



**PAE LIVING BUILDING** PORTLAND, OREGON

# The PAE Living Building proves the triple bottom line works: you can do well by doing good.

## PEOPLE

Supporting an equitable future for all

**1<sup>ST</sup>**

Living Building Challenge project in Portland, Oregon

**1<sup>ST</sup>**

Developer-driven Living Building in the world

**\$20K**

In annual ongoing energy savings donated to affordable housing project

## PLANET

Leaving the natural world better than we found it

**108%**

Net positive energy

**100%**

Water needs met onsite

**40%**

Embodied carbon reduction

## PROSPERITY

Meeting the highest aspirations for sustainability

**500**

Year building

**85%**

Occupied by B Corps and non profits

**10%**

Projected investor rate of return

**“To address the climate crisis, we must make the use of cutting-edge technology and innovative design routine, not an exception to the rule. PAE’s Living Building work puts these principles into action and is a model for others to follow.”**

**U.S. CONGRESSMAN EARL BLUMENAUER**





## A replicable Living Building

### Challenge:

Design a 500-year building that exceeds net zero, is financially replicable, and positively impacts its surrounding community.

### Solution:

The first developer-driven living building in the world. An elegant structure that responds to its historic context, featuring biophilic, occupant-centered strategies, while using less energy, water, and materials.

### Impact:

The project team is freely sharing data and lessons learned, including touring over 3,300 people in two years, to help others follow this model.

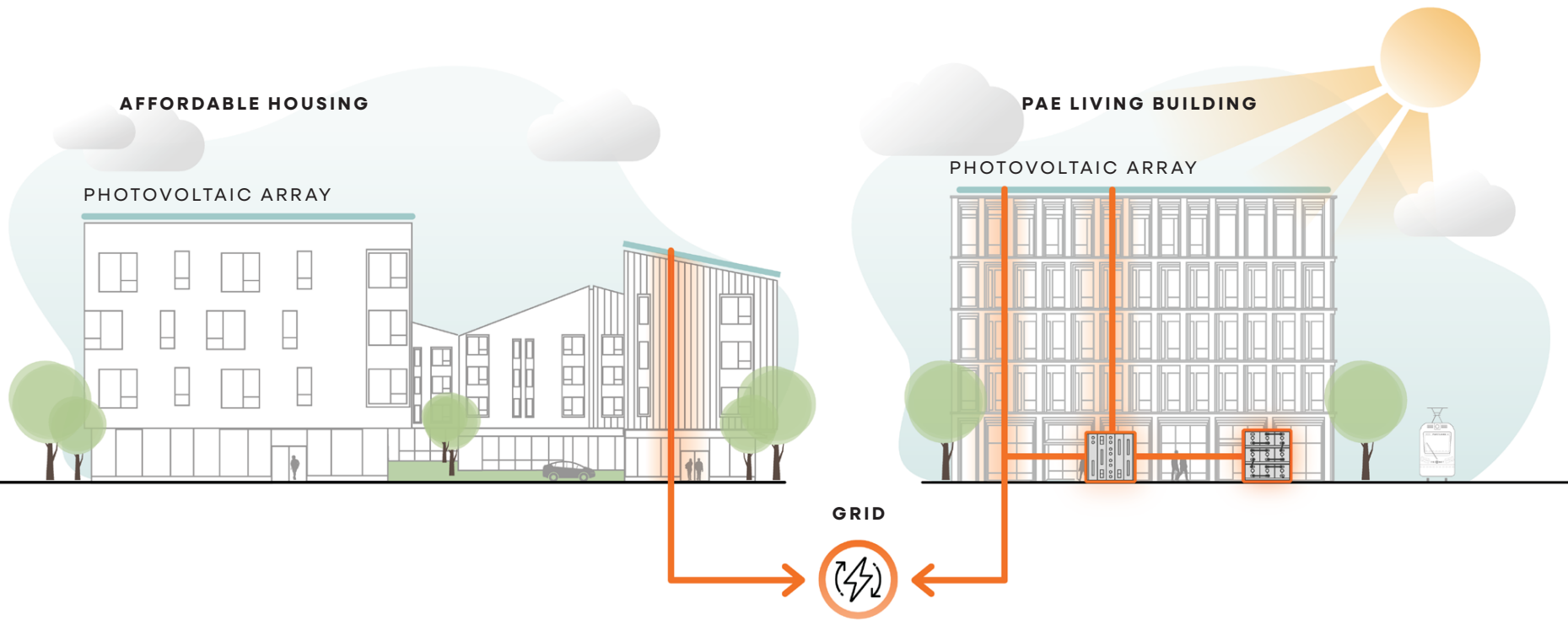
### GOLDEN RATIO PROPORTIONS





The PAE Living Building creates a human scale environment where one was lacking, filling in a vital missing tooth and restoring a piece of the walkable, transit-oriented neighborhood.





