Opportunities and Barriers to Affordable Housing Electrification Retrofits: An Owner's Perspective

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Abstract

Electrification of domestic hot water, HVAC, and cooking end uses in deed-restricted affordable housing in California poses many challenges and opportunities. While state and utility incentive programs have reduced upfront financial barriers to implement robust electrification retrofits, a range of other considerations impact a building owner's ability to invest in these projects - such as asset lifecycle intervention points, financial cycles, and long-term operational concerns. In this paper, we will offer the owner's perspective on pursuing electrification of affordable housing, delving into both the upfront and operational implications that influence decision-making.

Through case studies and organizational interviews, we will describe the process leading up to pursuing a retrofit, the experience implementing retrofits, and operational outcomes from the investment. Building on our recent experiences with electrification retrofits, we will provide commentary on how emerging technologies, such as multi-function heat pumps, and load-shifting strategies, can improve energy affordability for tenants and owners. In addition, we will explore recent examples of integrated decarbonization retrofit projects that included both electrification and on-site renewable energy. Finally, we will suggest policy strategies to accelerate and scale energy retrofits for multifamily owners.

Introduction

Eden Housing is a California-based nonprofit affordable housing developer and owner. Since 1968, Eden has worked in partnership with cities and local community partners to develop and acquire more than 12,600 homes. Eden serves a diverse population of 65,000 low-income residents, from low and moderate-income families, seniors, veterans, and people with disabilities, to formerly homeless individuals. Eden has invested in sustainability throughout its portfolio, with the goal of reducing energy use, water use, and waste, while providing positive financial returns for the organization and our tenants. Eden has a robust clean energy portfolio – with over 8 MW of solar PV installed across our properties. In recent years, electrification of HVAC, hot water, laundry, and cooking appliances has become a growing priority for the organization. Inspired by the DOE's Better Climate Challenge, which has since been sunset, Eden is working to decarbonize our properties where technically and financially feasible. Fuel switching from natural gas to electric appliances will allow Eden to maximize the value of renewable energy assets and reduce utility bills, streamline energy procurement across our portfolio, and model pathways to achieve California's ambitious climate goals.

Assessing electrification across a portfolio of 165 properties and 13,000 units is a daunting and complex challenge. Each of our properties is unique, with varying ownership structures, tenant profiles, and physical typology, ranging from garden-style to mid and high-rise buildings. Properties also have a mix of electric and gas appliances, and financial conditions affecting their ability to invest in system upgrades. This paper will outline Eden Housing's approach to bringing order to this complex process. First, we will cover a portfolio-level

framework for evaluating electrification retrofit opportunities. Following from this overview, we will use three project case studies to describe key considerations, challenges, and outcomes from electrification retrofit pilot projects.

Portfolio Electrification Planning

Operational Milestones

When evaluating opportunities for electrification of domestic hot water and HVAC equipment in deed-restricted affordable housing, a basic parameter to consider is *when* owners touch these systems. Currently, there are three primary intervention points in the lifecycle of an affordable housing property when mechanical and plumbing system adjustments are made.

End-of-Useful Life

First, and most obvious, is the recurring replacement of building systems that are at or near the end of their useful life. In most instances, owners choose to replace equipment at failure to reduce the burden on a property's limited reserves and prioritize critical issues such as water intrusion, structural damage, or other life-safety concerns. The opportunity for electrifying equipment at this intervention point is extremely limited, due to the focus on restoring hot water or space conditioning services to the tenant as quickly as possible. In addition, incremental cost premiums are particularly difficult to absorb for individualized equipment installations. Many properties, due to their public subsidy, are required to solicit competitive bids and choose the lowest cost alternative. Incentive and rebate programs that support electrification are difficult to capture for these projects as well; many utility multifamily incentive programs are designed for building-level, rather than measure-specific, electrification or the staff time needed to process administrative requirements for participation in incentive programs is prohibitive for capacity-constrained property operations staff.

