EDEN HOUSING

Moving Toward a Carbon-Free Future for Multifamily Housing:

Greenhouse Gas Reduction Assessments Report

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EXECUTIVE SUMMARY

Eden Housing is a nonprofit developer and manager of over 160 affordable multifamily housing communities that advance equity and opportunity for low-income families, seniors, and other special needs communities across the state of California. Eden's long-time commitment to sustainability and its investment in staff and technical support has put it in a strong position to address decarbonization for its existing housing portfolio. Eden recognizes that it must focus on the existing properties in order to achieve the goal of fully decarbonizing all of its portfolio.

By mitigating the greenhouse gas emissions of our portfolio, we help lessen the impacts of climate change and improve the air quality in our neighborhoods and in resident living spaces. Reducing carbon emissions is driven to a great degree by energy efficiency and renewable solar energy, which lower the cost of energy for both residents and the property owner.

Eden has joined the US Department of Energy's Better Building Challenge (BBC), participating along with other affordable housing owners in the challenge to reduce energy consumption by 20%. Eden uses the US EPA's ENERGY STAR® Portfolio Manager® to compile whole-building energy data for the entire portfolio. In 2023 Eden signed on to the Better Climate Challenge (BCC) and committed to the goal of reducing carbon emissions from the existing portfolio by 50% over 10 years.

The Association for Energy Affordability (AEA), with funding from the TECH Clean California pilot program, used property data in Portfolio Manager to analyze the portfolio carbon emissions and to develop an electrification roadmap. With funding support from the Wells Fargo Foundation and Enterprise Community Partners, Eden has completed over 30 Greenhouse Gas (GHG) Emissions assessments of properties which the roadmap identified as the biggest GHG emitters.

By having multiple assessments completed over a short period of time, Eden has been able to identify commonalities and patterns, consider how to group property types with similar decarbonization approaches, and plan how to align recommendations with the life cycle of the buildings. The GHG assessments are now informing next steps at multiple scales: smaller items that can be done immediately by on-site staff; discrete projects—some funded through incentive programs—that require more planning and cross-departmental coordination, and large scale projects that will be incorporated into a major refinancing and renovation event.

Lessons learned so far from the decarbonization journey and the GHG assessments include:

- It takes strong and consistent leadership from the top and buy-in from across the organization.
- A whole-portfolio picture and strategy is the most effective way to make real—and measurable—progress.
- It is essential to get whole-building energy data in one place. BBC and BCC encourage using ENERGY STAR Portfolio Manager, but other tools are available.
- Get the type of GHG assessment that is right for your portfolio. GHG-focused assessments were enough for Eden because it already understands so much about its portfolio. Other organizations may need more extensive energy audits along with GHG analysis.
- Get as many audits done at the same time as possible. It helps to identify patterns and commonalities, as well as unicorns, and informs solutions at multiple scales.
- Internal digestion of new information takes time and effort across the organization. Intentions and planning must allow for this.
- Equity must be a strong driver in developing action plans, considering not only energy costs but energy cost sharing, and taking location impacts and climate risks such as air pollution, heat exposure, extreme weather and wildfires into account when setting out priorities for action.
- Decarbonizing water heating is particularly challenging. How we heat water is essential to reducing GHGs, but the available solutions are complex for both unit-based and central systems and must be planned and implemented carefully.
- Opportunities for action occur at multiple scales and require cross-organization coordination to implement.

Eden Housing would not be as far along on this journey as it is without the support and encouragement of funders and government programs, and a committed Board of Directors and staff. Special thanks to the Wells Fargo Foundation and Enterprise Community Partners for their support of the GHG assessments that are a critical part of this important work.

Josephine Lum Lodge, Hayward, CA

BACKGROUND

Eden Housing has a long history of building energy efficient multifamily affordable housing. The leadership of the Board, executive director, and senior staff has enabled Eden to reduce energy use in its communities and improve comfort for its residents over a sustained period of time. Eden has received Enterprise Green Criteria, LEED, and Green Point Ratings for almost all of its new buildings. Since the 1970's Eden has added renewable energy systems to our communities.

Eden signed onto the Better Building Challenge (BBC), committing to reduce our portfolio's energy use by 20% within 10 years. By getting utility cost/usage information uploaded into ENERGY STAR® Portfolio Manager®, Eden has been able to track our whole building energy use and GHG emissions. With this information uploaded to Portfolio Manager, Eden is able to prioritize and track our progress on reducing energy use, costs, and GHG emissions.