## Celebrating community resilience

The historic district did not allow visible PV from the public right-of-way, so the team had to look creatively at how to achieve net zero. The result, known as scale jumping, was to maximize PV on the building roof and purchase and install a PV system on a nearby affordable housing project, the Renaissance Commons. Renaissance Commons benefits by owning the system and realizing \$20k of energy savings annually, while PAE purchases 100% renewable electricity from the utility for any additional energy needs beyond what the building produces. This expands the overall renewable energy in the district and meets the Living Building Challenge intent.



# \$20K

in annual energy savings donated to Renaissance Commons affordable housing project



The lobby integrates artwork from Toma Villa, a Portland-raised member of the Yakama Nation. The wood carving and motifs of indigenous basketry designs welcome visitors.

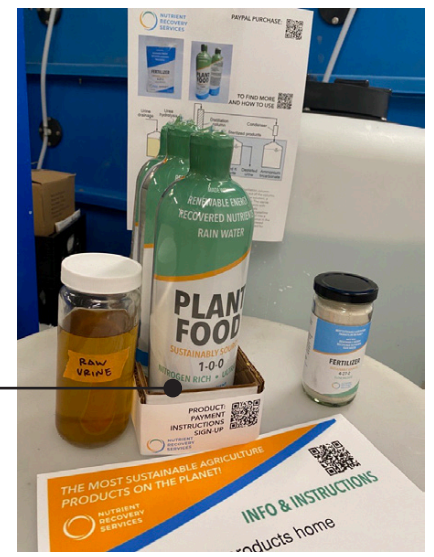




FARM



GARDEN

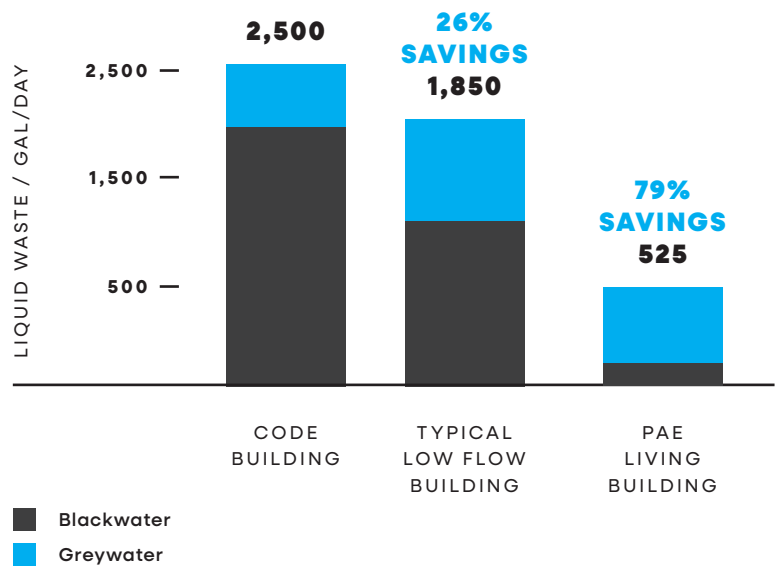


A first-of-its-kind fertilizer system transforms human bio-waste into nutrients. Solid waste is diverted by the vacuum flush system from the foam-flush toilets to a set of composters, which converts it into high quality agricultural compost. Urine is captured and refined into a valuable, high-nitrogen fertilizer that is sold at local nurseries.

# Minimizing the impact of people and place

The building itself is designed as an ecosystem, efficient and effective because of its simplicity. Energy and water systems mimic natural processes, while the design honors natural systems with consideration to how air, water, and light move through the structure to nurture both the building and its occupants.