Substantial Rehabilitation

On the other end of the spectrum from emergency equipment replacement is the substantial rehabilitation milestone in a property's lifecycle. Substantial rehabilitation can happen when an owner applies for and is awarded Low-Income Housing Tax Credits (LIHTC) to rehabilitate older properties that have major capital needs. It is important to consider that HVAC and hot water systems are typically lower priority retrofits during substantial rehabilitation. Owners prioritize capital-intensive structural and foundation upgrades, dry-rot and water damage repair, and building envelope upgrades such as roof, siding, and window replacements to mitigate critical health and safety concerns. Replacement of aging mechanical and plumbing systems nearing the end of their useful life is included in scope as funds allow. Because substantial rehabilitation scope typically covers a full property, this is a more opportunistic intervention point to pursue efficiency upgrades or electrification of building systems across a whole site. For example, rehab HVAC scope of work may include replacement and/or electrification of all HVAC systems at a property. However, complex electrification projects, like those that require electrical service upgrades, are difficult to implement as part of a rehab project, because strict project financing and contracting deadlines limit appetite for the lengthy lead times that come with utility coordination.

Proactive Electrification

A third, less typical opportunity for retrofitting HVAC and hot water systems in multifamily affordable housing is a proactive investment in efficient or all-electric equipment. This type of project will be the focus of this paper, as it is a newer model that Eden has pursued to achieve full site electrification. In nearly all instances, owners can pursue a proactive electrification retrofit only when public sector or utility funded incentive programs are available to cover, or significantly reduce, the out-of-pocket cost of the energy upgrade. Decision-making for proactive retrofits comes down to a few core criteria:

1.) What is the capital need at the site? (e.g. water heaters are near the end of useful life and frequently failing, but there are no near-term plans for rehab tax credits)
2.) What are the available incentives to cover the project cost?
3.) What is the estimated project cost?
4.) What are the operational cost implications of a retrofit scenario for both the owner and tenants?

A strong understanding of a property's physical needs is critical to developing proactive electrification projects. At Eden Housing, Physical Needs Assessments (PNAs) are conducted every 5 years for each property and serve as the reference to determine the scale of investment needed to maintain the asset. PNAs contain significant data on the age of HVAC and hot water systems, as well as information on technical barriers to electrifying equipment, such as undersized electrical sub panels, breakers, or utility closets. Three case studies from Eden Housing's portfolio showcasing the organization's experience with proactive electrification retrofits, from project inception and technical viability assessments to completion, are provided later in this paper.

Electrification Roadmapping

Affordable housing developers and owners can leverage the framework described above to compile a robust electrification roadmap at the *portfolio* scale.

Using the building blocks of technical and financial decision-making criteria for pro-active electrification retrofits, paired with an understanding of an asset's three lifecycle milestones, multifamily owners can establish a phased plan for each property. Owners can then translate these property-specific plans into a portfolio electrification roadmap.

Eden Housing is developing a portfolio tool to compile disparate data from across the organization: -- property replacement reserves and cash flow projects, capital needs from PNAs, utility data, and ongoing equipment maintenance costs will all be referenced in one place. This integrated approach will enable us to quickly evaluate and plan for electrification of our properties, identify challenging sites, and move near-term projects forward. Table 1 below provides a sample schema of baseline owner decision-making criteria for selecting opportunity projects, before projects are scoped and incentives are identified.

Table 1: Schema - Owner Electrification Decision-Making Criteria

Project Status	**Property Name**	**Priority Electrification or Renewable Energy Project**	**Current Property Reserves**	**5 Year DHW Capital Needs**	**5 Year HVAC Capital Needs**	**Annual Utility Costs**

3 - Financial Feasibility Analysis	XYZ	Central DHW Electrification	$191k	$0	$146	$6200

The pipeline tracking tool is a live document, rather than a point-in-time static snapshot, that Eden updates monthly. Finally, building owners must anticipate financial costs of projects and identify sources of incentive funding. Owners with a pipeline of potential projects are also well-positioned to quickly leverage competitive incentive programs when applications open.

Case Study 1: Emerson Arms – Martinez, California

Project Inception

We identified Emerson Arms as a candidate for electrification in 2023 because of the prevalence of central and individual gas appliances throughout the site, as well as the resulting high greenhouse gas emissions impact. Built in 1973, the 32-unit site consists of three separate buildings of wood frame construction with two of these over podium parking. There are 28 2-bedroom units and 4 1-bedroom units. Typical of construction at the time, each apartment features gas equipment including gas stoves and wall furnaces with no active cooling on site. Water is master metered and hot water for the units is provided by two central gas water heaters located in the garage of the largest building. Electrical capacity at the site posed a significant challenge for the project due to undersized transformers and electrical feeder lines into the building as well as the presence of outdated and unsafe electrical panels. We worked with our Association of Energy Affordability (AEA) technical assistant and the contractor to monitor load and capacity in order to determine post-retrofit electrical use. A solar assessment was also completed as a part of the assessment work. While retrofit of gas stoves was not originally included in the scope due to electrical constraints, the project turned into an opportunity for full electrification when AEA identified an opportunity to install battery enabled stoves through a study grant by the California Market Transformation Administration.

