pilots, such as the California Air Resources Board Clean Mobility Options (CMO) Voucher program so that shared mobility operators can reach commercialization (CARB n.d.).

3.5 Air Quality

BAAEC performed hyper-local outdoor ambient air quality monitoring to measure levels of carbon monoxide (CO), carbon dioxide (CO_2), nitrogen dioxide (NO_2), ozone (O_3), methane (CH_4), fine particulate matter (PM2.5), and black carbon (BC) at 1-second intervals in ~100-meter segments. We monitored Nitrogen Oxides (NOx) out of exhaust tailpipe emissions in a heavy-duty fleet of vehicles that provide consistent services to the community. BAAEC also monitored PM2.5, NO2, CO, and volatile organic compounds (VOCs) in the kitchens of Advanced Homes participants. The ambient air quality can help identify concentrated hotspots of pollutants, the tailpipe monitoring can help make the case for prioritizing the electrification of truck fleets, and the indoor monitoring can help justify the gas-to-induction stove retrofit transition. While creating a quantifiable impact on air quality at a local level is difficult, awareness and customer education are part of accelerating the switch to clean energy technologies. At the time of this paper, BAAEC is finishing the air quality analysis and has not developed community-facing information. Our goal is to develop educational information and raise community awareness regarding the source and type of pollutants affecting air quality and what mitigating emission reduction strategies they can consider in their homes and the broader community.

3.6 Grid Services

As we electrify end-uses and decentralize the electricity grid, we will become more reliant on carefully dispatching DERs and using bi-directional flows of electricity. With these strategies, we can make demand flexibility a predictable energy supply resource to the grid. We currently do not see low-income and disadvantaged communities participating in bring-your-own-device virtual power plant (VPP) programs or demonstration projects because they do not have the funds to purchase these technologies themselves. But, perhaps the CEC's solicitation (CEC 2024b) to fund demonstrations of community-based virtual power plants (VPP) means that people are beginning to notice the need to design more inclusive programs.

BAAEC is exploring customer-centered grid services by (1) partnering with the local CCA (Clean Power Alliance) in a load-modifying VPP, (2) with Southern California Edison in the CPUC's dynamic rate pilot, and (3) developing a smart local energy simulation. In each case, we intend to explore the benefit to the customer in participating and helping the grid. Our working hypothesis is that there is a model to help low-income people access renewables and DERs via advanced tariff design. Advanced tariff designs may include dynamic and transactive energy to optimize grid services without sacrificing bill savings. We will also explore the concept of local energy markets. Using BAAEC's signature customer and community-based approach, we will find the business, financial, and regulatory models that can support an equitable energy transition for all. If we do not intentionally design models for inclusivity, low-income people will not have the opportunity to purchase and benefit from local renewable energy and DERs.

Because BAAEC is in the early stages of this feature of an advanced energy community, we do not yet have challenges and recommendations to share.

Chapter 4: Conclusion

Despite its challenges, the BAAEC project is a cause for optimism. We have learned how to authentically engage with community to bring low-income homeowners the resilience, cost-savings, and climate benefits of participating in the clean energy transition. Across the features of the BAAEC project, we've co-developed and iterated on project designs and outreach strategies to develop a community-based approach that can be replicated to realize an equitable energy transition for all. Using our lessons learned and the capacity built through the BAAEC project, the project team secured $22M from the Strategic Growth Council for a similar community transformation project in another community (California SGC 2023). Our work continues in Bassett, Avocado Heights, and other communities.

Ultimately, our goal is to replicate BAAEC's insights and help stakeholders build capacity to create Advanced Energy Communities and forge solutions to systemic challenges. As we help community stakeholders transform more communities into advanced energy communities, solutions to the challenges BAAEC faced with things like financing, braiding of incentives across income-qualified programs, shared mobility, and transportation electrification will become widespread: a positive feedback loop for continuous improvement that can influence policy and future programs. Our collaborative governance approach will ensure the needs of each community are addressed as advanced energy communities spread. With this approach, we can reach the scale and speed necessary to meet our climate and equity goals while supporting a shared prosperity for all.

References

An Act (An act to add Sections 769.3 and 913.15 to the Public Utilities Code, relating to electricity). 2022. Ca. A. Ward. (passed September 16).

CARB (California Air Resources Board) n.d. "Clean Mobility Options Voucher Pilot Program (CMO)." https://ww2.arb.ca.gov/our-work/programs/clean-mobility-options.

California SCG (California Strategic Growth Council). 2023. *TCC Round 5 Implementation Grant Award Details.* https://sgc.ca.gov/meetings-events/council/2023/12-14/docs/20231214-7_Attachment_A_TCC_R5_Implementation_Grant_Award_Details.pdf.

