

HVAC CASE STUDY

It's a New Day for Efficiency and Comfort at Portland Preschool



Preschool matches efficient building practices with net-zero ambitions.

In operation for more than 40 years, New Day School is a longstanding Portland, Oregon, preschool with a deep commitment to environmentally friendly and sustainable practices. When New Day School's Kishalay building required a renovation, the preschool's leadership team quickly committed to adopting advanced practices and products to ensure the renovations would result in a net-zero energy building.

In addition to applying passive building principles that optimize heat gains and losses throughout the building, the building operators added a 45.5 kW solar photovoltaic (PV) system that provides enough annual energy for two buildings at the preschool.

With these decisions in place, the preschool needed a highly efficient HVAC system to reduce HVAC energy use while improving the indoor air quality and maintaining a high level of comfort for students, teachers and staff. Following guidance from their contractor, Green Hammer, the preschool found the ideal HVAC solution with a very high efficiency dedicated outside air system (very high efficiency DOAS).



"I think very high efficiency DOAS is a great choice for preschools to ensure high air quality at the developmental phase of a child's growth when their bodies are developing, their lungs are growing, and fresh air is so vital to their health."

— Didi Anandakrsnapriya, New Day School Director

Project Overview



Building Type
Urban preschool



Project Floor Area
2,900 sq. ft.



Energy Utility/Program
Portland General Electric



Total Project Cost
\$22.80 per sq. ft.



Annual Reduction in GHG Emissions
50%



Reduction in Total Building Energy Use
50%

“ Teachers and staff feel safer in a building with a high standard of air filtration and flow. Knowing that stagnant air is moved out of the building and the incoming air is fresh and filtered makes everyone feel much safer.”

— Didi Anandakrsnapriya,
New Day School Director



High-performance HVAC puts energy waste in time-out.

Representing the next step in the ongoing evolution of HVAC design, very high efficiency DOAS utilizes the most efficient HVAC systems and design principles to provide better indoor air, while reducing commercial building HVAC energy use by an average of 69%.¹

Very high efficiency DOAS combines high-efficiency HVAC equipment with the dedicated outside air system (DOAS) approach that separates heating and cooling from the ventilation. This separation allows for optimal and efficient control of each of these critical building functions. The system utilizes a heat recovery ventilator (HRV) to extract/reject heat from the stale indoor air, and brings in 100% fresh, filtered outdoor air throughout the building.

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The result is a healthy and efficient HVAC solution that reduces overall commercial building energy use by an average of 48%.¹

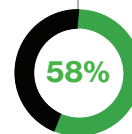
And, by significantly reducing or eliminating the recirculation of air between spaces, very high efficiency DOAS reduces the recirculation of pollutants and contaminated air to improve occupant health, comfort and overall satisfaction.

The school's new HVAC system benefits the students, teachers, staff and building operators by providing:

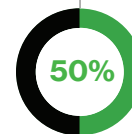
- **Better indoor air quality** due to filtered 100% outside air being brought into the space, with little recirculation
- **Increased occupant comfort** through improved temperature stability and the ability to create zones with unique temperature controls
- **Improved occupant productivity** by improving indoor air quality and comfort
- **Lower energy bills**

CONVERSION SUMMARY

Pre-existing HVAC system:	Constant volume 5-ton packaged heat pump rooftop unit
New HVAC system:	2x 1.5-ton ductless heat pumps 1x 2-ton ducted mini-split heat pump 1 Ventacity VS1000RT HRV



reduction in total HVAC energy use



reduction in building energy use

Healthier air without the energy waste.

By providing 100% filtered outside air, the very high efficiency DOAS system decreases contaminant spread. This healthy upgrade to enhanced ventilation helps dilute the concentration of virus-containing aerosols that can remain suspended in stagnant building air. In this way, very high efficiency DOAS could reduce the spread of infectious diseases like Covid-19.²

However, unlike competing high-ventilation HVAC systems, very high efficiency DOAS does not increase energy costs despite providing 100% filtered outside air. Very high efficiency DOAS combines high-efficiency design principles and with high-efficiency products, such as an HRV with heat recovery and ultra high-efficiency fans, to keep energy use down. For example, the Ventacity VS1000RT HRV installed at New Day School constantly changes ventilation rates by monitoring CO₂ levels to know when buildings are unoccupied. By reducing ventilation rates when children and staff are outside, the HRV helps the building efficiently provide excellent indoor air quality, instead of unnecessarily running at full speed regardless of occupancy.

Results

These upgrades helped the New Day School become Oregon's first net-zero-energy preschool. Their new HVAC system cut the building's overall energy use in half, while enhancing the indoor air quality for students, teachers and staff. Building operators confirm that the new equipment has been operating reliably for the past year and a half, and the thermal comfort and indoor air quality have been consistently excellent. Recent measurements verify that the space temperature remains aligned with the 70F setpoint throughout the week, and the classroom CO₂ levels maintained consistently safe levels.

In addition to the cost savings and improved comfort, the project resulted in a 4 metric tons (50%) reduction in greenhouse gas emissions (GHG) annually.³



The drastic difference in air quality is amazing! Before the renovation, our building was hot, stuffy and humid, and we had lots of odor issues in the classroom. Now the air is fresh and odor-free. With air quality such a major topic of discussion during the pandemic, it has been comforting to know we are having a constant exchange of fresh air at all times.”

— Didi Jayagiita,
New Day School Teacher

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¹ Based on twelve real-world demonstration projects by Northwest Energy Efficiency Alliance, as compared to code-minimum systems.

² 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.

³ Reported GHG emissions reduction is based on the following assumptions: 1) 11.7 pounds of CO₂ per therm of natural gas saved, 2) 0.91 pounds of CO₂ per kWh avoided (Northwest Power and Conservation Council's latest report from 2018 on avoided CO₂ rates in the Northwest).

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