Financial Viability

Following a Property Needs Assessment for the site in the fall of 2020, the asset management team focused on building envelop mini-rehab activities, such as replacing dry rot, windows, and other structural components, but did not address the outdated electrical panels or any other energy efficiency projects. The plan was to pursue incentive funding from MCE Community Choice Energy's Low-Income Family and Tenants Program (LIFT) and Multi-Family Energy Savings Program (MFES). Upon finding out the LIFT program was to close, we obtained the go ahead to proceed with the project. We secured additional funding through the Low Income Weatherization Program (LIWP). Additional incentives were provided by a grant study funded by the California Market Transformation Administrator.

Pre-Retrofit Monitoring & Discovery

Eden worked with AEA and the installing contractor who designed a monitoring approach during pre-construction that could directly inform system design. Given the site's electrical constraints, AEA's technical staff monitored whole-site electrical demand along with residential domestic hot water usage. This monitoring provided the data needed to understand how the new multi-head mini-split units would impact available electrical capacity, and to appropriately size the new central hot water heating plant(s) based on actual hot water demand.

The monitoring and load analysis showed that capacity would be tight once the new electrified loads were added, particularly until transformer upgrades were completed. Importantly, the hot water monitoring also found that resident hot water usage exceeded what would typically be expected for a 32-unit building given the number of residents.

Utility Coordination

Early in the project, Eden asked the contractor to coordinate with the utility on feeder line upgrades. That request ultimately led to a prolonged, roughly 13-month utility timeline, and the scope of utility work shifted from addressing undersized feeder lines to replacing three transformers. Transformer replacements were completed one at a time, and each step required utility confirmation and authorization before the next phase could proceed and before new electrical equipment could be energized.

This sequence required flexibility from the installation team to maintain resident heating needs during the transition. In some cases, the original gas wall furnaces were left in place and kept operational until we received utility approval after transformer installation to turn on the new electric HVAC units. Once the HVAC units were energized, gas furnaces for decommissioned and no longer available for use. The team also adjusted the new mini-split settings to reduce amperage draw, which helped manage limited on-site electrical capacity while utility work was underway.

Roadblocks – Asbestos

The project was further complicated by the presence of asbestos-containing material in the joint compound used in the apartment wall construction. As a result, the electrical panel replacements required hazardous materials protocols, careful containment, and additional coordination around installation sequencing and site logistics to ensure resident safety.

In the end, the asbestos condition did not present a major obstacle for the contractor, who coordinated closely with an experienced, certified hazardous materials subcontractor. The work was well organized, with crews typically completing two to three units per day. Impacted areas were sealed and taped off, and the work was completed within the contained spaces. As an added precaution, residents were instructed to vacate their units for the day, even though the work were fully contained areas

Technology Spotlight – Induction Stoves

AEA also presented an opportunity to expand the heat pump HVAC and heat pump water heating scope into a full electrification project through participation in a California Market Transformation Administrator (CalMTA) study grant. The grant funded installation of Copper Home (formerly Channing Street Copper) induction ranges, which are battery-enabled and plug into a standard 120V outlet. This approach avoided the need to add 240V capacity at each apartment's electrical panel, which was not feasible given the site's undersized electrical infrastructure. Because the Copper Home ranges rely on connectivity for software updates and load management, Wi-Fi was required so the Copper team could coordinate and stagger charging across the site's 32 units and prevent all batteries from charging simultaneously. Charging was scheduled primarily overnight to align with time-of-use periods when electricity is typically least expensive, with the goal of supporting lower resident utility costs.

To support the resident transition to induction cooking, funding from MCE, LIWP, and AEA also provided new pots and pans sets for every residential unit, since induction cooking requires cookware made with ferrous (magnetic) metal. During the resident engagement project

kickoff event, Copper Home attended with Chef Lisa and Copper technical staff to demonstrate the stove, cook on-site, and answer resident questions about what to expect with induction cooking and day-to-day use of the new equipment.

