

HVAC CASE STUDY

OREGON DEPARTMENT OF TRANSPORTATION DRIVES UP HVAC SAVINGS AND INDOOR AIR QUALITY

HIGH-PERFORMANCE HVAC SOLUTION HELPS RIGHT-SIZE VENTILATION AND COMFORT

When the Oregon Department of Transportation (ODOT) moved their construction administration personnel into the Barlow Building, built in 1956, they knew that the aging HVAC system was not well-suited for the new occupancy. After years with no air conditioning and high energy bills, ODOT began an HVAC upgrade by installing three mini-split heat pump units to provide heating and cooling to select offices.

Satisfied with the improvements to their building's comfort and efficiency, ODOT went on to add six more heat pumps throughout the building. While the new units sufficiently conditioned the entire indoor environment, the building was still served by a labor-intensive, gas-steam boiler that was ten times bigger than the heating needs required. Furthermore, the boiler only tempered ventilation air and its constant-volume ventilation fans provided more than four times the required ventilation. All told, this wasteful equipment accrued more than \$6,000 in additional energy costs and \$3,500 in additional maintenance costs per year.

When ODOT project manager Luis Umana attended a local ventilation training and learned about the very high efficiency DOAS approach to HVAC, he learned that a high efficiency energy- or heat-recovery ventilator (ERV/HRV) could nearly eliminate the ventilation load and provide the precise amount of ventilation air required by any occupancy level. In one fell swoop, this move could help ODOT move on from their inefficient boiler system and its costly maintenance, maximize energy and money savings, and improve indoor air quality and comfort.



PROJECT OVERVIEW



BUILDING TYPE
Office



YEAR BUILT
1956



PROJECT FLOOR AREA
20,000
sq. ft.



ENERGY UTILITY/PROGRAM
Portland General Electric / Energy Trust of Oregon



REDUCTION IN TOTAL BUILDING ENERGY USE
64%*



REDUCTION IN HVAC SYSTEM ENERGY USE
79%*

*compared to the pre-conversion system of a boiler, ventilation fans and nine mini-split heat pumps.

ODOT LEAVES ENERGY WASTE IN THE DUST

This high-performance approach to HVAC combines high-efficiency equipment with design best practices, including:

- Using an electric heat pump system that meets ENERGY STAR® performance standards
- Pairing the heating and cooling with a high-efficiency heat/energy recovery ventilator (HRV/ERV)
- Right-sizing the heating and cooling equipment
- Decoupling the HRV/ERV from the heating and cooling
- Optimizing the ventilation fan energy

The very high efficiency DOAS approach provides better control of thermal comfort and improved indoor air quality for the Barlow Building’s occupants, while reducing the building’s HVAC energy use by 79%.

ODOT’s upgraded approach to HVAC is helping them save 14,252 kWh and 7,168 therms per year while benefiting occupants, operators and owners in a variety of ways:

- Better control of ventilation air by delivering the precise amount of filtered 100% outside air to the space based on occupancy, with no recirculation
- Increased occupant comfort through improved temperature stability and the ability to create zones with unique temperature controls
- Improved occupant productivity by improving thermal comfort and control
- Lower energy bills and maintenance costs
- Addition of more than 1,000 sq. ft. of added shop space where the existing boiler was removed

“ODOT is very pleased with the new HVAC system. The system is more reliable and requires less maintenance, and the occupants are much more comfortable.”

— Kristen LaLonde, Facilities Strategic Planning Manager, Oregon Department of Transportation (ODOT)



CONVERSION SUMMARY

Existing HVAC system:	9x Daikin RMXS48LVJU ductless heat pump units 2x fixed speed 5 horsepower fans 1x 3,100 MBH Gabriel gas steam boiler
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New HVAC system:	9x Daikin RMXS48LVJU ductless heat pump units (installed between 2018–2019) 1x Ventacity VS3000 ERV (installed 2020)
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reduction in total HVAC energy use*



reduction in overall building energy use*

*compared to the pre-conversion system of a boiler, ventilation fans and nine mini-split heat pumps.

HEALTHIER AIR WITHOUT THE ENERGY WASTE

By providing 100% filtered outside air, ODOT's high-efficiency HRV helps them decrease contaminant spread. The introduction of fresh outside air and avoidance of recirculated air minimizes the circulation and introduction of contaminated particles—an important way to 1) minimize the spread of viruses like Covid-19¹ and other toxins inside the building, and 2) reduce entry of harmful particles from outside, including during periods of poor outdoor air quality.

However, unlike competing high-ventilation HVAC systems, this approach does not increase energy costs despite providing 100% filtered outside air. Combining high-efficiency design principles with high-efficiency products, such as ENERGY STAR rated heating and cooling equipment and a high-efficiency HRV, allows building operators to avoid compromises while they create a safe, healthy and efficient indoor environment.



“Having a dedicated outside air system that provides the correct amount of fresh air to our building occupants is paramount to finding the balance between minimal energy consumption and proper ventilation for health, safety and comfort—particularly during a pandemic.”

— *Kristen LaLonde, Facilities Strategic Planning Manager, Oregon Department of Transportation (ODOT)*

RESULTS

In addition to saving energy, the team also saved more than \$3,500 annually on reduced labor by avoiding many hours of maintenance per week from consolidated HVAC operations. Now they enjoy easy-to-operate ductless heat pumps and an HRV, instead of spending their time on the labor-intensive maintenance requirements of an old boiler, hot water pump, ventilations fans and a water treatment system.

And the decommissioning of this old equipment also freed up significant building space. Now able to convert the boiler room to shop space and storage, ODOT freed up office space that had previously been used for the shop. This allowed them to relocate a crew into the Barlow Building, eliminate a lease and further reduce operational costs for the region.

¹ Based on findings from NEEA's 2021 Covid-19 Risk Reduction Strategies and HVAC System Energy Impact Report: betterbricks.com/resources/covid-19-hvac-risk-reduction-strategies.



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