The decision to participate in the BBC and to make the effort to have whole-building information in Portfolio Manager has been fundamental to Eden's ability to understand its portfolio and to move forward with energy efficiency and decarbonization measures. Because Eden was engaged in this BBC work, Eden was able to receive funding and support from the TECH Clean California program to create a Portfolio Electrification Roadmap. The roadmap analysis and report was done by the Association for Energy Affordability (AEA), a designated technical services company for TECH Clean California, and a long-time energy services provider, especially for low-income communities and affordable housing.

At the same time, Eden's Executive Director and Board of Directors decided that Eden Housing would participate in the Better Climate Challenge (BCC) as well as BBC. The Better Climate Challenge asks organizations to commit to reducing greenhouse gas emissions by 50% over a ten-year period. Eden included all existing properties in the portfolio as of December 2022 and has committed to achieving the 50% reduction benchmark by 2032.

DOE and HUD offer excellent resources for organizations that help them convert these building and climate challenges into action. The BCC Emissions Reduction Planning Framework and Audit Checklist offer a step-by-step plan for implementing emission reduction measures (ERM). In Figure 1 we mapped Eden Housing's recent actions as well as near-term goals onto the BCC process map to demonstrate how Eden is implementing the steps along this decarbonization journey.

Figure 1: Eden Action Steps Overlaid on BCC Guide Roadmap

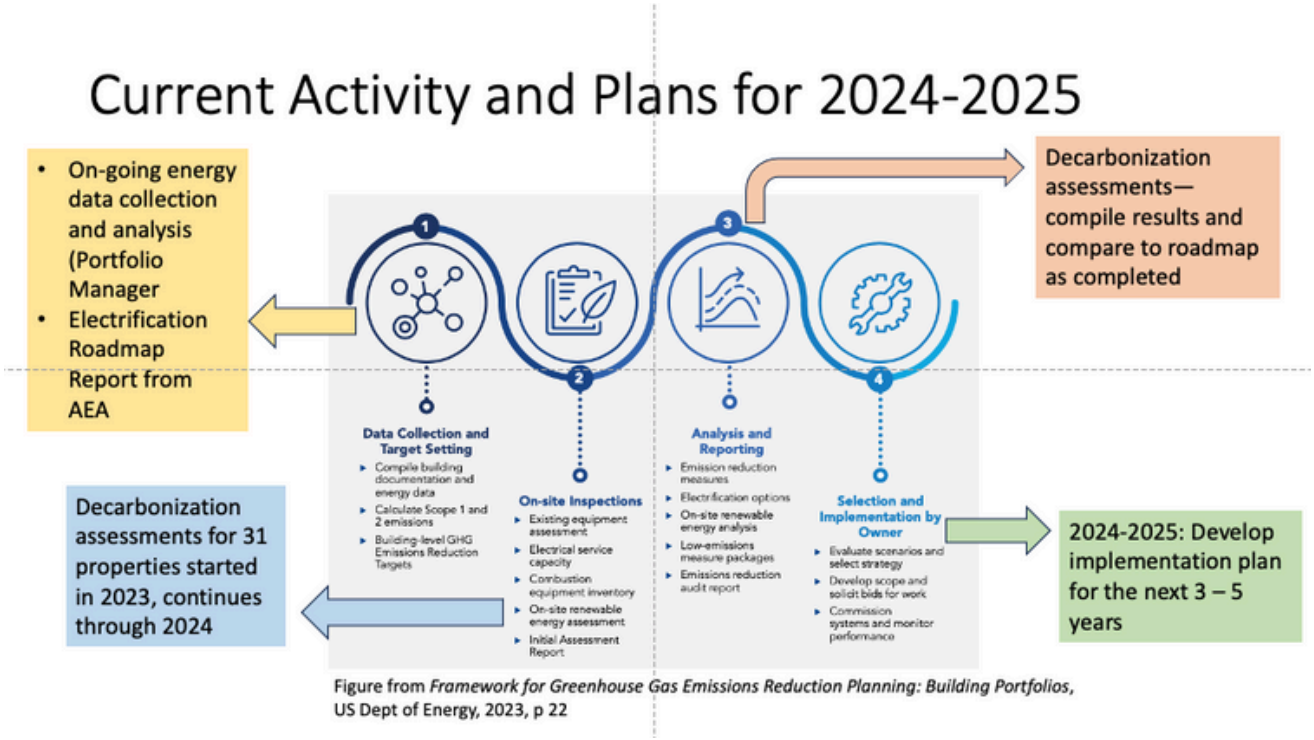


Figure from *Framework for Greenhouse Gas Emissions Reduction Planning: Building Portfolios*, US Dept of Energy, 2023, p 22