Tenant Engagement

Tenants were engaged prior to any of the equipment installation efforts to introduce the new technologies and set expectations, including that each household would receive a new set of induction-compatible pots and pans. At the resident project kickoff and incentivized stove study sign-up event, the contractor also presented on the new heat pump HVAC, even bringing a unit for residents to see firsthand. The team also included the remediation vendor to explain what to expect during hazardous materials work and to answer resident questions about sequencing, safety, and in-unit impacts. Residents were also surveyed after the installation of induction stoves to understand use patterns and customer satisfaction.

At the same time, the lack of consistent on-site staffing over the course of the project affected the tenant experience and made relationship management and day-to-day coordination more difficult than typical. During the wall furnace removals and the transition to electric space heating, the contractor provided laminated "how-to" guides to support residents in operating their new heat pump mini-split systems.

Operational Considerations – Tenant Benefits & Utility Costs

While incentive and rebate programs have supported Eden Housing to overcome upfront financial and technical barriers to electrification, asset managers must consider the long-term operational implications of these systems. For affordable housing properties, such as Emerson Arms, the most pressing factors are tenant experience, comfort, and cost.

Emerson Arms is an example of beneficial electrification, where Eden achieved a goal of providing cooling systems while also fuel-switching heating away from natural gas. With the changing Bay Area climate punctuated by increased frequency of extreme heat, beneficial electrification projects like Emerson Arms will improve the resilience of our portfolio and the comfort of our tenants. Electrification of in-unit appliances, such as the installation of induction cooktops and ductless mini-split heat pumps, will increase tenant-paid unit electricity bills, while reducing natural gas bills. The specified electric appliances at Emerson Arms are significantly more energy efficient than comparable gas equipment, so tenants' overall energy use will decline. Figure 1 below shows the results of the phased electrification project at Emerson Arms, prior to the planned solar installation. However, variability between natural gas and electric utility rates will determine bill changes resulting from electrification. Over the past few years, electric utility rate escalation in Northern California has, on average, outpaced natural gas utility rate escalation, meaning that electrification projects must be tightly and efficiently specified to yield bill savings.

At Emerson, early results have been promising. Tenants have seen net cost savings because of battery-enabled induction stoves, which reduce peak power draws without compromising cooking function. Tenant feedback and operational results from the Emerson Arms' induction cooktop installation have been published by CALMTA.

Mitigating Cost Risk

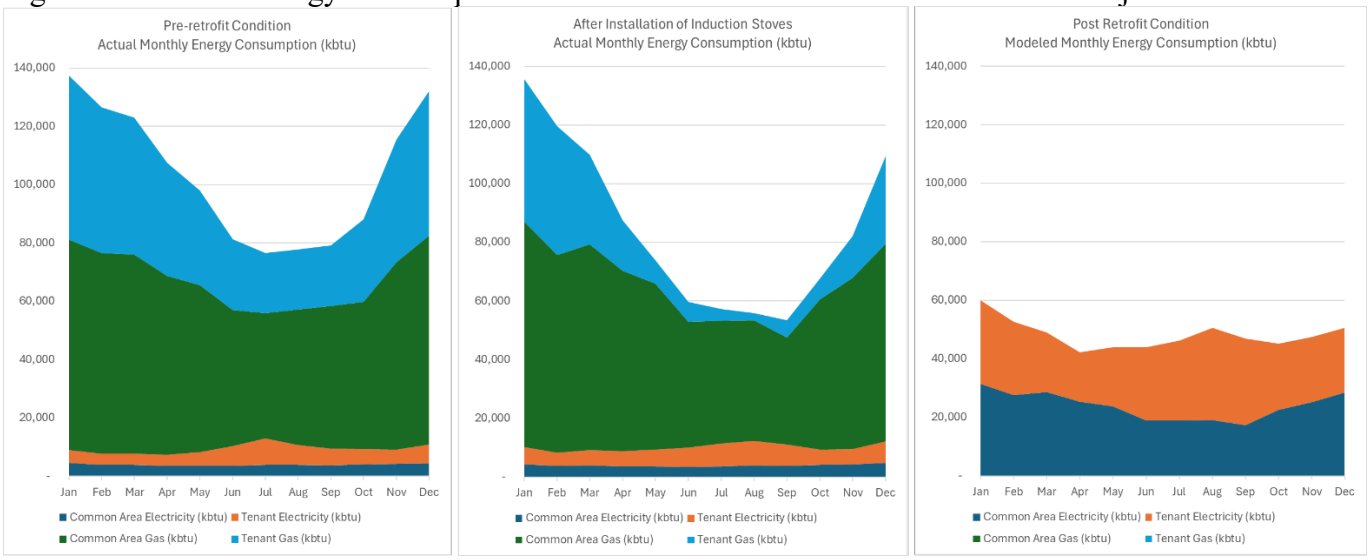
Eden Housing has many years of experience deploying on-site renewable energy systems, particularly solar PV and solar thermal, to drive down costs and increase utility affordability for

