Creating Connections
To the Community and Each Other

The Lakeside Senior Apartments in Oakland, Calif., provide 91 permanently affordable homes for low-income and formerly homeless seniors, many of whom had been displaced by rising Bay Area housing costs. The building’s goal to be a model of healthy and sustainable development for seniors from its outset informed all decisions about design, combining a concern for healthy materials and systems along with social resilience, restoring connections among people, and repairing the urban ecology.

By Katie Ackerly, AIA, LEED AP, CPHC
Lakeside Senior Apartments offers a rooftop community suite that features outdoor decks with garden beds where residents can grow their own food and get their hands dirty.
In an urban area experiencing a housing crisis like the Bay Area, developing dense, urban-infill housing that protects vulnerable residents from being displaced or that brings them out of homelessness has inherent environmental benefits, if difficult to quantify. This half-acre lot houses roughly 180 people, while increasing site permeability and enriching the urban neighborhood.

This building brought focus to an area with an existing senior community, good transit and vital neighborhood resources, all on the shores of Lake Merritt, a natural estuary in the heart of downtown Oakland. The new building accommodated lost parking and added parking capacity in a below-grade garage topped by five levels of housing and community uses, including new permeable landscape. In addition to providing comprehensive affordable housing and supportive services, core goals of the project were to activate sidewalks to increase safety and enjoyment and create a sense of place.

At the same time, sensible strategies to conserve resources guided the architecture. The building design begins with a tight envelope and massing articulation that responds to orientation. Strategies focus on reducing energy and water

**Case Study: Lakeside Senior Apartments**

**Building at a Glance**

<table>
<thead>
<tr>
<th>Name</th>
<th>Lakeside Senior Apartments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Oakland, Calif.</td>
</tr>
<tr>
<td>Owner</td>
<td>Satellite Affordable Housing Assoc</td>
</tr>
<tr>
<td>Principal Use</td>
<td>Low-income senior housing</td>
</tr>
<tr>
<td>Includes</td>
<td>Staff offices</td>
</tr>
<tr>
<td>Employees/Occupants</td>
<td>183</td>
</tr>
<tr>
<td>Expected (Design) Occupancy</td>
<td>183</td>
</tr>
<tr>
<td>Percent Occupied</td>
<td>100%</td>
</tr>
<tr>
<td>Gross Square Footage</td>
<td>89,000</td>
</tr>
<tr>
<td>Conditioned Space</td>
<td>69,528</td>
</tr>
<tr>
<td>Distinctions/Awards</td>
<td>AIA COTE Top Ten Award; AIA/HUD Secretary’s Award: Excellence in Affordable Housing Design</td>
</tr>
</tbody>
</table>

**For New Construction**

| Total Cost | $25 million |
| Substantial Completion/Occupancy | 2014 |

**Key Sustainable Features**

- **Water Conservation**: 25% water savings
- **Recycled Materials**: 100% diverted concrete/asphalt waste and 80% total construction waste
- **Daylighting**: Daylit and motion-controlled corridors and common areas
- **Individual Controls**: Ceiling fans, heat recovery ventilators
- **Carbon Reduction Strategies**: High-density (138 residential dwelling units/acre) urban infill development

**Energy at a Glance**

| Annual Energy Use Intensity (EUI) (Site) | 25 kBtu/ft² |
| Electricity (Grid Purchase) | 15.5 kBtu/ft² |
| Electricity (On-Site Solar or Wind) | 9.5 kBtu/ft² |

**Building Team**

- **Building Owner/Representative**: Satellite Affordable Housing Associates
- **Architect**: David Baker Architects
- **General Contractor**: Roberts-Obayashi Corporation
- **Mechanical Engineer**: Robison Engineering
- **Electrical Engineer**: FW Associates
- **Energy Modeler**: Robison Engineering
- **Structural Engineer**: Murphy Burr Curry
- **Civil Engineer**: Sandis
- **Landscape Architect**: PGA Design
- **Lighting Design**: Horton Lees Brogden
- **LEED Consultant**: Bright Green Strategies