The Portfolio Electrification Roadmap Report provided a portfolio-scale strategy with recommendations for action. AEA analyzed each property in the portfolio for its energy use (total energy consumed); its energy use intensity (EUI) (energy use per square foot--kBTU/SqFt/yr); its total GHG emissions (metric tons per year of CO2 equivalent or MTCO2e)—both direct on-site and indirect utility-generated; and its GHG or carbon emissions intensity (CEI) (kgrams per square foot). AEA also considered key equity issues such as property location in high heat and wildfire risk zones, ambient air pollution loads, and tenant energy costs to compile an equity rating for each property.

AEA grouped the properties by the type and fuel source for key systems, and who pays the energy bill. Table 1 shows how the 126 properties included in the analysis break out by systems, seven types in all.

Table 1. Eden Portfolio System Types

Property Types / Groupings	Number of Properties	Percentage of Portfolio
Unitary Gas DHW, Unitary Gas HVAC	40	32%
Central Gas DHW, Unitary Elect HVAC	38	30%
Central Gas DHW, Unitary Gas HVAC	20	16%
Unitary Gas DHW, Unitary Elect HVAC	13	10%
Central Gas DHW, Central Gas HVAC	10	8%
Unitary Elect DHW, Unitary Elect HVAC	4	3%
Unitary Elect DHW, Unitary Gas HVAC	1	1%

In the Electrification Roadmap, based on AEA's analysis, the total portfolio annual GHG emissions is calculated as 13,540 metric tons. (MTCO2e) The direct GHG emissions are 8,827 MTCO2e. To meet BCC goals, Eden must reduce GHG emissions by 50%, or 6,770 MTCO2e, by 2032. This can be from a combination of direct and indirect measures, for example, Eden can replace a natural gas-fired water heater with a heat pump for a direct reduction in GHG emissions, or a property can purchase electricity from a clean energy provider as an indirect measure. The roadmap also offered suggestions of typical decarbonization measures that could be implemented at the properties and an initial analysis of how various combinations of measures could achieve the 50% GHG Emissions reduction goal for each group of property types.

THE GOAL: DECARBONIZATION

Within the umbrella of sustainability, the goals of green building incentive and rebate programs have been to reduce energy use and energy cost, and the programs rewarded one or both of those parameters. In response to the increasing impacts of global climate change, incentive programs and policymakers have been explicit that the ultimate goal is to reduce, and then eliminate, greenhouse gas emissions from buildings. This shift in language and focus has been challenging for affordable housing development and owners. One big difference that this shift has made is to elevate the importance of retrofitting and maintaining existing buildings.

Decarbonization is a four-step process:

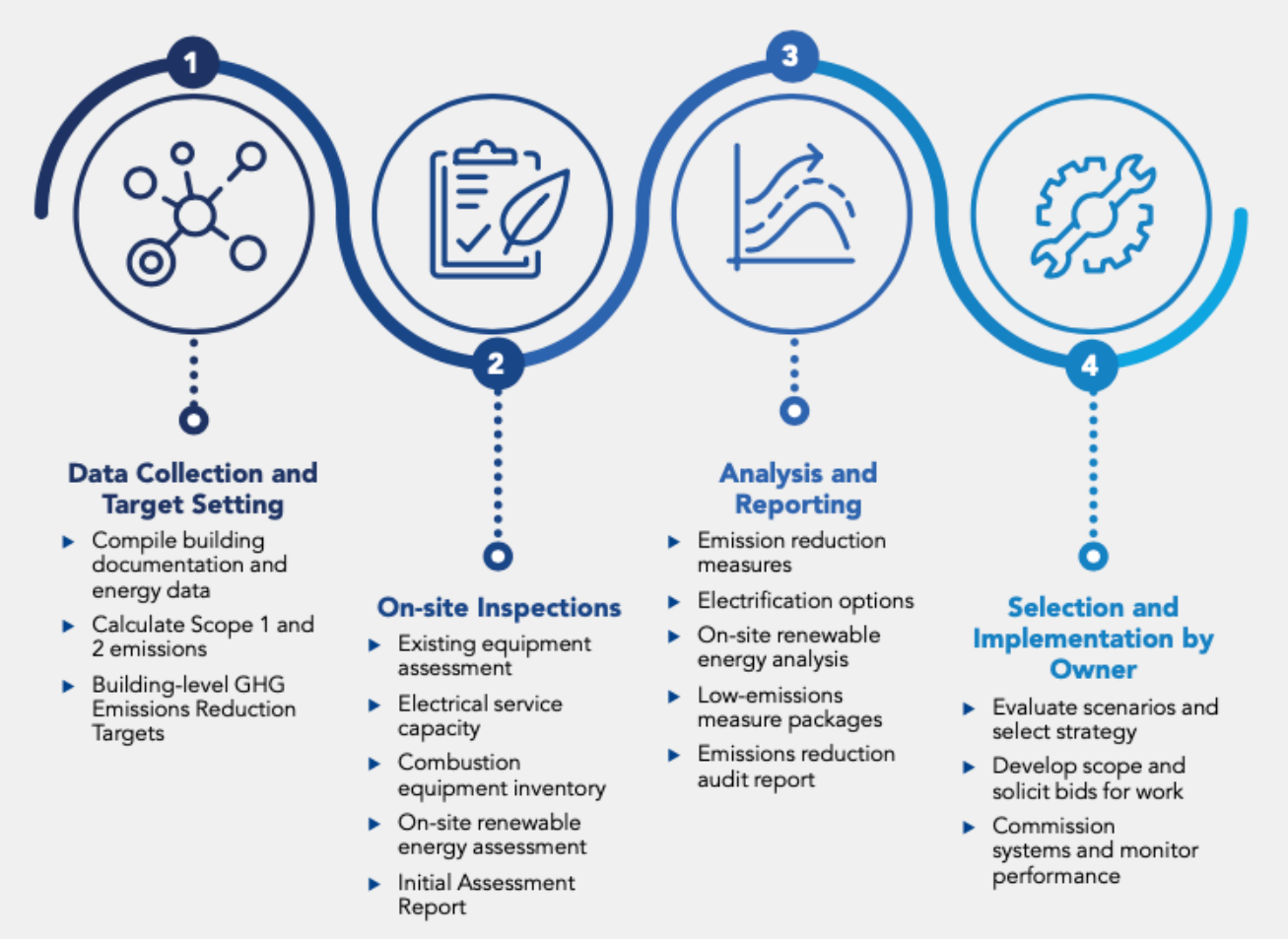
- Reduce total energy use (lower EUI)—using energy efficiency measures
- Convert fossil fuel systems to electricity
- Produce clean energy/electricity on site
- Purchase clean energy from the grid

Reducing the total amount of energy a building needs remains integral to carbon emissions reduction. Currently, electrification is getting much attention, but energy efficiency is an essential component of decarbonization.

GHG REDUCTION ASSESSMENTS

Using the BCC resources as a guide for its decarbonization process, Eden's next step was to conduct GHG assessments. The scope of work that Eden defined was a combination of steps two and three in the diagram in Figure 2. The goals for the assessments were to provide information on existing systems, fuel types and condition; to assess site, building and unit electrical system capacity for electrification; and to evaluate solar and electrical vehicle potential.

Figure 2. DOE BCC GHG Emissions Audit Path Diagram



[Figure from the DOE Better Climate Challenge GHG Emissions Reduction Audit Checklist, p 5.]

Eden used their Portfolio Electrification Roadmap as the guide to select the first set of 30 properties for assessments, looking for examples from each of Eden's five most typical building types, and for properties with a mix of high energy use and high carbon emissions and opportunities for positive equity impacts. Funding from Wells Fargo Foundation and Enterprise Community Partners covered the cost of these assessments, which were conducted by Peralta Energy and Abraxas Energy Consulting and were completed between October 2023 and September 2024.

GREENHOUSE GAS ASSESSMENTS

A high-level organization-wide sustainability roadmap or climate action plan (CAP) creates a strong foundation and starting point for inspiring organizational change and aligning stakeholders with an overview of a GHG reduction plan. A CAP or sustainability roadmap does not include details about specific energy efficiency projects and GHG emission reduction measures at the building level. Building-level emissions reduction assessments or audits provide the detailed analysis needed to select measures appropriate for each site.