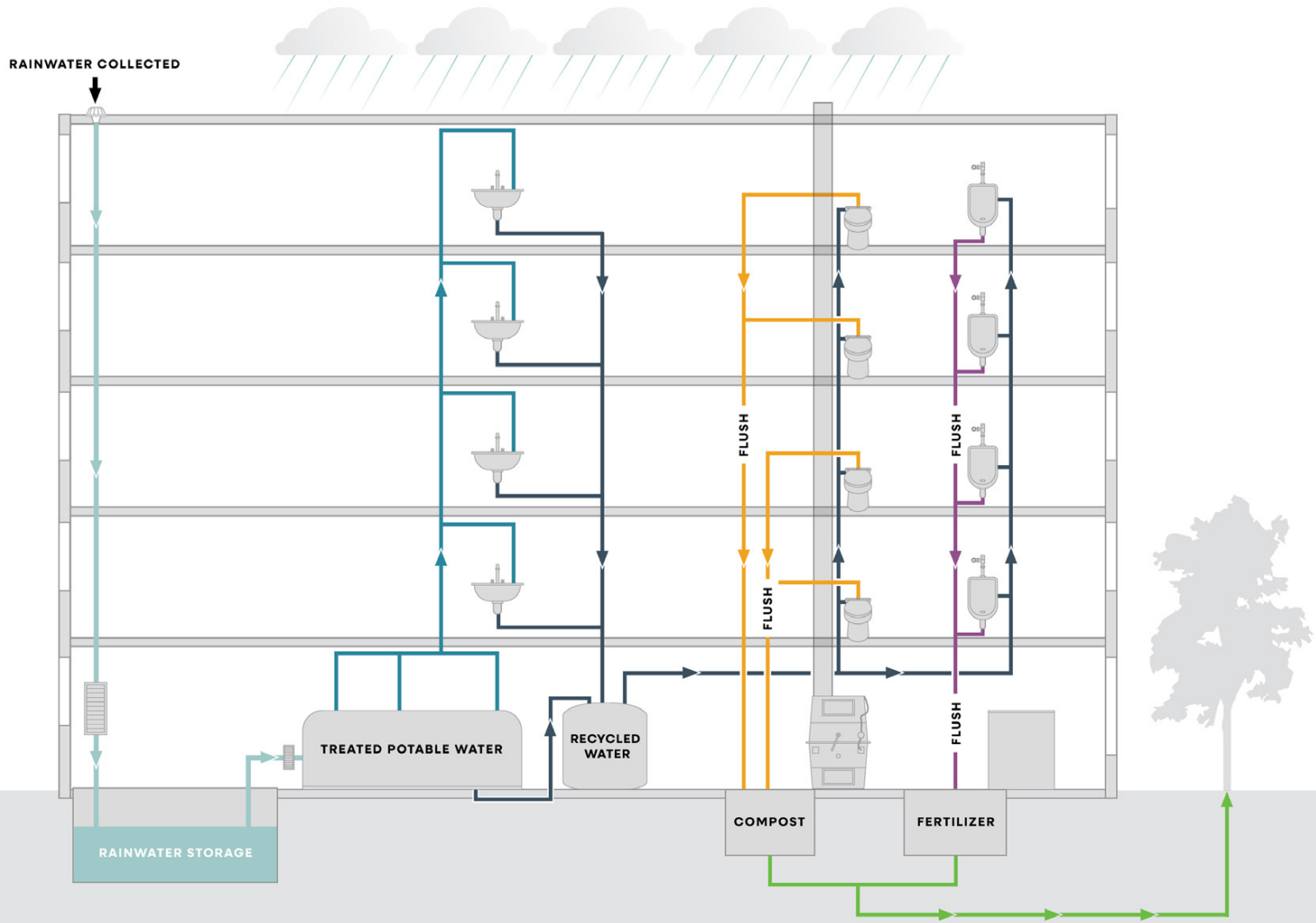
## APPROACHING NET ZERO LIQUID WASTE







Biophilic murals by Pacific Northwest artist Jessilyn Brinkerhoff depict Oregon's diverse landscapes—from coastal to forested to alpine regions—and serve as a wayfinding tool.

