Case Study

California State University Northridge - Northridge, CA

The Challenge

California State University, Northridge (CSUN) sought to improve the energy efficiency of Lilac Hall without disrupting operations or investing in new hardware. Despite having modern HVAC equipment in place, the building faced inefficiencies tied to static system schedules and underutilized occupancy data. Rising energy costs and the university's sustainability commitments added urgency to find a smarter, cost-effective solution that could integrate with existing infrastructure.

The Solution

The AI optimized software leveraged Lilac Hall's existing networked lighting controls to drive real-time HVAC optimization. Integrated seamlessly with the building's BACnet-enabled management system, the platform dynamically adjusted airflow and temperature based on actual occupancy. This approach delivered immediate results—cutting electricity use by 15.1%, natural gas by 35.6%, and achieving a 288% ROI with a three-month payback—without requiring any new hardware or construction.

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Maximizing HVAC Efficiency with HVAC AI Module: A Case Study at CSUN's Lilac Hall

In an era of rising energy costs and sustainability goals, California State University, Northridge (CSUN) transformed Lilac Hall's energy performance with HVAC AI's innovative software. By leveraging existing networked lighting controls, HVAC AI's software only solution delivered remarkable savings without additional hardware or construction. Key highlights of the project's performance include:

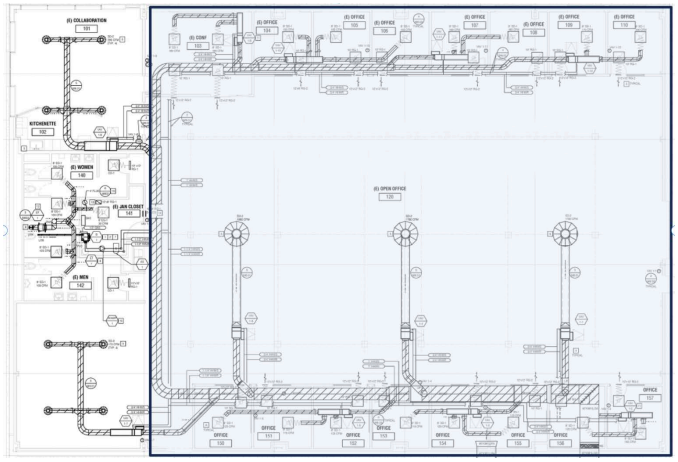
Energy Savings: With utility rates at $.20 per kWh and $1.20 per therm, CSUN realized $0.70 per square foot in combined annual energy cost savings. Total building (not only HVAC) electricity was reduced by 15.1% ($3,445/year) and natural gas by 35.6% ($3,572/year) for the entire building even though HVAC AI was managing 8,000 square feet out of 10,000 square feet of total space in the building.

Operational Excellence: Seamless integration with existing infrastructure, requiring no additional construction or hardware, achieving a 288% ROI and 3-month payback.

This success sets the stage for campus-wide adoption, offering a scalable model for sustainable energy management.

Project Overview: Energy Efficiency at Lilac Hall

Lilac Hall, a 10,000-square-foot sustainable facility at CSUN built in 2018, exemplifies the university's commitment to environmental stewardship. With 8,000 square feet of faculty offices and collaborative open workspaces, the building features eco-friendly materials and advanced HVAC systems. In 2024, HVAC AI's software optimized these systems,



reducing energy waste while maintaining comfort. HVAC AI manages the HVAC systems for the building's offices and open workspaces, while excluding common areas such as restrooms, the main entrance, kitchen, and a chemistry lab, located on the left side of the image below. The remaining areas consist of faculty offices positioned along the top and bottom sections of the floor plan, with a large, high-ceiling open workspace centrally located between them.

Lilac Hall's advanced HVAC infrastructure includes a Daikin heat pump for cooling, a Lochinvar Knight WHN 155 hot water boiler, a Bell & Gossett Series E90 E9050S-ECM heating hot water pump, Titus variable air volume (VAV) units for precise airflow management, and a Siemens Desigo BACnet-enabled Building Management System (BMS) for comprehensive control.

Figure 1 – Blue area represents the space managed by HVAC AI, composed of offices and a large high ceiling open workspace.

Software Only Implementation Approach

Using existing LED lighting with networked occupancy sensors, HVAC AI dynamically adjusts the HVAC system based on real-time occupancy data, software algorithms and machine-learning models. Integrated with the building's BMS (building management system), this software-only solution delivers precise airflow and temperature control, slashing energy consumption without additional hardware and without causing comfort issues.

One of the most significant advantages of HVAC AI's implementation at Lilac Hall was its seamless integration with the university's existing infrastructure using a software only approach. Because the building already had networked lighting occupancy sensors in place, HVAC AI's software was able to leverage these sensors without requiring additional hardware. The software was deployed on a virtual machine provided by the university, which allowed for an effortless connection to the building's BACnet HVAC network.