our properties. As we accelerate electrification of our properties, maximizing solar PV will be essential, not only to serve these new loads with clean, carbon-free electricity, but also to mitigate risk of negative bill impacts from electric utility escalation.

Future load modeling and accurate allocation of loads to on-site meters are essential to maximize the value of a solar PV installation integrated with an electrification retrofit. Incentive amounts for popular solar incentive programs, such as California's SOMAH program, are based on the solar allocation split between tenants and common area loads. Higher value incentives are provided for the tenant allocation, as the program is intended primarily to improve utility cost affordability for low-income residents.

For the electrification of loads at Emerson Arms, the pre-retrofit and post-retrofit split of tenant and common area electricity consumption shifted considerably. The table below shows the reduction in tenant energy use resulting from induction stoves (light blue) as well as the full post-retrofit condition where all gas is eliminated from the property. Future load modeling was conducted to justify an increased allocation of the proposed solar PV system to the common area meter, which will power a large central heat pump water heating plant.

Figure 1: Sitewide Energy Consumption Outcomes - Emerson Arms Electrification Project



Case Study 2: Virginia Lane – Concord, California

Project Inception

1140 and 1121 Virginia Lane are two distinct, unconnected properties located a block apart, but they function as a combined decision point from an energy and emissions perspective. Built in 1964 and 1970, both sites have central gas domestic hot water heating plants with solar thermal preheating that was added during a major rehabilitation in 2016. 1121 Virginia Lane is a building with 53 apartments that had through-wall PTAC units, gas wall heaters, and electric stoves, with residents paying for electricity. 1140 Virginia Lane is a building with 38 apartments that similarly had PTAC units and gas wall heaters, but cooking was gas, and the building was master-metered for gas, meaning residents paid for electricity while owner-paid gas costs drove operating expenses. Benchmarking showed high gas usage and elevated greenhouse gas emissions across the sites, while resident feedback consistently pointed to high electricity bills in the summer due to old AC appliances. This combination of owner cost exposure, emissions

reduction opportunity, and resident comfort needs made Virginia Lane a strong candidate for heat pump space conditioning upgrades.

The project was phased, with the first phase focused on 1140 Virginia Lane to reduce master-metered operating expenses and improve comfort by installing heat pump mini-split systems in common areas and in bedrooms that did not previously have air conditioning, while removing common area gas wall furnaces. The second phase extended the mini-split approach to 1121 Virginia Lane. We also evaluated electrifying cooking at 1140 Virginia Lane, however in coordination with AEA we determined the site's limited electrical capacity significantly constrained what was feasible at the unit level. Adding 240V circuits and panel capacity for induction ranges across the building was not realistic for the 38-unit site given the existing electrical infrastructure and there was not sufficient budget or incentives to install battery-enabled 120v stove appliances. The initial decision-making prioritized the space heating and cooling upgrade as the most impactful electrification measure within the site's constraints.

While Eden's long-term goals were full electrification for both addresses, we did not pursue hot water electrification as a measure for either address because the existing solar thermal systems and major hot water plant components were relatively recent. Decommissioning solar thermal and recently replaced water heaters, recirculation pumps, and system components would have been wasteful and would have reduced the value of prior capital investment.

Financial Viability

Funding for the first and second phases was built on an incentive stack from MCE Community Choice Energy's Low Income Family and Tenants Program (LIFT), the Multifamily Energy Savings Program (MFES), and the Low Income Weatherization Program (LIWP). For Phase 2 at 1121 Virginia Lane, the project also leveraged additional support through the Bay Area Healthy Homes Initiative (BAHHI). Even with incentives in place, initiating and completing both phases posed financial challenges due to deferred maintenance needs and limited reserves. The project also moved forward during a period when the City of Concord rent increase moratorium constrained the property's ability to make modest rent adjustments that would typically help keep pace with rising operating costs. These conditions increased reliance on external funding. In parallel, the property experienced unplanned capital needs, including sewer lateral replacement, hot water system-related work, and other repairs. The project also incurred unexpected soft and permitting-related costs. City permitting change requests and City Design Review Board involvement added review steps, permitting fees, and schedule impacts.