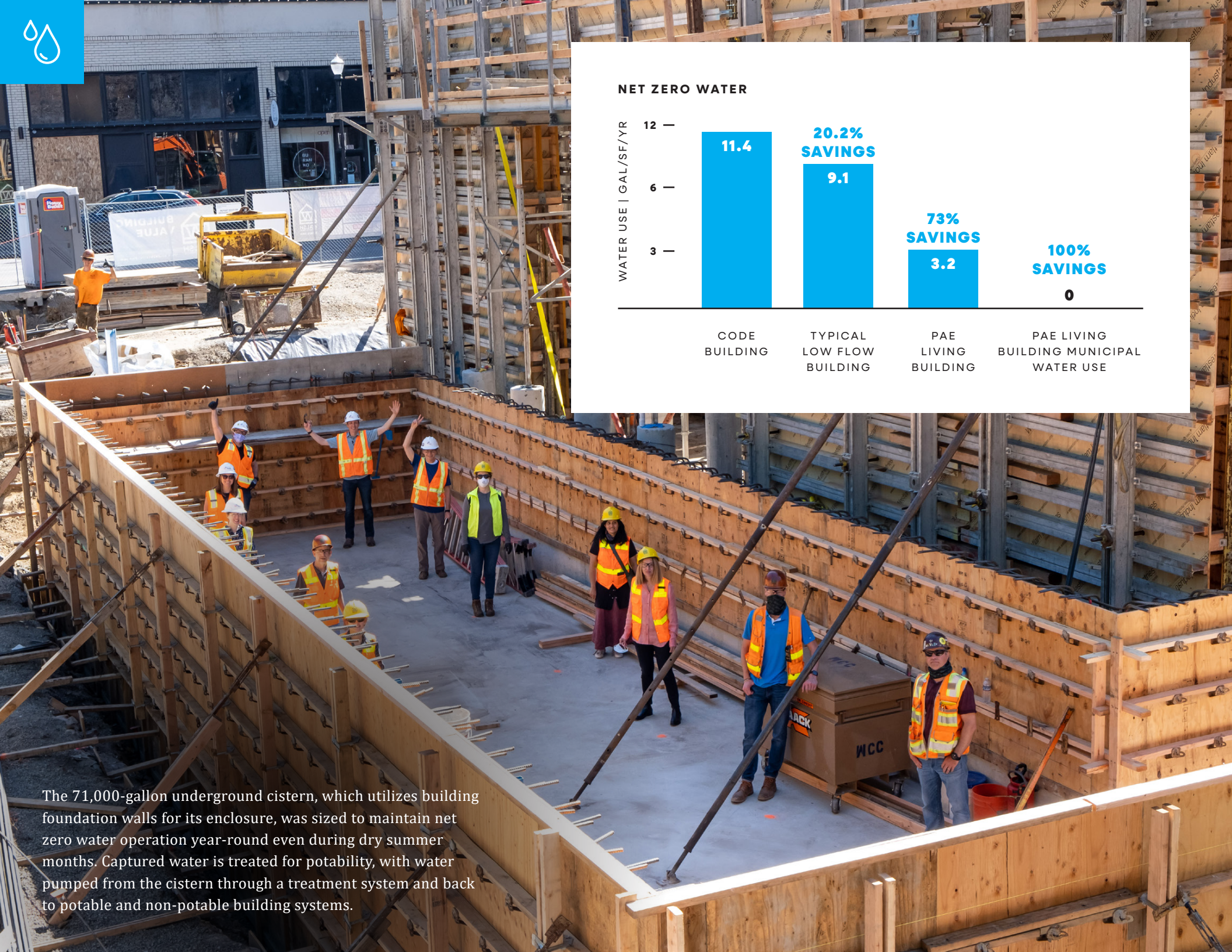


## Water independence

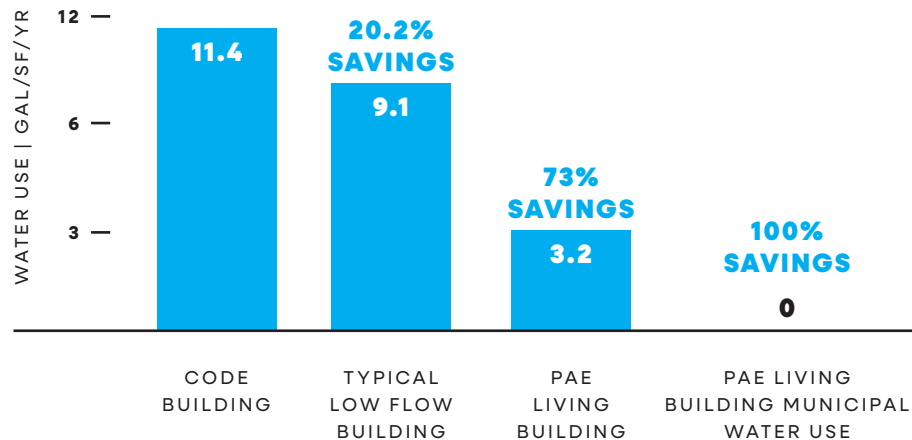
The only independent water district in the city of Portland, the PAE Living Building is fully disconnected from city water and sewer systems. Rain, including the precipitation that runs off the PV panels, flows to one of three drains on the slightly graded rooftop and then is channeled through the building core to an underground cistern.

# 100%

of water captured onsite



### NET ZERO WATER



The 71,000-gallon underground cistern, which utilizes building foundation walls for its enclosure, was sized to maintain net zero water operation year-round even during dry summer months. Captured water is treated for potability, with water pumped from the cistern through a treatment system and back to potable and non-potable building systems.



DESIGN FOR ECONOMY



**85%**  
Occupancy rate  
in a down market

## A blueprint for future market-rate Living Buildings

The PAE Living Building proves economic viability of commercial mixed-use structures that benefit the environment and their tenants while delivering financial returns. The building exceeds seismic and energy code minimums and is designed for future climate change. With just a 10% rent premium and a 10-year hold, the project development group projects a 10% return on their investment.

