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HVAC CASE STUDY

Historic building leaves energy waste and toxic air in the past

Very high efficiency DOAS and HEPA filters bring energy savings, resiliency, and wildfire smoke mitigation to classic Portland building.

Immediately recognizing the opportunity to reposition the National Historic Registered 1910 office building as a premiere property, the Portland-based real estate investment firm, Unico, acquired the Galleria building in 2018. Guided by their commitment to energy efficiency, innovation, and tenant well-being, Unico conducted a major retrofit of the downtown Portland building to achieve Energy Trust of Oregon's Path to Net Zero status and LEED Platinum certification.

By combining proven building renewal technologies and approaches – including a very high efficiency dedicated outside air system (DOAS) with high efficiency particulate air (HEPA) filtration – they knew they could revitalize the building and offer tenants the very best in indoor comfort, efficiency, air quality, and wildfire resiliency.

High-performance HVAC offers year-round efficiency and comfort.

Though beautiful on the outside, the iconic Galleria building required major upgrades to make it comfortable on the inside. To provide tenants with premium comfort in every season while also meeting ambitious efficiency goals, Unico embraced the HVAC equipment and design principles of very high efficiency DOAS, including:

Project Overview

Building type:
Office building

Year built:
1910

Project floor area:
40,000 sq. ft.
(top floor)

Energy efficiency:
Energy Trust of Oregon New Buildings Program

Utility incentives:
$527,381.60[1]

Reduction in whole-building EUI: **62%**

- **A DOAS approach** that separates heating and cooling from the ventilation equipment
- **High-performance electric heat pumps** that meet ENERGY STAR® performance standards
- **High-efficiency heat recovery ventilators (HRVs)** that recover more than 82% of the sensible heat from the stale indoor exhaust air, while delivering 100% fresh, filtered outdoor air at neutral temperatures to the building
- **Right-sized heating and cooling equipment**

Protecting occupants from toxic wildfire events.

Equipped with active, passive, and outdoor air quality (OAQ) modes, the Galleria's new HVAC system is able to adjust automatically to enhance efficiency and comfort – even during the most extreme weather events. With wildfires increasing in frequency throughout the Western U.S., this feature is all the more crucial to ensure the health, safety, and comfort of the Galleria's occupants.

The project team installed HEPA filters upstream of the HRV units to work in tandem with the system's OAQ mode, which engages temporary booster fans when outdoor sensors indicate poor air quality. Third-party measurement at the Galleria building confirmed that these mitigation strategies successfully reduced hazardous PM2.5 particulates by 85% in the indoor spaces, while only adding an energy use intensity (EUI) of 0.06 kBTU/sq. ft./year to annual energy bills. The Galleria building's occupants can now rest easy knowing that their indoor air will remain clean, safe, and comfortable, regardless of what's happening outside.

Robust third-party measurement confirms outstanding system performance.

Upon system installation, the Northwest Energy Efficiency Alliance funded a living laboratory retro-commissioning study of the very high efficiency DOAS. With 15-minute interval data provided by a wide range of sensors, including those tracking energy use, electrical demand, indoor air quality, and outdoor weather, the analysis team compiled and investigated a wealth of system performance and occupant comfort information.

In addition to contributing to the very high efficiency DOAS's well-documented ability to deliver clean indoor air, comfort, and efficient operations, the study confirmed that combining the system's enhanced controls with HEPA filtration can provide significant protection from even the most extreme outside weather events.

Conversion summary

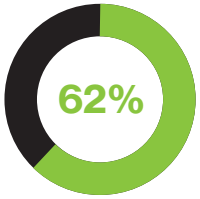
Pre-existing HVAC system:	• 12x 10-ton constant-volume packaged gas RTUs
New HVAC system:	• 96-ton VRF heat pumps with zonal control • Heat pump RTU serving the breakroom • 4x Ventacity VS 1200CMh HRV with central scheduling and onboard DCV controls • HEPA filtration upstream of HRV units

> The Galleria building serves as a strong example of non-energy benefits offered by net-zero buildings. These strategic, comprehensive upgrades ensure the building will have significantly reduced energy use, while supporting occupants with a safer, healthier, and more comfortable indoor experience."
>
> *— Shelly Carlton, Senior Program Manager – New Commercial Construction, Energy Trust of Oregon*

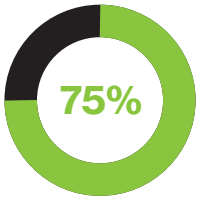
Results

In addition to reducing overall building EUI by 62% and reducing harmful outside air particles by 85%, the new HVAC system provides a variety of benefits to employees, clients, owners, and operators, including:

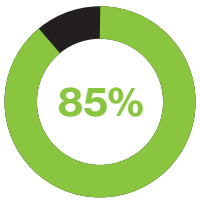
- **Enhanced indoor air quality** due to filtered 100% outside air coming into the space, with less recirculation between rooms than the pre-conversion system
- **Increased occupant comfort** through improved temperature stability and the ability to create zones with unique temperature controls
- **Reduced energy bills**
- **Energy Trust of Oregon Path to Net Zero status**
- **LEED Platinum certification**



Reduction in overall building EUI[2]



Reduction in HVAC EUI[3]



Reduction in hazardous PM 2.5 particulates in indoor spaces

Project Partners

SERA Architects

Fortis Construction

Ecotope

Project Partners

SERA Architects

Fortis Construction

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[1] This incentive amount was earned for the whole-building energy performance improvements, inclusive of the very high efficiency DOAS upgrade.
[2, 3] Compared to modelled pre-conversion system baseline (12x 10-ton constant volume packaged RTUs with gas heat and DX cooling).

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