Roadblocks – Municipal Design Review

A clerical error during permit submittal to Concord Permitting and Inspections triggered additional review by the City of Concord Design Review Board. As part of that process, prior rehabilitation Conditions of Approval were re-evaluated against current site conditions and multiple corrective items were identified. For the HVAC scope, the City required added mitigation for condenser placement and appearance, including aesthetic screening on all building elevations, even where not visible to the public. We also worked through an extended review to gain approval of a prefabricated screening product (Air Dekko) rather than custom-built enclosures, which helped control costs and limit schedule impacts but required iterative coordination with the Board. The Board also added landscape-related corrections and other closeout items. These expanded requirements created unanticipated costs outside the original HVAC budget. We secured additional incentive support from LIWP and LIFT for HVAC-related

items, specifically the Air Dekko covers and the landscape architect fee to produce the required building elevations with HVAC. Remaining non-HVAC costs were covered through property reserves.

Operational Considerations – Preventative Maintenance

Eden Housing prioritizes preventative maintenance to extend the life of building systems at our properties and reduce long-term capital expenses. Eden maintains a standard preventative maintenance checklist for common building components. This is a compilation of tasks that maintenance staff should complete at each site on an annual basis. The switch from gas to electric HVAC equipment also means a shift in the type of preventative maintenance work on these systems. As such, the installation of ductless mini-split heat pumps at Virginia Lane instigated a broader conversation at Eden about operations and maintenance implications of electrification and process changes needed to ensure proper maintenance of heat pumps. Eden is currently developing a preventative maintenance plan for common heat pump configurations.

The installation at Virginia Lane provided a few key learnings about the maintenance of ductless mini-split systems. In particular, the seemingly simple task of routine cleaning of indoor unit filter screens presents a significant operational challenge for maintenance staff. Six months to one year after installation, 1140 and 1121 Virginia Lane began to experience equipment failures in the mini-split heads driven by basic maintenance gaps. Dust accumulation on the internal filter screens restricted airflow and contributed to pump strain, ultimately requiring pump replacements on relatively new units. While ductless mini-splits offer a straightforward design and can be easier to install and commission than more centralized systems, the long-term operations burden can be significant at scale.

Filter maintenance requires opening the front panel of each indoor unit to remove and vacuum or clean the replaceable screens. The appropriate service cadence is not one-size-fits-all and varies based on resident conditions and behaviors, including housekeeping practices, pet hair, and smoking. From an owner perspective, the challenge is less the complexity of the task and more the volume: in a 91-unit property where each apartment has multiple heads (including a common area head and bedroom heads), the number of indoor units that require recurring service becomes substantial. The table below summarizes key considerations for owners designing preventative maintenance programs for ductless split systems.

Table 3: Ductless Mini/Multi-split Preventative Maintenance Considerations

Scenario	Advantages	Disadvantages
Option 1: Educate tenants on how to clean filters and encourage them to do this themselves.	Engage and empower tenants to save energy and improve comfort Reduce burden on maintenance staff	Risk of damaged equipment, potential liability issues depending on equipment location Lack of certainty that equipment will be cleaned and maintained
Option 2: Staff does all filter cleaning. Do not allow tenants to replace filters.	Owner maintains full control of preventative maintenance	Maintenance capacity constraints or costly maintenance contracts Requires frequent in-unit visits, especially when considered with broader maintenance tasks

Ultimately, technical feasibility and lower costs made the ductless mini-split system an attractive option for Virginia Lane from an upfront installation perspective. The residential units at Virginia Lane are small, meaning that fewer indoor units were needed to meet comfort conditions. The property also did not have existing ductwork or attic space for an air handling unit. A ductless configuration was the best option for an electrification retrofit here. However, the decentralized nature of the indoor air equipment in these systems and resulting operations and maintenance considerations discovered at Virginia Lane have discouraged us from recommending these systems for large family properties with multiple bedrooms in each apartment, which will require many indoor units.

Case Study 3: Eden Palms – San Jose, California

Project Inception

Eden Palms is a large, 145-unit family housing property in San Jose. The property was built in 1997 and while building systems have been maintained and replaced over the past 30 years, Eden Housing had identified this site as a priority for a substantial rehabilitation project. As described in the previous section, rehab projects include re-syndication of a property with low-income housing tax credits and a new partnership structure. While Eden's development team put together a strategy for the property's re-syndication, the asset management team investigated potential system options for an HVAC and hot water upgrade project at the site.