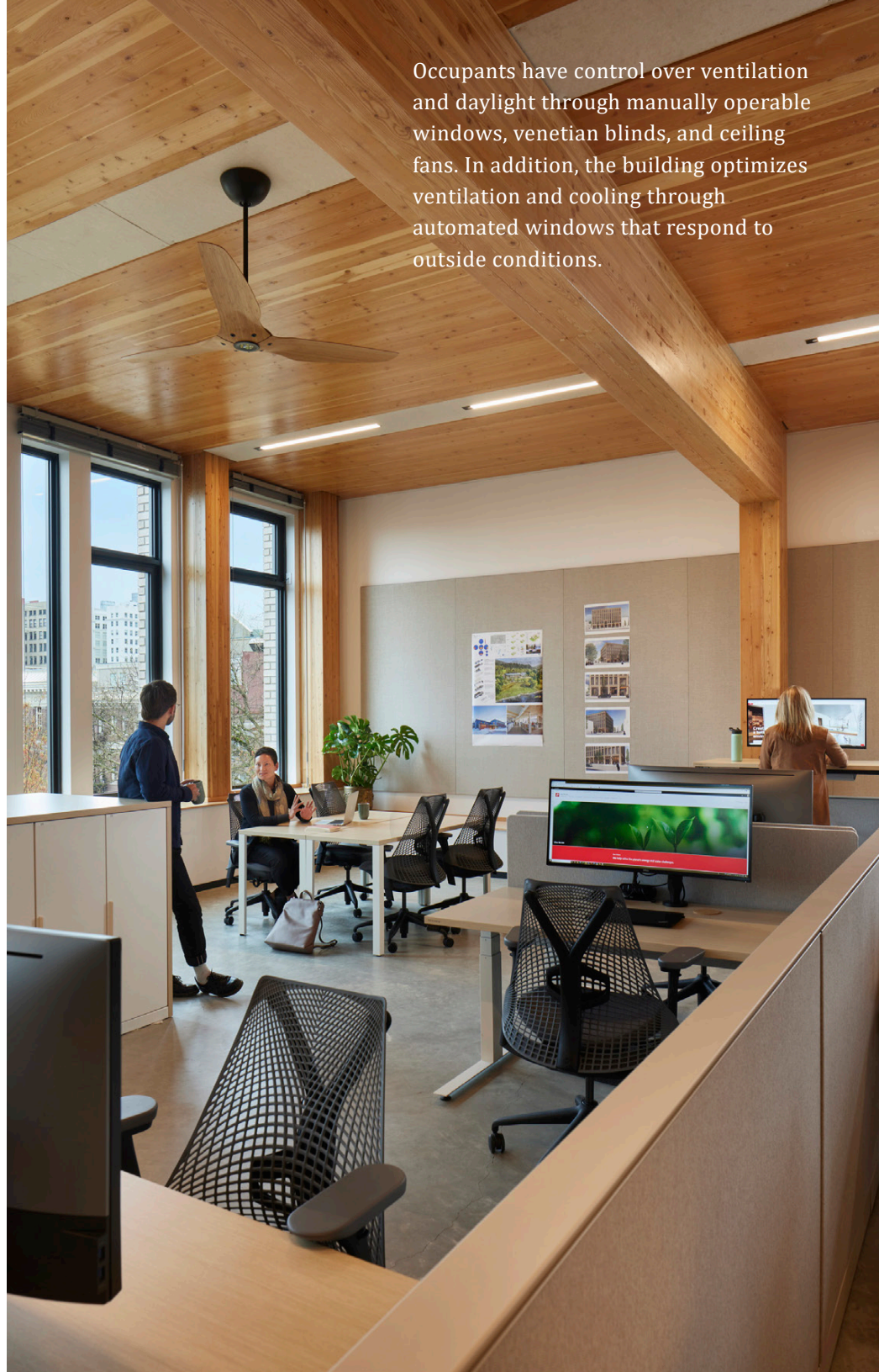
**10%**  
Rent premium

**10**  
Year hold

**10%**  
Projected developer rate of return



A flexible floorplate can be modified to support future uses with minimal interventions.

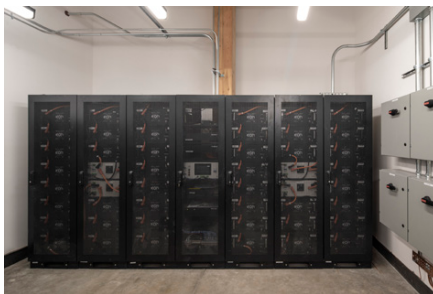


Occupants have control over ventilation and daylight through manually operable windows, venetian blinds, and ceiling fans. In addition, the building optimizes ventilation and cooling through automated windows that respond to outside conditions.



