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AvalonBay's First LEED Platinum Project Features Innovative Solar-Thermal/Tankless Water Heating System

Rooftop installations at the 182-unit Avalon Hayes Valley apartment complex couples 64 solar-thermal collectors with 18 tankless units to meet all domestic hot water needs, while also helping project exceed the California Title 24 energy code by nearly 30 percent.

BY JOHN O'REILLY

SAN FRANCISCO — When, in September 2015, the 182-unit Avalon Hayes Valley apartment complex in San Francisco was awarded LEED® Platinum Certification in the Multifamily Midrise category, it was only the most recent expression of the ongoing commitment of AvalonBay Communities to environmental sustainability and corporate responsibility in its properties. The latter now number 282 developments, containing nearly 83,000 apartment homes in 11 states and the District of Columbia, with another 27 communities under development.



That same month, AvalonBay was named a leader in residential real estate by the annual Global Real Estate Sustainability Benchmark (GRESB) survey, which awarded the company a Green Star for its top ratings in the various environmental categories. In December, AvalonBay was named the 2015 Residential Leader in the Light by the National Association of Real Estate Investment Trusts 2014. In all, the company currently owns 16 LEED and 10 Energy Star certified communities. An additional 23 communities are pursuing certification.

All of the above reflects from the ambitious Corporate Responsibility Goals AvalonBay set for itself last year for achievement by 2020. These include a 15 percent reduction in “energy-use intensity” and “water-use intensity,” measured in kilowatt-hours (kWh) per foot and gallons per apartment dwelling, respectively. Responding to the California drought, AvalonBay has cut water consumption in its properties there by 12 percent over the past year, while LED lighting

retrofits in 26 communities nationwide have netted annual energy savings of four million kWh, the equivalent of subtracting 577 passenger vehicles from the highway.

Among the keys to AvalonBay's success as a developer of sustainable properties is its willingness to take the long view on its investments, looking to maximize their impact on the local environment and community, as well as the health and safety of the residents. AvalonBay not only develops apartment parcels, serving as its own general contractor on all new-building projects; but also continues to operate and maintain these communities after its construction crews have all gone home.

"This is a highly intentional culture," explains Mark Delisi, Senior Director of Corporate Responsibility. "We act like owners, and as such, we must consider the life-cycle impact of our decisions. When deciding whether to do something, we will evaluate the opportunity based on its contribution to the future health of a property: Is it the right thing, long-term? As property owners and managers, that's a priority for us."

Achieving Platinum

Earning LEED Platinum for both the East and West buildings at Avalon Hayes Valley — AvalonBay's first Platinum certification — was no small achievement. The project, a podium-style structure with five levels of residential living in each tower situated over a single-level parking garage, accumulated a total of 81.5 points, a half-point above the Platinum threshold.

"Building in San Francisco is kind of experimental, so you must always be on your game," says Senior Project Manager Bryan Moore, LEED AP, who served on the Avalon Hayes Valley "Asset Team" with Senior Development Director Joe Kirchofer and Property Manager Alyssa Perry. "Of course, that challenge also puts AvalonBay on the cutting edge when it comes to green building. We learn it here first and then communicate it to the rest of the country."



Jeff Koch, Senior Design Engineer at ACCO Engineered Systems (left), with Bryan Moore, Senior Project Manager, LEED AP, at AvalonBay Communities (center); and Martin Morehouse, Solar Thermal Engineer and Estimator at Sun Light & Power.

Bryce Colwell is a professional project-rater for DNV GL, an international energy consulting firm AvalonBay recruited to help it achieve certification. Colwell has spent the past decade evaluating projects on many different U.S. Green Building Council rating systems, and "only a small number of those projects have reached the top certification," he says. "This was my first apartment project to go Platinum — it happens, but not that often."