Space heating and hot water at Eden Palms are provided through gas-fired hydronic systems. Boilers in each unit supply hot water to both indoor fixtures and attic-mounted air handlers. Most units do not have active cooling systems, although a few special needs units have been retrofit with separate AC systems. As the project is in San Jose, a warmer Bay Area microclimate facing increased heat stress, Eden planned to add air-conditioning as part of any system retrofit on the property. The combined hydronic system at Eden Palms is found at several other Eden properties. As such, we hope that learnings from an electrification retrofit here can be scaled across the portfolio. Ahead of a potential rehab project, Eden identified six units to pilot an innovative technology solution to electrify the hydronic systems, leveraging thermal storage and load-shifting technology to deliver significant bill savings.

Financial Viability

AEA, in partnership with Franklin Energy, the California Energy Commission, and Harvest Thermal, invited Eden to participate in an Electric Program Investment Charge (EPIC) Program grant-funded pilot to demonstrate the performance of Harvest Thermal's all-electric hydronic space & water heating solution. The project was intentionally structured as a limited demonstration rather than a full-building retrofit, focusing on a sample of six residential units to validate effectiveness and implementation considerations. Funding for the pilot combined grant support and the project's eligibility for an estimated 30–40% federal tax credit, with the remaining cost responsibility retained by the property. This pilot approach reflects a broader financial constraint: many incentive programs are not well-suited to smaller, partial retrofits, and ownership may prefer to defer larger, comprehensive electrification investments until a major recapitalization or re-syndication milestone (for example, pursuing LIWP as part of a bigger scope and financing event) to improve cost-effectiveness and minimize disruption.

Due to the property's ownership structure, Eden could not monetize the estimated 30–40% federal tax credit, which increased the uncovered project cost and required pursuing

additional incentives. Eden therefore sought supplemental funding through the Technology, Energy, and Climate (TECH) Small Multifamily Program. Eden also applied for the San José Clean Energy EcoHome Rebatei, but that pathway proved administratively burdensome because it required resident account-level participation and sign-on, which is poorly aligned with multifamily ownership and centralized asset management. Despite Eden's responsibility for the operation, replacement, and cost of in-unit equipment, only 4 of the 6 households could ultimately be enrolled, limiting the incentive value and illustrating why some programs are not well designed for smaller multifamily retrofits.

Roadblocks – Space Constraints, Cooling

The proposed storage tanks needed to fit within the existing small exterior closets that previously housed the gas water heaters. The original tank sizes, intended to function as a "thermal battery" to support domestic hot water and space heating, were a tight fit. Early concepts included removing door frames to maneuver tanks into place, which would have created an impractical condition for future maintenance and replacement. Harvest and the installer identified tanks with appropriate dimensions that fit within the existing closets, avoiding the need for any enclosure modifications.

As discussed previously, active cooling is anticipated as part of any future rehabilitation scope. We explored incorporating cooling into the Harvest Thermal installation in the six pilot units, but adding cooling would have required a second condenser per unit and the grant did not cover the incremental equipment and installation costs. In addition to upfront cost, we anticipated an increase in electrical demand at both the unit level and in aggregate; however, at the time of evaluation we did not have clear, validated information on the total load impact or whether existing electrical infrastructure (unit panels, feeders, and building service capacity) could accommodate the added condensers without triggering broader upgrades. This uncertainty makes the approach difficult to scale, as replicating two condensers across a larger rehab could materially increase capital costs, space constraints, and installation complexity, and may require electrical service enhancements that were outside the scope of the pilot.

Technology Spotlight – Thermal Battery & Load Shifting

Harvest Thermal presents an opportunity to pair electrification with smarter controls by using time-of-use strategies to shift energy consumption away from higher-cost peak periods. The system is designed to "charge" thermal storage at higher water temperatures during lower-cost, lower-carbon hours and then leverage a tightly controlled mixing valve to meet domestic hot water and, where applicable, space heating loads at lower water temperatures. This approach is intended to improve affordability for residents by reducing exposure to peak electricity prices and supporting lower, more predictable energy bills over time. For properties with existing hydronic distribution, the technology is also promising because it can leverage existing piping and in-unit hydronic delivery, potentially reducing the extent of interior retrofit work compared to fully ducted alternatives.