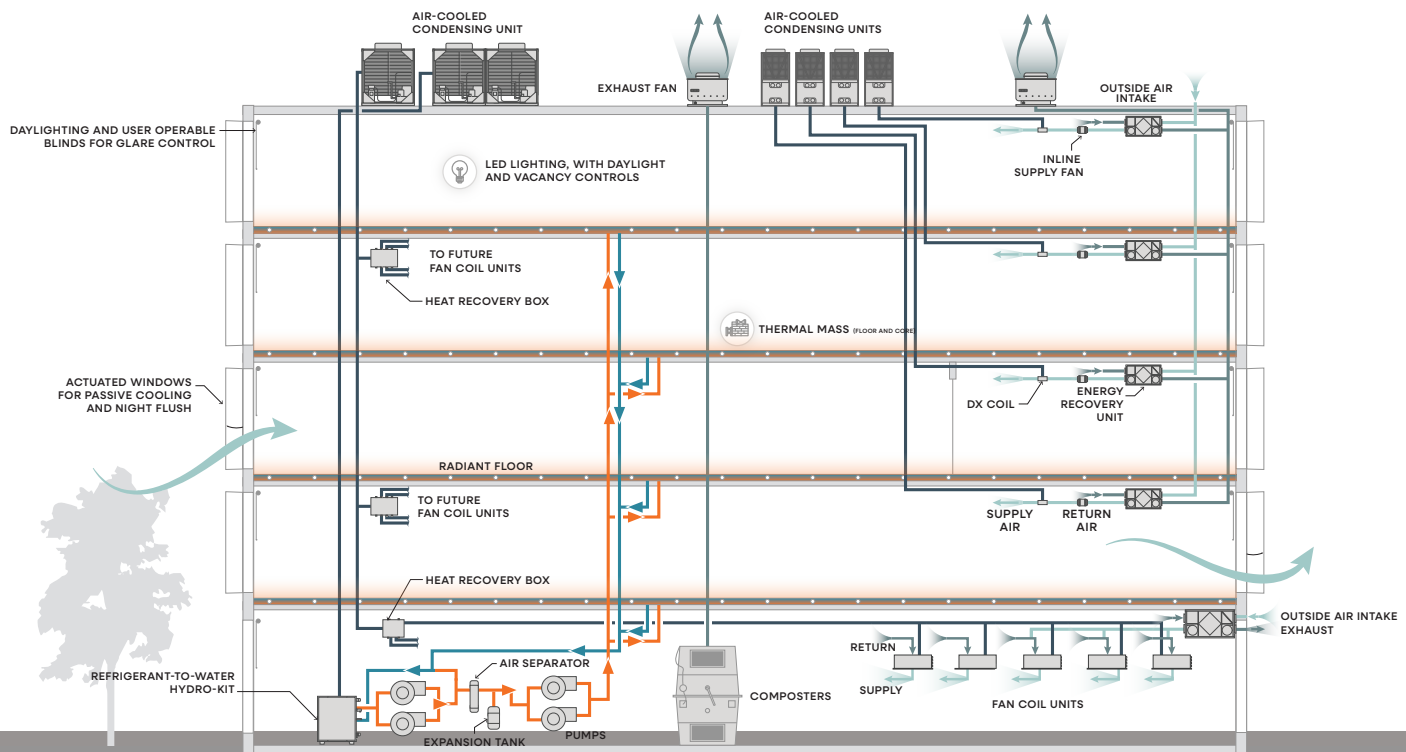
# Designed beyond code

The PAE Living Building produces all its energy needs via two systems: an onsite rooftop solar array and an offsite array gifted to an affordable housing project. A PV-powered battery storage system allows two-way power connection to the city’s utility network and electrical grid. Initial data shows the building is performing as intended. During a 12-month period ending August 2023, the project generated 306,300 kWh and used only 281,600, creating 8.7% more energy than the building used.



The PAE Living Building is one of the first buildings in Portland to install a PV-powered battery storage system, which provides resilience and manages the local grid’s limited back feed capacity.

- 108%** net positive energy
- 19.5 EUI** operational energy use (before pv)
- 53%** energy saving over code (before pv)
- 81%** better than Architecture 2030 baseline (before pv)



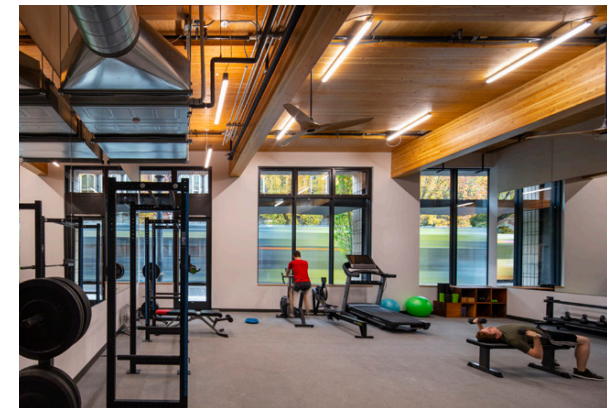


The rooftop is utilized for water and energy capture, eliminating usable space for occupants. Instead the fifth-floor deckony features large operable windows, creating a four-season social hub that connects occupants with nature.