Eden determined that for its purpose, full energy audits were not necessary. Because of previous energy benchmarking and active participation in various energy efficiency incentive programs Eden already had a good working knowledge of the energy and efficiency characteristics of its properties. Thus, the scope of the GHG assessments was to visit each property, confirm key energy systems, fuel type and responsibility for paying the utility bills. The scope included an electrification readiness assessment to provide an initial view of electrical system capacity at all scales: the site, the buildings, and the individual apartment units. Because transformers are not all well labeled, the site capacity could not be evaluated at every property. The energy analyst compared the electrical capacity with current equipment on each panel and estimated load increases from standard electrification measures.

Eden relied on trusted vendors that had done previous energy audits and analysis of Eden properties to complete the assessments. Other organizations may look for vendors with experience delivering ASHRAE Level 2 energy audits or credentials such as the Building Performance Institute's Multifamily Building Analyst. The US DOE's *GHG Emissions Reduction Audits: A Checklist for Owners* provides guidance on specifying an effective audit, and Eden used that checklist to define the scope of our GHG assessments. The CAP, emission reduction plan, and audits work together to help an organization develop an emissions reduction strategy. The GHG assessments were similar in form and content to ASHRAE Level 2 energy audits with the important addition of Deemed Electric Loads & Capacities. The reports followed the outline shown in the sidebar.

SAMPLE GHG ASSESSMENT OUTLINE

1. PROPERTY INFO
   a. Energy Suppliers, Metering, and Electrical Systems

2. EXISTING CONDITIONS
   a. Building Envelope
   b. Mechanical - HVAC and DHW Systems
   c. Appliances
   d. Lighting
   e. Water Fixtures and List of Inspected Units
   f. Photos of Existing Conditions

3. ENERGY USAGE

4. RECOMMENDED ENERGY EFFICIENCY AND EMISSIONS REDUCTION MEASURES
   a. Health and Safety Opportunities
   b. Phased measures
   c. Space constraints

5. ENERGY & GREENHOUSE GAS SAVINGS

6. ELECTRIC LOADS & CAPACITIES
   a. Deemed Electric Loads & Capacities

7. RENEWABLE ENERGY

8. APPENDIX: Funding Programs

The GHG reports identify the energy use by system and current GHG emissions along with estimates of changes in energy use and reductions in GHG emissions for various packages of measures. The reports complement the analysis from the Portfolio Electrification Roadmap and in some cases update or correct information for the roadmap. Recommendations for most properties were divided into a Phase 1 that included items that could be implemented without upgrades to the electrical system and a Phase 2 that included items that required electrical system upgrades.

The GHG reports also provided information on potential challenges that would have to be addressed for decarbonization measures, such as the size of existing water heater closets compared to the size of typical heat pump water heater models for individual apartment configurations. The reports also included information on any existing photovoltaic electricity (PV) systems in place and whether the site had space for more PV in the future. Finally, the reports noted whether sites were candidates for adding EV charging capacity or battery storage for on-site PV production.

ASSESSMENT INSIGHTS

The large number of assessments completed as a group offer numerous insights about the portfolio and suggest ways to group properties, set priorities, and organize electrification projects.

For example, the assessments make it clear that the primary contributor to GHG emissions in the Eden Housing portfolio is water heating. At many properties, water heating is half of the total energy use, contributing at least half of the GHG emissions. In response, changing water heating from natural gas to electric heat pumps is a priority recommendation for most properties. The assessments give Eden Housing information needed to sort the properties into groups that have central water heating systems or unit-based systems, and flags properties where water heater closets will need reconfiguring in order to fit heat pump models. The assessments also identify properties with central water heating for laundry centers. These insights enable Eden Housing to determine whether projects can be completed through operations and small capital projects, or whether actions should be incorporated into a larger refinance/renovation project.

At most, but not all, properties, electrical system conversions combined with other measures result in both energy use savings (reduced Energy Use Intensity) and energy cost savings. At a few properties, electrification results in modest energy use savings but energy cost increases due to cost differentials between natural gas and electricity. In these situations, Eden will need to proceed carefully, especially if higher costs will be borne by residents, and address impacts of the energy cost burden.