Hayes Valley scored high on a number of measures, such as “Location & Linkages” and “Sustainable Sites,” scoring nine of 10 possible points for the first (with a community WalkScore of 98) and 16 of 22 for the second. These lofty numbers derive from its inner-city location in an “extremely dense” neighborhood in San Francisco, according to Colwell. “You can walk or bike to just about anything, while the property’s proximity to local mass transit systems is outstanding. AvalonBay even created a bicycle sharing program for its residents and earned an innovation point for that idea.”

Avalon Hayes Valley also scored well in “Water Efficiency” (9 of 15 possible points) and in the all-important category of “Energy & Atmosphere” (19.5 of 38). In fact, the project achieved an optimized energy performance in mid-rise buildings that exceeded the state of California’s Title 24 energy code (version 2008) by 28.6 percent. According to Pyatok, one of the architects on the project, the apartment units “are anticipated to see 20 to 32 percent savings in electricity and gas use over a typical apartment.”



The job of the solar collectors is to boost the temperature of the incoming water supply, so that the tankless units need not work so hard to meet the set point temperature of 120°F.

AvalonBay recently announced a new “Building Certified” construction standard, requiring all of its new high-rise and mid-rise construction projects to achieve third-party certification of environmental and energy efficiency from external rating programs such as LEED or Energy Star. Adds Delisi: “For garden-type apartment projects, LEED or Energy Star may not be mandatory, but it must be considered.”

But this “new” AvalonBay policy is, in large part, echoing current reality on the ground, according to [Susie Maglich](#), Director of Design Resources, whose job is to manage design and construction standards for all new construction and redevelopment projects for AvalonBay. “Many of our construction teams have already pursued or achieved building certifications on our projects, which shows just how deeply AvalonBay has instilled the sustainability message in our teams in recent years.

“A lot of the points needed for certification are already AvalonBay construction standards,” Maglich continues. “Low-flow plumbing, low-VOC paints, LED lighting — our teams routinely use these materials, whatever the level of certification they pursue on a given project. Which is why those same teams are becoming so proficient with the LEED certification process.”

Maglich oversees the maintenance of a massive AvalonBay construction standards manual that lists products, descriptions, assemblies, model numbers — “anything we want to standardize

across the entire organization nationwide, to ensure our teams are capturing lessons learned and implementing best practices.”

Getting Comfortable with Tankless

Given AvalonBay’s emphasis on maximizing efficiency and sustainability, you might assume the company aggressively seeks out and embraces new building technologies. But while fully committed to innovation and the benefits it brings, the company treads carefully with new products on behalf of its properties and residents, according to Maglich.

“Working with our project teams, we will pilot most new products on one or more projects, studying it through construction and then on the operations side,” she says. “Only after we get totally comfortable with a product or system will we begin to consider it as a standard.”

A good example of this piloting process — and another major contributor to the impressive LEED scores at Avalon Hayes Valley — is the buildings’ use of a solar-thermal-supported, tankless water heating system, manufactured by Noritz America, for all domestic hot water needs.

While not unheard of for large multifamily projects, solar thermal and tankless water heating technology are far from commonplace in this type of building. However, at AvalonBay, “individual tankless systems are now included in our standards,” says Maglich, thanks to their successful installation in a number of projects in the Northeast, “where the units are used for both domestic hot water and space heating.”

The installation at Avalon Hayes Valley is much larger and more complex than the individual Northeast systems, involving the centralized, rooftop placement of multiple tankless units to provide domestic hot water to all apartments. This is the second multi-unit, rooftop installation for AvalonBay. The first is a key feature at AVA 55 Ninth: a 17-story, 273-unit apartment building located in a similar San Francisco neighborhood a few blocks from the Hayes Valley buildings. Shortly after its completion in 2014, AVA 55 Ninth achieved LEED Gold.

Both projects are considered “pilots,” notes Maglich. “Our hope is that centralized tankless systems will soon also become an AvalonBay standard because of the success we have achieved with these two San Francisco installations.”