## Connecting occupants to nature at every level

At the ground level, canopies and planters provide protection from the Oregon climate, while the gym and bike room encourage activity. An inviting mass timber staircase features tunable lighting and windows onto the floorplate to encourage use for those able to do so. On the top floor, the deckony provides a community hub, connecting occupants to views of the mountain and river and providing access to urban agriculture.

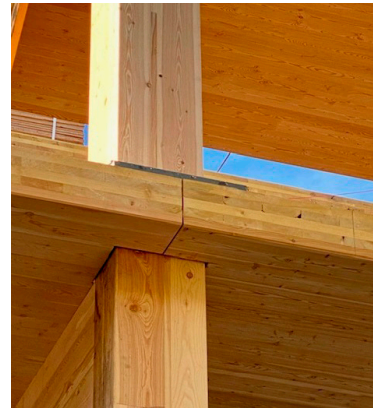






An innovative moveable glass wall system connects occupants to the sights and sounds of the city while allowing access to the integrated urban agriculture that provides fresh salads and herbs for seasonal use.





**40%**

Embodied carbon Savings

**50%**

Refrigerant emissions savings

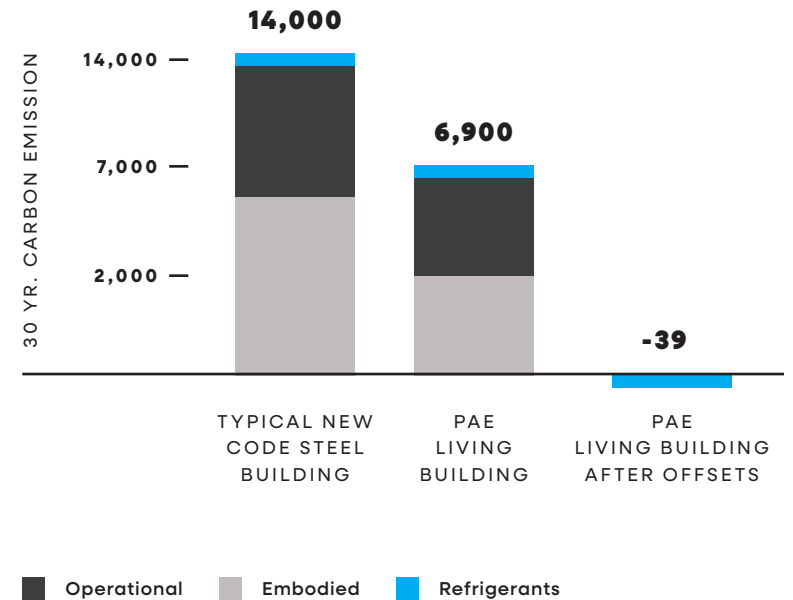
**101%**

Total carbon emissions savings

## A 500 year building

The team designed with longevity in mind, selecting inherently resilient and low carbon structural materials that minimize maintenance. The team exposed structural systems as much as possible to allow materials to serve multiple purposes, and prioritized local materials, including timber, fiberglass windows, metal panels, and masonry.