Operational Considerations – Technology Risk

Eden is no stranger to innovation and was glad to participate in the grant-funded pilot to test an emerging, fully electric system. At the same time, we evaluated feasibility for scaling the Harvest Thermal approach to a development-led rehabilitation across the remaining 139 units.

Across several metrics, the pilot project at Eden Palms has been successful. As seen in the summary table below, energy use and cost are considerably lower than the pre-retrofit condition, with energy savings ranging from 76-85% and cost savings ranging from 15-41%. The results reflect the difference between the pre-retrofit and post-retrofit total energy consumption and bills, across all 6 units. To date, Eden has not received resident complaints related to the pilot installations, which is an important early indicator that comfort and day-to-day operation are meeting expectations.

Table 4 – Eden Palms Harvest Thermal Energy & Cost Outcomes

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Energy Savings	78%	78%	77%	82%	83%	84%	84%	85%	85%	84%	80%	76%
Cost Savings	30%	27%	15%	27%	35%	29%	28%	32%	35%	41%	31%	20%

However, there were some ancillary owner considerations that impacted the technology's viability for a site-wide rehab. As discussed earlier, Eden cannot capture federal tax credits for installing energy storage, a key value proposition for the Harvest Thermal system. Claiming these federal tax credits for a proactive pilot is difficult, but when a property is re-syndicated using the complex LIHTC process it is even more challenging. Secondly, expanding a newer, higher-cost technology sitewide introduces uncertainty around long-term performance, vendor viability and support capacity, replacement parts availability, and future maintenance requirements. Given the magnitude of a full-site investment, Eden weighed these risks against other more conventional electrification pathways with broader market adoption and a larger service ecosystem, recognizing that the pilot is an important learning opportunity but not, on its own, sufficient justification to commit to a single, premium solution across the entire property. To inform decision-making for a sitewide retrofit, we outlined three alternative system options, including costing, for the sitewide mechanical, electrical, and plumbing (MEP) rehab scope of work, as shown in Table 4 below.

Table 5 – Eden Palms HVAC & Hot Water Electrification System Options

	Option 1	**Option 2**	**Option 3**
Heating	Ductless mini-split HVAC (heating + cooling)	Ducted mini-split HVAC (heating + cooling), new air handler	80 gal HPWH with Harvest Thermal mixing valve, preserve hydronic system with new air handler
Cooling	Included in above	Included in above	New DX outdoor unit, connected to air handler
Hot Water	50 gal HPWH	I50 gal HPWH	Included in heating system
Notes	• No air handler needed • Negative exterior architectural impact due to refrigerant line installation	• Air handler needed • Retains existing indoor air registers • Limited architectural impact	• Air handler needed • Retains hydronic system and indoor air registers • Limited architectural impact

	• Long term maintenance risk/cost • Single outdoor condenser	• Single outdoor condenser	• Long-term risk of stranded or non-functioning controls equipment
Cost/unit	$22,000	$25,000	$30,000

In late 2025, the property was awarded rehab tax credits. Ultimately, we chose Option 2 – a ducted mini-split installation with a separate hot water system for the reasons described below:

- Ability to reuse existing ductwork
- Limited architectural impacts and single outdoor condenser for AC and heating
- Long-term maintenance concerns with ductless installation
- Upfront cost barrier for Option 3, tied to the organization's limited ability to capture federal clean energy tax credits.
- Long-term technology risk associated with Option 3, given the scale of the project.

Conclusion

In reviewing these pilot projects across our portfolio, Eden Housing's experience highlights both the promise and the complexity of electrifying existing affordable housing. Electrification can deliver meaningful benefits—including improved resident comfort, reduced greenhouse gas emissions, and the opportunity to integrate renewable energy—but successful implementation depends on careful alignment of technical feasibility, financial resources, operational capacity, and resident engagement. The case studies presented here demonstrate that there is no single pathway to electrification; each property requires a tailored approach informed by building conditions, lifecycle timing, and available incentives. For owners of large multifamily portfolios, developing a flexible portfolio-level roadmap, investing in early technical assessment and monitoring, and planning for long-term operations and maintenance are critical steps. As incentive programs evolve and technologies mature, affordable housing owners will play an important role in demonstrating practical pathways to decarbonization while continuing to prioritize affordability, resilience, and quality of life for residents.

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