Eden's GHG assessments include recommended phasing of retrofits, for example Phase 1 would electrify water heaters, laundry dryers and bulk relamping with LEDs. Phase 2 would include updating the in-unit HVAC with heat pumps. Within each of the property types, similar strategies can be used, and similar challenges must be addressed. This will allow Eden to test approaches at one or two properties within each category, and then scale up using lessons learned.

The energy analysts evaluated the property electrical capacity and recommended Phase 1 projects for each property that could be completed with the existing capacity. The reports also flagged properties for which further load analysis should be done. Taken together, the reports offer assurance that Eden Housing would be able to make significant GHG emissions reductions across the portfolio without needing major electrical upgrade work. For a few properties, the Phase 1 recommendations reduce direct GHG emissions to zero, but for most properties, the Phase 1 recommendations result in 28% - 83% emissions reductions. For many properties, achieving 100% direct GHG emissions reductions requires some level of electrical system upgrades. The necessary upgrades can be required at any of three levels—the unit electrical panel, the building and common area load centers, and the transformer from the utility. For properties not located in Community Choice communities, addressing indirect GHG emissions requires adding substantial new PV capacity and battery storage, which may be limited by roof age and structural requirements, and safe space for battery placement.

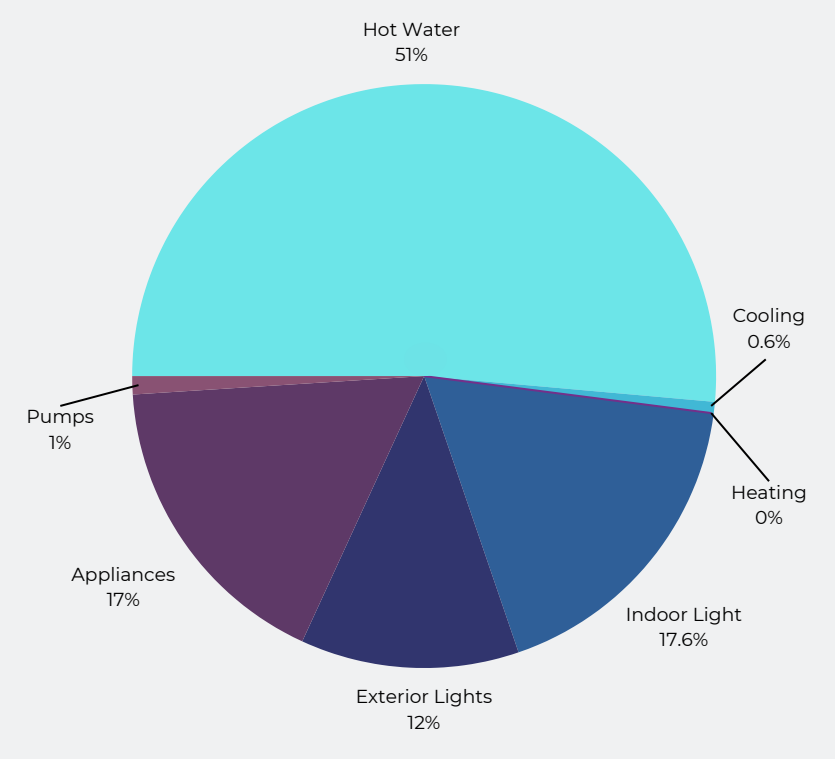
Recall the four-step decarbonization process discussed earlier, where Step 1 is Reduce Energy Use. Another challenge is that for many of Eden's properties, to properly address this step of the decarbonization process requires significant improvements to building envelopes. These improvements include increasing insulation and doing comprehensive air sealing. In some cases, new windows would be needed. For Eden, wall insulation upgrades would require major changes to the building exteriors. Many buildings have standard 2 x4 walls with batt insulation. Adding insulation would require removing the siding, adding rigid insulation to the exterior, re-setting windows and sills (because the wall depth would have changed), and putting on new siding. This is both a major logistical and cost challenge. Although these improvements would reduce the energy needed and improve comfort for residents, to date the incentive programs for heat pump conversions have not included the funding needed for envelope upgrades or the project planning and management needed to implement them.

Eden's Electrification Roadmap offered some limited information of the estimated cost of common upgrades, suggesting for example, that replacing in-unit water heaters would be in a range of $3,000 - $6,000 per unit. From the assessments, Eden learned that many properties will require apartment water heater closets to be rebuilt and resized for heat pump models, in addition to bringing electrical service to the closet and capping the gas line. That will put the cost at the high end of the estimate range.