### CARBON NEGATIVE LIFECYCLE





## Materials Health Matters

**942** Products installed

**318** Red-List Free materials

**22** Salvaged and re-used materials

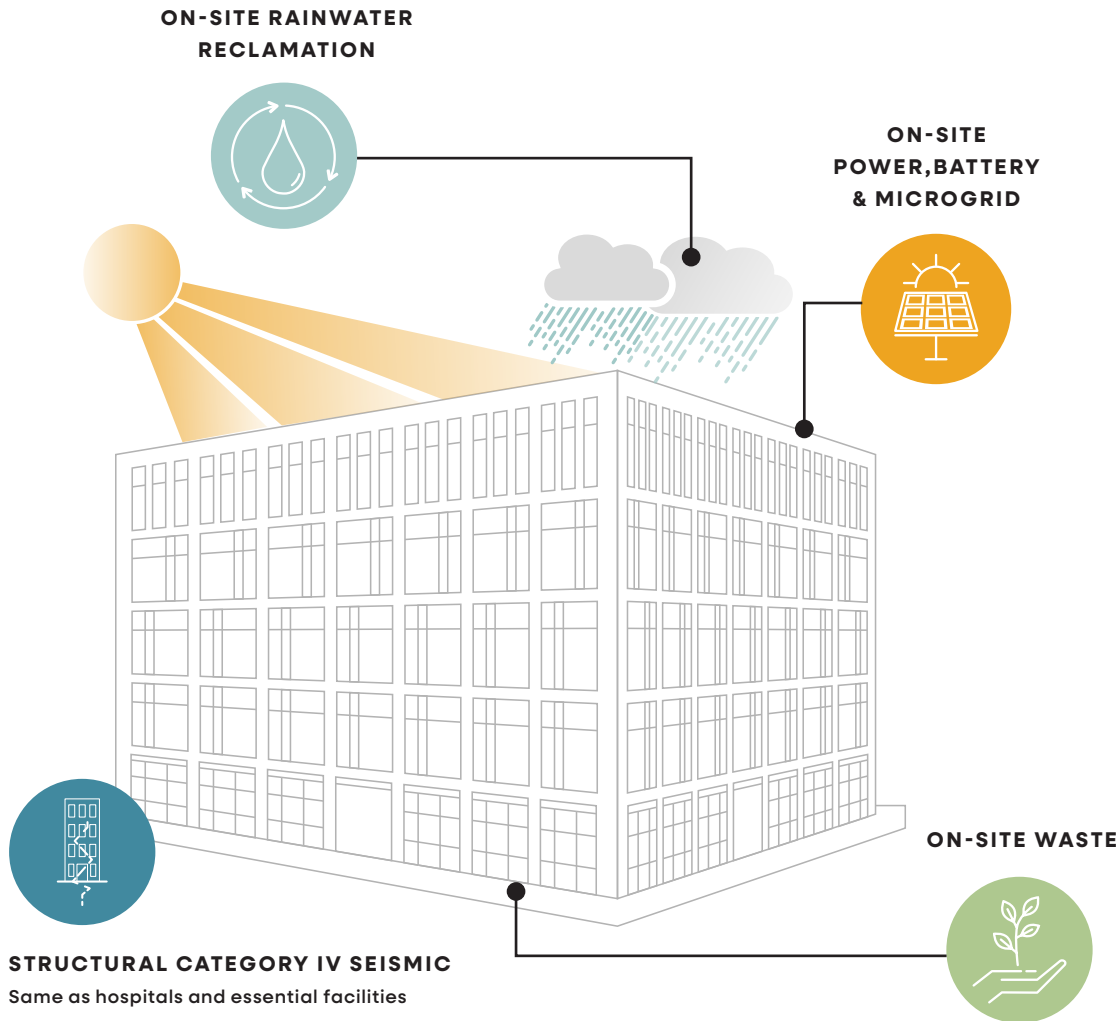
Achieving the Living Building Challenge Material Petal is one of the most difficult aspects of the Living Building Challenge. Every material was vetted against the LBC Red List to avoid potential health impacts to all populations affected by the material manufacturing lifecycle. Where no Red List Free product could be found, the team challenged 1,612 manufacturers to consider change in their product ingredients to expand market availability of healthy materials.





# Resilient in a changing climate

The PAE Living Building is engineered beyond code minimums to meet Category IV structural resistance design criteria, the same level required by hospitals and fire stations.



The PAE Living Building can operate completely disconnected from the grid for at least a week year-round, and up to 100 days during summer months.



A densely reinforced shear-wall core surrounded by glulam columns and beams and concrete-topped CLT floor diaphragms allow the building to survive a major seismic event.



PAE Living Building  
Directory

5	PAE	
4	Edlen & Co.	New Buildings Institute University of Utah
4	PAE	Earth Advantage Greenleaf Building
3	PAE / LUMA	Proton
2	Beneficial State Bank	

**“Though unmistakably contemporary, the design is crisp and timeless. No one knows yet if we’ve completely turned the corner on COVID, but when we have, this is the kind of office people will return to.”**

**BRIAN LIBBY, PORTLAND TRIBUNE**



## Putting Living Buildings on display

A key goal for the building is to demonstrate what's possible at the highest levels of sustainable design and inspire change. The building showcases its energy and water systems through educational signage and visual access to systems. Tours, community events, and continuous data sharing ensure future buildings can learn from and emulate this model. Tours have included local and international attendees, including students, politicians and policy makers, community groups, academics, fellow industry professionals, and more.

**3,300**

People toured

**50+**

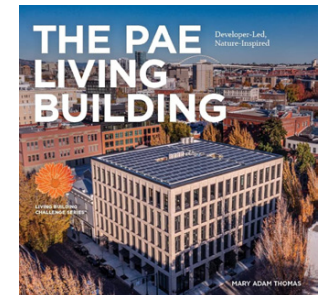
Publications

**4**

Books

**10**

Recognitions for sustainable excellence





On the third floor, the reception desk, cabinet pulls, and end tables are constructed from four maple trees that had to be removed for construction. Six new street trees were installed in their place.

## PAE Living Building

ZGF Architects

Edlen & Co, Portland, Oregon

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