**Energy Model**

- **Modeled at 2 kBtu/ft²**
- **Natural Gas**: 9.5 kBtu/ft²
- **Annual Net Energy Use Intensity**: 25 kBtu/ft²
- **Annual Source (Primary) Energy**: 58.6 kBtu/ft²
- **Energy Star Rating**: 99
- **Carbon Footprint**: 3.52
- **Percentage of Carbon Deferred by Purchasing Offsets**: 0%
- **Years Contracted to Purchase Offsets**: 0
- **Heating Degree Days (Base 65°F)**: 2,608
- **Cooling Degree Days (Base 65°F)**: 350
- **Annual Hours Occupied**: 8,760

**Water at a Glance**

- **Annual Water Use**: 3,271,231 gallons

**Building Envelope**

- **Roof**: Built-up roof on roof trusses.
- **Overall R-value**: 38
- **Reflectivity**: 78 SRI
- **Walls**: Conventional wood framed
- **Overall R-value**: 21
- **Glazing Percentage**: 25%
- **Windows**: Effective U-factor for Assembly 0.40
- **Solar Heat Gain Coefficient (SHGC)**: 0.38
- **Location**: Latitude 37.5 N
- **Orientation**: -45 deg

In an urban area experiencing a housing crisis like the Bay Area, developing dense, urban-infill housing that protects vulnerable residents from being displaced or that brings them out of homelessness has inherent environmental benefits, if difficult to quantify. This half-acre lot houses roughly 180 people, while increasing site permeability and enriching the urban neighborhood.
demand first, followed by efficient, cost-effective equipment that requires minimal maintenance and takes advantage of heat recovery and solar energy to reduce loads. Urban sites do not always afford much flexibility in the basic decisions of massing and orientation; on this corner site, however, orienting the building in two bars with primary residential windows facing away from the southwest satisfied both load reduction and community goals, with the southwest street edge facing the lake now governed instead by sunny, verdant landscape and visual porosity.

**All About Connections**

The ground floor community room, just off of a welcoming, main entry, is a new hub of activities for seniors in the neighborhood. This room opens onto the central courtyard through a large folding door, creating a flexible space that accommodates a monthly “town hall” meeting, weekly bingo game and tai chi. In turn, the central courtyard, lined with a transparent glass fence, provides a protected space with a visual connection to the larger neighborhood. The second, top-floor community suite—with resident garden plots, event kitchen, and wellness room—reserves sweeping lake views for all residents.

The common spaces, apartments, and services support residents’ ability to live independently as long is comfortable. Wide corridors allow wheelchairs to pass and feature handrails to help with balance. The rooftop community suite offers wellness classes and a cooking/gardening program. The rooftop features garden beds tended by residents with help from a local farming non-profit.

**A Focus on Ecology**

The site is one block from the recently-renovated Lake Merritt, now a thriving urban park, and close to bus and rail lines. Building edges are activated by extensive street plantings—including the only street trees in the area—which draw nature up from the revived lake and reintegrate the natural ecology into the neighborhood. The building edge is designed to connect people to the city as well as to nature; stoops open to the sidewalk, while the welcoming entry and central courtyard make the building visually accessible to the street.

By building on this site—a former parking lot and adjacent disused parcels—and building on top of the replacement parking, this project has radically reduced the site’s pollutant load. By directing rainfall on all exposed surfaces to permeable
The central courtyard features extensive low-maintenance and drought-tolerant plantings, which are designed to be experienced both up-close and from above.

The paving, planters and swales, this project now also treats 80% of the average annual rainfall, reducing flow rate and removing 85% of any remaining pollutants that may exist in the water.