In spite of these challenges, sub-analysis of the group of 24 property assessments conducted by Peralta Energy demonstrates the potential of completing only Phase 1 recommendations. Currently, together these properties emit 3921 metric tons of GHG annually. If all Phase 1 recommendations are completed at these properties, the emissions reduction is 2770 metric tons/year, a 71% reduction.

Eden Housing can use this information to understand how to meet its GHG emissions reductions goals, and how individual and multi-property implementation will contribute at least half of the GHG emissions, as shown in the Figure 3 pie chart for Nuevo Amanecer in Pajaro, California.

Figure 3: GHG Emission Percentages from Nuevo Amanecer GHG Assessment Report



NEXT STEPS

With 30 reports completed, Eden is now moving into Step 4 in the Figure 2 diagram. The first step is to digest the wealth of information in the reports and to analyze and categorize the properties and proposed measures. By having so many assessments completed in a short period of time, patterns and commonalities are more apparent, for example, the number of laundry centers with gas-fired clothes dryers and stand-alone gas-fired water heaters. This helps to plan for scalable measures that can be implemented at multiple properties as staff learn how to execute projects during initial pilots. But the reports as a package also identify the unicorns—the properties with particular configurations or issues that will require careful individual planning.

The next step is to define discrete projects and action items and build the teams needed to complete them. Some will be cross-departmental, and require coordination between asset management and operations, or asset management and real estate development. Successful implementation of the decarbonization plan will require a new level of on-going collaboration that engages all real estate-related departments—asset management, real estate development, property management and operations. The hope is that the investment in internal process and shared learning from initial projects will result in alignment of skills and capabilities of both staff and consultants that can scale the effort and accelerate implementation. Eden is developing its process for regular meetings and a pipeline and project tracking system that can support this new level of coordination. Expected outcomes as this process is established include:

- Collaboration with Eden's property operations department to develop guidelines for implementing energy efficiency and decarbonization measures that can be addressed through operations.
- Strengthened coordination with Eden real estate development pipeline for projects due for major refinancing in the next 1-5 years to ensure incorporation of decarbonization measures.
- Identification of good pilot projects to test implementation strategies across property types.

Another crucial step is to identify funding programs to support the targeted efforts. California utilities and state government have on-going rebate and incentive programs, including Pacific Gas & Electric's Energy Savings Assistance Multifamily program and the TECH Clean California program. California's federally funded Home Electrification and Appliance Rebates (HEAR) program was announced and open for applications at the end of September 2024. With a combination of incentives and property resources, some elements will be feasible to include in individual property annual budgets or replacement reserve spending. Other projects require major 'gut rehab' renovations that are best accomplished as part of a full refinancing and recapitalization event. Other projects are in between, and Eden will need to seek out incentive programs and federal, state, and local funding opportunities to be able to complete the work. The assessments

provide crucial information to support the property and project prioritizing, and to lay the groundwork for identifying funding solutions.

LESSONS LEARNED

Eden's participation in BBC and BCC and completion of the GHG assessments offers several lessons for Eden and other organizations that have a commitment to reducing carbon emissions in their housing portfolios.

The Altenheim, Oakland, CA

1. This is a journey. It takes strong and consistent leadership from the top and buy-in from across the organization. Eden has strong leadership from its Executive Director and its Board of Directors. In practical terms, this means that the Director of Building Performance and Sustainability (Tom White) makes regular reports to both the senior leadership team and key Board committees to keep them informed about goals and progress. It is challenging to build whole-organization understanding of the goals, keep everyone informed about progress, and meet people where they are in terms of expectations for their participation in the overall effort.