CEC (California Energy Commission). 2023. "California Adopts Goal to Make More Electricity Available Through Smarter Use." California Energy Commission Media and Public Communications Office, May 31. https://www.energy.ca.gov/news/2023-05/california-adopts-goal-make-more-electricity-available-through-smarter-use.

———. 2024a. *2022 & 2023 Report of the Disadvantaged Communities Advisory Group.* February, 16. https://efiling.energy.ca.gov/GetDocument.aspx?tn=254702&DocumentContentId=90325.

———. 2024b. “GFO-23-309 - Virtual Power Plant Approaches for Demand Flexibility (VPP-FLEX).” Energy Research and Development Division, March 1. https://www.energy.ca.gov/solicitations/2024-03/gfo-23-309-virtual-power-plant-approaches-demand-flexibility-vpp-flex.

Davalos, M., S. Kimberlin, and A. Mesquita. 2021. *California’s 17 Million Renters Face Housing Instability and Inequity Before and After COVID-19.* Sacramento: California Budget & Policy Center. January. https://calbudgetcenter.org/app/uploads/2021/01/IB-Renters-Remediated.pdf.

DOE (Department of Energy). n.d. “Technical Assistance | Community Solar.” https://www.energy.gov/communitysolar/technical-assistance.

EPA (Environmental Protection Agency). 2023. “Biden-Harris Administration Launches $7 Billion Solar for All Grant Competition to Fund Residential Solar Programs that Lower Energy Costs for Families and Advance Environmental Justice Through Investing in America Agenda.” Environmental Protection Agency Press Office, June 28. https://www.epa.gov/newsreleases/biden-harris-administration-launches-7-billion-solar-all-grant-competition-fund.

Evergreen Economics. 2022a. *2022 Low Income Needs Assessment.* December 8. https://liob.cpuc.ca.gov/wp-content/uploads/sites/14/2023/07/2022_LINA_Report_120922_FINAL.pdf .

———. 2022b. *Process Evaluation of the Disadvantaged Communities Green Tariff and Community Solar Green Tariff Programs.* April 28. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/solar-in-disadvantaged-communities/dac-sash-evaluation-report-final.pdf.

———. 2023. *Process and Load Impact Evaluation of the Disadvantaged Communities-Single-Family Affordable Solar Housing Program (DAC-SASH).* March 31. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/solar-in-disadvantaged-communities/dac-gt-and-csgt-evaluation-final-report_033122v2.pdf.

Federico, F. D. Env., S. Pincetl, Ph. D., and E. Fournier, Ph. D. 2019. *Advanced Energy Community Deployment Around Existing Buildings in Disadvantaged Communities.* California Energy Commission: Energy Research and Development, January 31. https://www.energy.ca.gov/publications/2019/advanced-energy-community-deployment-around-existing-buildings-disadvantaged.

Goedkoop, F., D. Sloot, L. Jans, J. Dijkstra, A. Flache, and L. Steg. 2022.“The Role of Community in Understanding Involvement in Community Energy Initiatives.” *Front. Psychol.* 12 (10.3389.) https://doi.org/10.3389/fpsyg.2021.775752.

Lew, V., A. Ng, M. Petouhoff, J. Steinbuck, E. Stokes, and M. Werner. 2023. *The Electric Program Investment Charge Proposed 2021–2025 Investment Plan: EPIC 4 Investment*

Plan. Sacramento: Energy Research and Development Publication Division, November 15. https://www.energy.ca.gov/publications/2021/electric-program-investment-charge-proposed-2021-2025-investment-plan-epic-4.

Lou, Z. 2020. *Resilience Before Disaster: The Need to Build Equitable, Community-driven, Social Infrastructure.* https://apen4ej.org/wp-content/uploads/2020/10/Resilience-Before-Disaster-FINAL-UPDATED.pdf.

The White House. n.d. Justice40 Initiative | Environmental Justice | the White House. https://www.whitehouse.gov/environmentaljustice/justice40/.

Sarria, S. 2024. "Building Decarbonization Proceeding: Building Decarbonization and Renewable Gas Section." Webinar, January 19. https://efiling.energy.ca.gov/GetDocument.aspx?tn=253983&DocumentContentId=89289.

SGIP (Self Generation Incentive Program). 2023. "2nd Quarterly Workshop of 2023." Webinar, June 28. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/self-generation-incentive-program/2023-sgip-2nd-quarterly-workshop.pdf.

Wengroff, J. 2023. "Perl Street and The Energy Coalition Secure Battery Storage Incentive Financing to Enable Deployment in Low-Income Households." *BusinessWire.* July 18. https://www.businesswire.com/news/home/20230718972529/en/Perl-Street-and-The-Energy-Coalition-Secure-Battery-Storage-Incentive-Financing-to-Enable-Deployment-in-Low-Income-Households.

UCLA (University of California, Los Angeles). n.d. Map | LA Community Solar Opportunity Map. https://solar.energyatlas.ucla.edu/map.html.