Of the approximately 4,600 acres of watershed that flows into Lake Merritt, only 320 acres drain through filters before entering the lake. While one project may not have a measurable impact on the stress of pollutants on the urban estuary, this project makes visible and demonstrates how high-density urban development can improve and respect the urban watershed.

Native plantings, high-efficiency irrigation and a robust plant mix with drip irrigation in all street and courtyard plantings contribute to a resilient but lush landscape.

**Design for Efficiency**

For a non-profit housing developer in the crushing Bay Area construction market, decision-making must be mindful of economic realities and place priority on material durability and system simplicity, allowing form to follow function.

The design follows the 80-20 rule: Use 80% straightforward, durable materials on the bulk of the building; concentrate 20% premium materials at points of high visibility.

On this project, this principle was extended to the building’s systems. Heat recovery ventilation (HRV) was a modest first-cost investment designed to help reduce resident heating bills while improving building durability and indoor air quality. HRVs were incorporated to mitigate the cost burden on low-income seniors after an hydronic heating system was cut for expense. Given the climate and envelope heating load reductions, the trade may even have resulted in a more resilient long-term design, considering the simplicity and reliability of electric baseboard heaters, and likewise the complexity, commissioning issues and reliance on gas, which all would have come with the hydronic system. An energy analysis estimated that the HRVs would deliver 30% to 65% annual heating demand savings, depending on the unit, and reduce the average annual heating bill to about $65. In fact, real data bears this out for the two bedroom manager’s unit. Given Oakland’s mild climate, it’s possible the sensible heat recovery efficiency was overestimated, and the true financial benefit of the HRVs is the focus of ongoing post-occupancy efforts.

This project was the first in our portfolio to use heat recovery ventilators; at the time, it was difficult to find models that were sized properly for a small one-bedroom apartment. Although we have used HRVs and ERVs in more projects since, there is much we have learned and still have to learn about their appropriateness.

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**CASE STUDY**

**LAKESIDE SENIOR APARTMENTS**

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**Figure 1** MANAGER'S UNIT ELECTRICITY, YEAR-OVER-YEAR

![Manager's Unit Electricity, Year-Over-Year](image)
for affordable housing. It was an unusual luxury for us to conduct additional energy analysis to examine the utility savings expected from using heat recovery, and since we have improved our capacity to do this type of design-phase analysis when questions arise that can not be determined by a compliance energy model.

Oakland has a mild, sunny climate with occasional “heat storms,” in which late summer temperatures can spike to 90°F for several days before sea breezes bring relief. The building form and envelope limit southwest exposure (9% glazing ratio), open the building to the north, and place recessed balconies and sunshades to provide natural sun control. Glazing ratios on southeast and northwest façades are tuned to balance daylight and sun. Louvered screens and metal sunshades were deployed as a key architectural feature. Lower heating loads are further facilitated by high-density wall insulation, additional roof insulation, high performance windows and measured air tightness exceeding Energy Star standards by nearly 40%. Ceiling fans provide personal thermal control to ease warmer days.

Corridors are enclosed and semi-conditioned to maintain more stable conditions as seniors make their way to and from home. But the design team worked to ensure the corridors didn’t feel enclosed, with daylit ends and operable windows pecking out to views of the city. This project also features high-efficacy lighting, daylighting, and common-area occupancy sensors throughout all common spaces.

One motive for pursuing LEED certification was to safeguard the health and safety of the senior resident population. The HRVs offer a balanced and continuous filtered fresh air system that improves air.

The building is well sited to help residents stay active, independent, and connected to the life of the neighborhood, including the bustling park and pathways ringing Lake Merritt.

The design used a wide range of complementary sustainable strategies—from simple to technical—to achieve LEED Platinum certification.
quality. To further reduce exposure to airborne irritants, all paints, adhesives and carpets have low or no volatile organic compounds (VOCs) and/or formaldehyde.

Low-flow fixtures throughout the building result in a roughly 25% potable water savings over a LEED baseline.