2. Utility consumption data is fundamental. And to tackle decarbonization, the data must include both house and tenant accounts to capture the whole building consumption and emissions picture. The BBC and BCC programs require this whole building, whole-portfolio picture, recognizing that it takes a whole portfolio strategy to make real—and measurable—progress.
3. It is essential to get whole-building energy and GHG emissions data in one place. BBC and BCC encourage using EPA's Portfolio Manager, but other tools are available. This is not easy: organizations face many data challenges. In many cases, common area meters are tracked and bills are paid by 3rd party utility cost management companies. Data can be tracked within property management and accounting platforms. Individual tenant bills are not tracked. Utilities still make it difficult to get whole building data that includes the gross tenant usage. It can be hard to even know where all available information is located and how to get it all in one place for a comprehensive view. Organizations must invest the effort in knowing what data is where and getting it all into one place. Ideally, several people in the organization are trained and familiar with whichever tool is chosen for this purpose, in order to build and maintain this crucial organizational capacity.
4. Get the type of GHG assessment that is right for your portfolio. Some organizations that are newer to energy and GHG emissions planning may need full energy audits along with GHG emissions analyses. GHG-focused assessments were enough for Eden because it already had recent energy audits for many of its properties and understands so much about its portfolio. The BCC program resources include a guide for GHG audits with recommended scopes of work and project checklists to help owners develop their audit and assessment plans.
5. Complete as many audits or assessments at one time as possible. Getting many audits done at once helps to identify patterns and commonalities as well as unicorns and informs solutions at multiple scales. Having more information increases the odds that organizations can identify scalable strategies that can streamline planning and implementation timetables and increase the odds of success.
6. Allow internal organizational processing time. Internal digestion of so much new information takes time and effort across the organization. Various departments and people need different kinds and levels of information to absorb goals and expectations. People want to know what is expected from them in their daily work as a result of expressed goals and project plans. As described earlier, new cross-departmental coordination will be needed. Information, stated intentions, and planning must allow for this.
7. Equity must be a strong driver in developing action plans. Equity considerations include not only energy costs but energy burden as a percent of household income. Location impacts and climate risks such as air pollution, heat exposure,

extreme weather and wildfires must be taken into account when setting out priorities for action. Fundamental goals of providing safe, healthy, and affordable homes to lower income residents cannot get lost in the effort to decarbonize.

8. Hot water and decarbonization remains challenging. How we heat water is essential to reducing GHG emissions and we must move away from fossil fuel systems. But the available solutions are complex for both unit-based and central systems even for new construction. In existing buildings, the complications of electrical load capacity and space constraints are additional concerns that also must be addressed.
9. Electrical system capacity is a major constraint for 100% electrification at many properties, especially older ones.
10. Opportunities for action occur at several scales: time of replacement at end of useful life, focused early-retirement system changeovers (possibly driven by funding program opportunities), medium scale retrofits, major rehabilitation timed with refinancing or recapitalization.

RECOMMENDATIONS FOR LENDERS

Lenders can support organizations with their electrification and decarbonization efforts in a number of ways. First, many banks and financial institutions are equity investors in Low Income Housing Tax Credit developments. As an investor, they could support and incentivize decarbonization measures by offering a higher rate of equity pay-in for a project that includes these measures. Also, as an investor in existing properties, they could offer more flexibility for use of project reserves to accomplish electrification measures.

Because additional secured debt is very difficult for existing properties with mortgages and equity investors, lenders could consider offering Equity Equivalent Investment (EQ2) loan products, or program-related investments, at the owner/portfolio level that could be used for green and electrification projects across multiple properties without requiring property-based securitization.

Also, the Greenhouse Gas Reduction Fund (GGRF) programs are starting to roll out. Lenders can partner with the GGRF intermediaries to further enhance and leverage the funds that will be available to affordable housing for acquisition/rehab and retrofits.

CONCLUSION AND ACKNOWLEDGEMENTS

Eden Housing acknowledges and thanks the many organizations and people helping to reduce the carbon emissions from our buildings. Thanks to Wells Fargo Foundation, Enterprise Community Partners, and HUD for funding this critical batch of GHG assessments. Eden acknowledges AEA's work to create the electrification roadmap and the funding from the TECH Clean California program that funded their work. DOE and HUD, through their support of the BBC and BCC programs and the technical support for program participation from ICF, make it possible for Eden and other housing organizations to take on these challenges. But the work is just beginning. Affordable housing will continue to need support from funders and government for planning and implementation and to accelerate the transition to a decarbonized future.

AUTHOR'S BIO

Kimberly Vermeer, LEED AP Homes, is an interdisciplinary sustainability practitioner, author, and podcaster, with a special focus in multifamily affordable housing. She offers clients strategic thinking and practical support to advance sustainability and climate resilience in their projects and portfolios. In her podcast, Green in Action, Kim shares stories of the people and organizations that are leading the transformation of the affordable housing sector through sustainable design and development. Kim is co-author, with Walker Wells, of the book *Blueprint for Greening Affordable Housing*, Revised Edition. Her background includes housing finance, policy, and development.