HVAC BUILDING ARCHETYPE CASE STUDY:

Retail strip mall

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Using comparative data based on energy models, along with real-world performance data and product costs, this modeled case study illustrates the pros and cons of different HVAC options when upgrading a typical Northwest retail building.

Case study scenario

A business owner recently purchased a 12-unit, 22,500 sq. ft. retail building in Portland, Ore. The owner plans to renovate the spaces to increase rental value, including replacing the HVAC system that's exceeding its useful lifespan. They expepct potential tenants will value thermal comfort and indoor environmental quality and want to use those selling points to differentiate the rental spaces from others on the market. Their HVAC contractor presented them with two systems: 1) a code-minimum like-for-like replacement system with packaged, single-zone heat pump rooftop units (RTUs), and 2) an advanced performance dedicated outside air system (DOAS) with heat recovery ventilators (HRVs) and a variable refrigerant flow (VRF) system.

Example building profile

Type: 1-floor retail strip mall

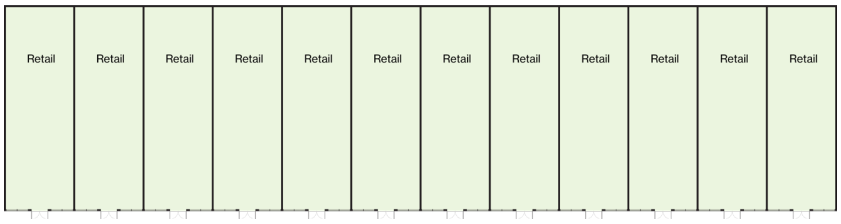
Project type: Major renovation

Location: Portland, OR / climate zone 4C (mixed marine)

Size: 22,500 sq. ft.

Year built: 1994

System comparison	Like-for-like, code-minimum replacement	Advanced performance DOAS
System design	(12) 4-ton packaged single-zone heat pump RTUs	(4) 32-ton[1] high-performance VRF system with (24) indoor units (6) 1000 cfm HRVs (82% sensible effectiveness)
Full system cost (install, equipment, permitting) per sq. ft.[2]	$45.60	$60.80
HVAC / whole-building EUI (kBtu/sq. ft./yr)[3]	29.9 / 56.7	10.0 / 37.6
Annual energy costs ($0.09 kWh)	$33,657	$22,321 (34% reduction)
Rental increase potential	---	$1.50/sq.ft./yr.
Carbon emissions (lbs/yr CO2_e)[4]	570,187	378,147 (34% reduction)
Air quality	Partially recirculated, semi-filtered air with coupled ventilation	• Fully decoupled heating/cooling and ventilation • MERV-13 filtered air with no recirculation delivered directly to the space
Control	Limited zonal control	Full control by zone and occupancy rates
Building performance standards and energy programs	n/a	• Helps prepare for forthcoming standards requirements • Potential incentives available



Added value for the cost

In this scenario, the building owner must weigh the higher upfront system cost with the additional value provided by the higher performance HVAC solution, including:

- **Enhanced controls and superior thermal comfort** – including two indoor units for each store – providing optimal, individualized control over each retail unit and advanced system controls resulting in ease of operation, improved comfort, and optimal humidity levels.
- **Enhanced indoor air quality** from 100% outside air delivery with no recirculation between spaces. Improved indoor air quality is proven to increase health, productivity, creative thinking, and employee performance by decreasing harmful CO_2 levels and viral spread.
- **Higher rent premiums and tenant retention**, by providing elevated comfort and indoor air quality, and reduced operating cost, which has the potential to increase rental income of more than $1.50/sq. ft. per year to offset the upfront cost and loan payment.
- **Meeting sustainability and carbon reduction goals**, and staying ahead of local building performance standards requirements.

> “One of the best benefits has been the quality of air. It’s just superior. If you’re to walk in the hallways, you won’t see particulates flying. When the sun shines in, the air is clear and it’s light and it’s crisp and it’s fresh.”
>
> *— Emily W., actual Portland-based building owner/ occupant with advanced performance DOAS*

Scan to learn more, including designer resources and Northwest-based case studies.

[1] The high level of heat recovery provided by the HRV and the superior extreme weather heating/cooling performance allows for the advanced DOAS to be right-sized at 32-tons of nominal capacity instead of the 48-ton RTU system.
[2] System costs are based on the average of two actual estimates solicited from design build mechanical contractors in 2024.
[3] Red Car Analytics, *Economic Analysis of Heat Recovery Equipment in Commercial Dedicated Outside Air Systems,* 2019.
[4] Environmental Protection Agency, eGRID2022, subregion WECC Northwest.

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Learn more about advanced performance DOAS at **betterbricks.com/apdoas.**