High Efficiency HVAC with Dedicated Outside Air Systems (DOAS) Show Strong Persistence of Savings

Tim Yoder, Alisha Piazza, Shat Pratoomratana & Linda Sandahl

Decarbonize, Reduce Energy, and Improve Indoor Environmental Quality with High Efficiency HVAC + DOAS

Introduction

Very High Efficiency (VHE) HVAC systems with Dedicated Outside Air Systems (DOAS) combine high-performance equipment selection with smart design principles. The systems offer validated real-world performance.

Key System Elements

1. Very high-efficiency Dedicated Outside Air System (DOAS) with energy recovery for ventilation
2. High-performance conditioning equipment
3. Ventilation fully decoupled from conditioning
4. Right-sized heating and cooling equipment

Field Validation Project Overview

The project built on existing work of the Northwest Energy Efficiency Alliance (NEEA) and the Institute of Market Transformation (IMT) that previously documented energy savings and benefits based on retrofits across the country. The project extended the NEEA/IMT work with tasks that:

1. Analyzed continued energy performance
2. Assessed occupant and operator satisfaction.

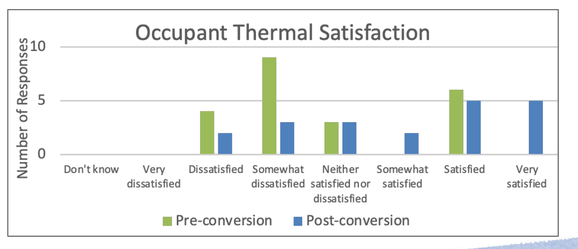
Field Validation Site Summary

Site Name	Occupant	State	Climate Zone	Conversion Date	Floor Area (sq. ft.)
Montana Office	Electric Co-Op	MT	6B	August 2016	5,735
Seattle Office	Engineering Office	WA	4C	September 2016	6,100
Seattle Airport	County Airport	WA	4C	April 2017	25,200
Monument School	Rural Elementary School	OR	5B	September 2020	7,200
Portland School	Urban Preschool	OR	4C	October 2020	2,900
Portland Government Office	Urban Government Building	OR	4C	August 2020	20,000
Portland Office	Engineering Office	OR	4C	April 2021	11,500
Tarrytown Office	Property Management Company	NY	4A	September 2019	70,926

Non-Energy Benefits

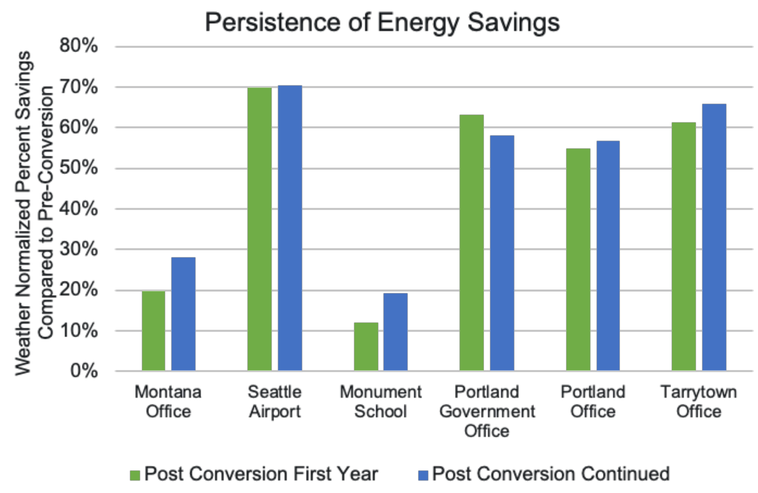
Replacing existing system with VHE HVAC systems can lead to other benefits in addition to energy savings. This study has documented the following non-energy benefits:

1. Improved occupant comfort
2. Improved occupant satisfaction
3. Operator approval.

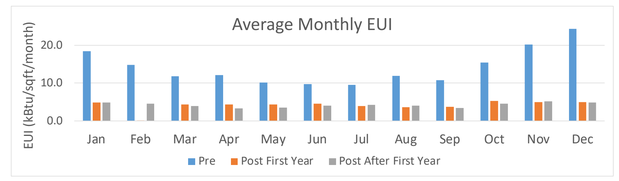


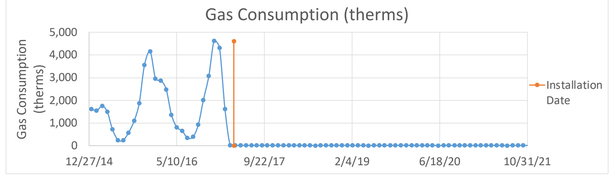
Verified Energy Savings

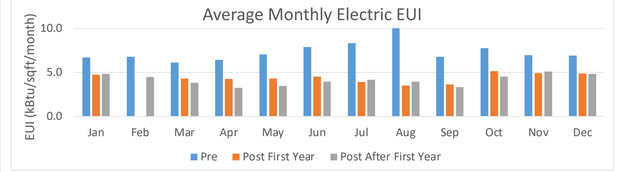
Utility billing data were analyzed to determine savings compared to pre-conversion system.



Monthly EUI data from utility billing data for the Seattle Airport site. Site electrified heating source and reduced electrical load

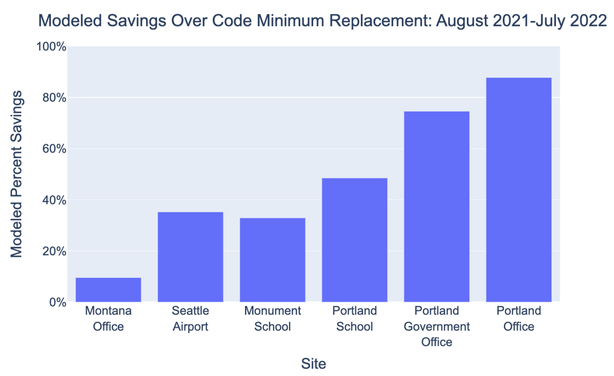


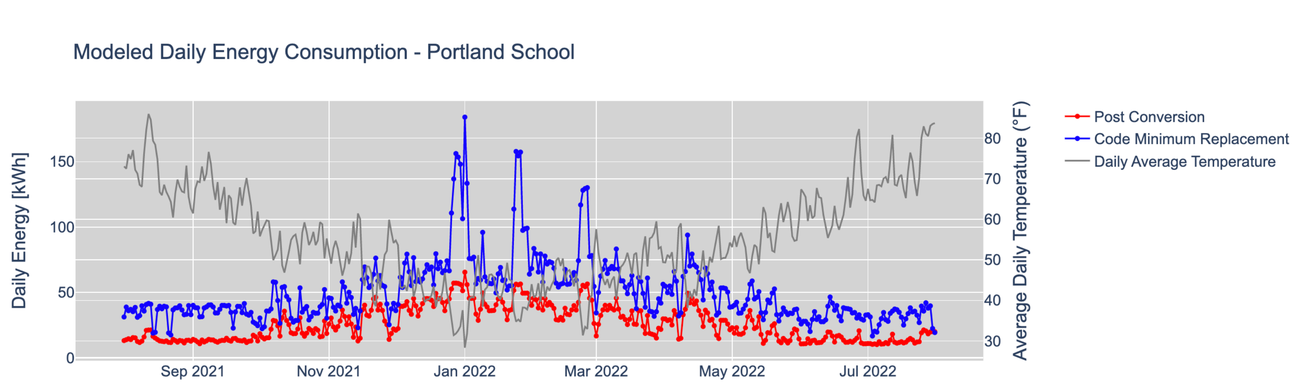




Modeled Energy Savings

Real-world savings depend on the efficiency of the existing systems. We used machine learning to extend previous energy models to predict energy savings of this HVAC system approach compared to a hypothetical code-minimum replacement at each site. Results show that operational changes impacted the extent of energy savings observed in the real-world systems.





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