Like most proponents of tankless, AvalonBay appreciates the energy savings of on-demand water heating, as opposed to constantly reheating and storing hot water in large tanks in anticipation of its use. Maglich and her colleagues also like the dramatically smaller footprint that comes with eliminating the storage function. But while these attributes were apparent from the outset, AvalonBay still had questions about tankless — mainly having to do with the long-term, of course.

“Because we hold onto the properties we build for many years, the maintenance and the operations sides of all these products and standards are very important to us,” says Maglich. “So we wondered how the move from conventional tank water heating to tankless would impact our Residential Services group.

“For instance, we’ve learned that we need to flush these tankless units every year, and that flushing routine is now part of our maintenance procedures. As a result, tankless has become one of our preferred methods when we are pursuing LEED or Energy Star or wherever the local energy codes are particularly stringent. We encourage our teams to go tankless to help us achieve our goals.”

Integrating Tankless and Solar

Both AVA 55 Ninth and AvalonBay Hayes Valley use 18 Noritz NCC1991-DV condensing tankless water heaters to meet domestic hot-water needs, including apartment sinks and showers, janitorial sinks, and even a dog-washing area in the parking garage. Both systems are rooftop installs, capitalizing on San Francisco’s year-round mild climate, although the 18 AVA units are sheltered inside a small mechanical room. Finally, the municipal water feeding both sets of tankless units are preheated by a solar thermal system to lighten the load, saving still more energy as well as wear and tear on the heaters.

But while all 18 tankless units at AVA operate as a single, fully integrated system, the twin-tower construction at Hayes Valley required they be split into a pair of nine-unit systems. “A fully centralized system would have required extending the water heater return lines from one tower to another,” explains Design Engineer Jeff Koch, CPD, LEED AP, of ACCO Engineered Systems, which did both the design and the installation of the tankless units, plus the waste and vent systems, storm drainage, natural gas and fuel oil lines.

“By confining each system to its own structure, we minimized the amount of return piping, reducing our labor and making the overall system more manageable and efficient.”

When a resident turns on a faucet or a shower, the tankless system at either tower senses the subsequent water flow and activates the burner in one of the nine rooftop units. If demand exceeds the capacity of that initial unit, the system controller will trigger a second tankless unit to fire, then a third, a fourth, and so on until the need is fully met. As demand subsides, the units shut down one by one.

The water supply itself comes through the solar thermal system, which was designed and installed by Sun Light & Power of Berkeley, Calif. Also located on the rooftop, the system consists of 32 solar collectors on each of the two structures at Hayes Valley. Each collector setup is connected to a pressurized, 1,950-gallon storage tank where the heat energy is stored, awaiting a call for hot water.

When a demand for hot water arises, the solar thermal system preheats the water supply through a pair of heat exchangers: the first between the collectors and the pressurized tank; the second between the tank and the municipal water that actually enters the tankless units. The latter operation is controlled by a variable speed pump, a Grundfos MAGNA3, that cycles on and off with demand in response to the building's DHW demand. The upshot: The glycol-water solution in the collectors never comes in contact with the buffered water in the storage tank, and the latter never infiltrates the DHW supply, thus eliminating any potential concerns over Legionella bacteria.



Pressurized, 1,950-gallon storage tank where heat from the solar collectors is stored, awaiting a call for hot water. When demand is low-to-moderate and the tank is hot enough, it can meet all the domestic hot water needs of the building it serves without the

The job of the solar collectors is to boost the temperature of the incoming water supply, so that the tankless units need not work so hard to meet the set point temperature of 120°F, according to [Martin Morehouse](#), Solar Thermal Engineer and Estimator at SLP. “The actual temperature-boost the system provides varies, depending on the available heat in the storage tank,” which itself depends on the available sunlight.

“During periods of low-to-moderate demand when the tank is hot, the solar pre-heat is able to meet 100 percent of the demand without the tankless units activating.” [Note: A tempering valve caps the tank water at the set point of 120°F.]