Predicted vs Actual Performance
A 52% solar fraction alongside high-efficiency gas water heaters were a primary contributor to predicted energy savings. However, actual energy use (Figures 1 and 2, Pages 20 and 21) reveals central gas uses (mostly hot water, plus laundry) were 33% higher than expected. This finding underscores the importance of pursuing research and demonstration efforts in multifamily building—to promote strategies that reduce hot water recirculation energy, and heat pump technologies in order to transition away from gas. Although this technology was not widely considered when this building was being designed, the equivalent all-electric building would have lower EUI and source emissions.

A 34.92 kW PV array covers 13% of predicted electricity use. The on-site PV, while a modest reduction, brought the predicted energy use intensity (EUI) down to approximately 23 kBtu/ft²·yr, just meeting the 2030 Challenge EUI reduction threshold for its time. Although available utility data does not show the total site use and actual PV offset, the net electricity use is considerably lower than predicted, nearly compensating for the increase in gas.

This may be the result of the senior residents using less than expected. Figure 3 shows just how sensitive resident utility bills can be to the heating months, due to the electric-resistance heaters. While not a substantial portion of the whole building’s energy use, this volatility—winter bills may be double or triple what they pay in summer—can be a shock for residents. The intent was for the heat recovery ventilators to relieve some of this shock; it is not possible at this time to confirm how much the heat recovery is drawing down heat loads.

Ongoing Engagement
Since the building opened in 2016, we have maintained contact with property staff through informal visits, tours for developers, and a structured post-occupancy evaluation (POE).

Our 2017 POE included a staff survey, a walkthrough with on-site staff and a focus group and survey with residents. The goals were to gain a comprehensive understanding of space function, indoor environmental quality and system operations, and to learn how residents perceive comfort and interact with
systems in their homes.

Residents who participated were positive about the bright, spacious quality of the building. Seventy-two percent reported their homes were usually comfortable, and 58% agreed it was easy to control the temperature. But residents prefer a high degree of control over airflow and thermal conditions, and about half used supplemental fans/heaters (especially in the bathroom while bathing), even those who reported being satisfied. This is an amenity we may consider on future senior projects. Not many residents were aware that a continuous mechanical ventilation system served fresh air to apartments. Mechanical systems generally were a source of skepticism or confusion, and wanting more control over window operation was a common theme.

For example, in some units, there was not enough acoustic isolation of the HRV, such that residents reasonably—but wrongly—perceived their bath fan exhausting into their bedroom. Heaters with convection components, although theoretically better for comfort, could also be confusing, because the presence of a fan implied to some a connection to a fresh air system.

Responses about acoustics showed a similar split (60% favorable); although generally acceptable, experience with noise can have an outsized impact on a resident’s health and sense of home, particularly among the elderly. Six of 21 residents indicated specific location-related complaints. The reality of a high-density urban residential building is that some private space often finds itself adjacent to a laundry room or loud elevator lobby, conditions that must be taken more seriously than standard practice dictates, not only in design but during construction oversight.

A walk-through with staff underscored challenges related to providing open circulation and amenity spaces designed to promote community while maintaining oversight and security. The courtyard and rooftop garden are among the most enjoyed spaces in the project, and we inferred that future senior housing should allocate more space to garden plots. However, stoops—designed to promote connection—worked too well, becoming a back door to admit guests to enter for shelter unobserved.

**Conclusion**

Lakeside Senior Apartments provides 91 homes that support disadvantaged seniors and help reconnect them to the beauty of their community. Although Lakeside is a good example of designing for high-performance, tax-credit-funded housing, there is still a lot to learn. Our experience on this project demonstrates how basic utility and post-occupancy data can be a powerful tool for illuminating simple yet overlooked performance dynamics, assigning value to design ideas, and pushing affordable housing design forward.

**ABOUT THE AUTHORS**

Katie Ackerly, AIA, LEED AP, CPHC, is an associate and sustainability lead at David Baker Architects in San Francisco.