During the cooler months, the solar collectors boost the incoming water by only 10°F to 20°F, with the system providing 30 to 40 percent of the heat energy required to meet demand. In summer, that “solar fraction” jumps to 80 percent, for a year-round average of 64 percent. Greenpoints become available when the renewable energy fraction reaches 40 percent, which is why AvalonBay was interested in the SLP system.

“The system is designed to produce 7,250 therms of energy,” Morehouse continues. “With the water heaters having a thermal efficiency of around 96 percent, the system should offset approximately 7,552 therms of natural gas, or the equivalent of 40 metric tons of carbon dioxide saved per year.”

And what if the solar collectors cannot provide any temperature boost, as might be the case when the fog rolls in or during an extended rainy period? “The tankless system simply compensates for what the solar system cannot provide,” says Morehouse. Even extensive maintenance is not a

concern, according to ACCO's Koch: "We have designed the tankless system with a bypass. If the collectors must go offline, the heaters will still function on their own to meet demand."

Tankless Takes the Inside Track

The ACCO organization is as enthusiastic about tankless as their counterparts at AvalonBay. Koch cites the energy savings, of course, stressing the high turndown ratio of a multi-unit system. At Hayes Valley, each heater has a minimum output of 16,000 Btu per hour at a flow rate of a half-gallon per minute. "If a tenant turns on a hot-water outlet at 3:00 a.m.," he explains, "we can comfortably and efficiently meet that isolated demand without firing all nine units."

But a few hours later when the entire building is in the shower, the heaters' maximum outputs — 199,900 Btu/h per unit, or nearly 1.8 million Btu/h for all nine — should be more than sufficient to meet demand.

The modular configuration also streamlines installation and maintenance, minimizing cost and inconvenience. All 18 tankless units at Hayes Valley were installed by two ACCO plumbers in two days, says Koch. Nor was an expensive crane needed to lift the 70-pound units onto the roof for installation onto steel screens: "The units are so light with no storage, the rooftop weight load was never a concern," he comments. "Plus, the screen mounts provide our installation and maintenance crews accessibility to the front and sides of each unit."

Likewise, if an individual tankless unit needs servicing, it can be easily isolated and removed for repairs without depriving the entire building of hot water. "Instead of using a crane to place a large piece of equipment onto the roof," says Koch, "you simply wheel the replacement model on a hand cart up five floors via the service elevator."

The lone problem ACCO has encountered with tankless relates to the increased amounts of silt in the water because of the drought in California. "Lower water tables throughout the state have resulted in silt in the plumbing," says Koch. "So ACCO now equips all our tankless installations with strainers that filter the incoming water before it enters the heaters. Problem solved."

So tankless technology has the inside track for any commercial project involving ACCO? That is certainly the case when the company functions as the design-build contractor from the outset of a project. In such instances, "we will likely evaluate that project in a way that will lean toward tankless," says Koch.

But certain projects use a consulting engineer to handle the "Basis of Design," which are concepts the owner-developer creates through a series of design-coordination meetings with the various principals.

“Once the design concepts have been established, it can be very difficult to change an owner’s mind or overcome his misgivings about a product like tankless water heaters,” Koch continues. “We inform our client on the possible savings in performance and maintenance, and sometimes we can win the debate. But people tend to stay with what they know best, so we install what the client has agreed to in the design meetings.”

But while every commercial project is far from a “slam-dunk,” Morehouse is excited about the prospects for solar —and tankless — in California, as the state drives toward a net-zero energy goal for new-residential buildings by the year 2020. In fact, he expects low-rise and mid-rise structures to be seriously considered for inclusion on the new net-zero stipulation.

“Getting as efficient as possible is the central reality for every developer, designer and installer in our current world,” he notes. “Tankless is definitely something that will be seen as a great benefit to the overall efficiency of buildings, and we believe our solar thermal system is an excellent complement to that technology.”

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