By continuously analyzing occupancy data, HVAC AI adjusted HVAC setpoints and airflow based on real-time usage patterns and occupancy models. This dynamic optimization ensured that HVAC systems operated efficiently, reducing energy waste in unoccupied spaces while maintaining a

comfortable indoor environment. The ability to make these adjustments in real-time provided CSUN with a cost-effective and low-maintenance solution for improving energy efficiency.

kWh Energy Performance and Results

HVAC AI reduced Lilac Hall's total building electricity consumption by 15.1%, saving 14,892 kWh annually ($3,445 or $0.34 per square foot). The table below compares usage before and after implementation:

KWH SAVINGS	Date Range	Avg Temp	Total kWh Usage	Avg Daily kWh Usage	% Savings
HVAC AI Off	Jul 2022 to Feb 2023	66.5°F	68,184 kWh	280.6 kWh	17.7%
HVAC AI Off	Jul 2023 to Feb 2024	67.3°F	64,104 kWh	262.7 kWh	12.5%
HVAC AI On	**Jul 2024 to Feb 2025**	**68.5°F**	**56,095 kWh**	**230.8 kWh**	**15.1%**

Figure 2 – HVAC AI kWh savings vs previous years for the same time periods. Cost per kWh $.20

To evaluate HVAC AI's impact, a scatter plot (Figure 3) illustrates daily kWh usage versus outdoor temperatures, revealing a significant reduction in electricity consumption after the software's deployment in June 2024. These savings were achieved seamlessly, with no disruptions to Lilac Hall's operations, underscoring the practicality and efficiency of HVAC AI's software-only approach. At lower temperatures, kWh usage converges as natural gas heating replaces the "Daikin electric heat pump cooling" during the winter season.

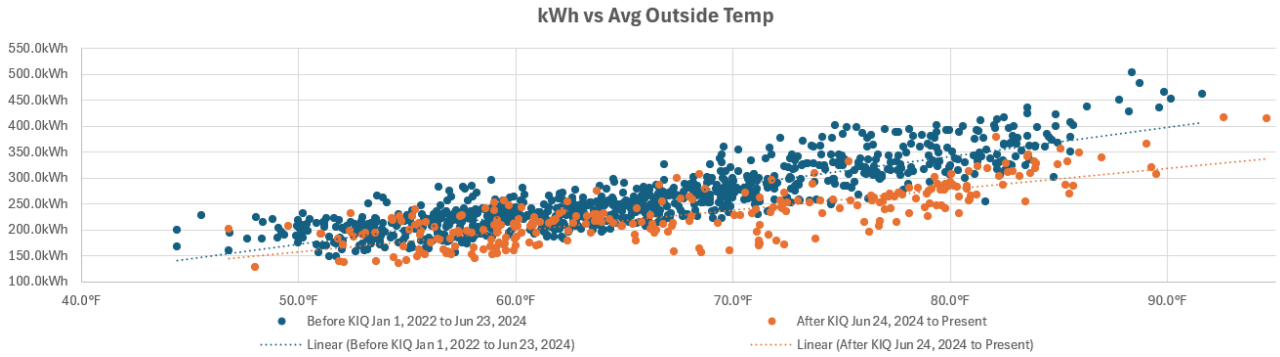


Figure 3 – Scatter plot of kWh usage from January 1, 2022 to February 28, 2025

Natural Gas Energy Performance and Results

HVAC AI's impact at Lilac Hall extended to natural gas consumption, with a detailed analysis comparing therm usage before and after the software's June 2024 deployment.

The results showcased a remarkable 35.6% reduction in therm consumption, saving 2,084 therms annually ($3,572 or $0.36 per square foot). This substantial improvement, driven by occupancy-based HVAC optimization, lowered operational costs and significantly reduced Lilac Hall's environmental footprint, reinforcing HVAC AI's value in sustainable energy management.

THERM SAVINGS	Date Range	Avg Temp	Total kWh Usage	Avg Daily Therm Usage	% Savings
HVAC AI Off	Jul 2022 to Feb 2023	66.5°F	5,423 therms	678 therms	34.9%
HVAC AI Off	Jul 2023 to Feb 2024	67.3°F	5,547 therms	693 therms	36.4%
HVAC AI On	**Jul 2024 to Feb 2025**	**68.5°F**	**3,530 therms**	**441 therms**	**35.6%**

Figure 4 – HVAC AI therm savings vs previous years for the same time periods.

A scatter plot (Figure 5) illustrates the impact of HVAC AI on natural gas consumption, comparing daily therm usage against outdoor temperatures. The data shows a clear decline in therm usage following the software's June 2024 deployment, achieved without disrupting Lilac Hall's operations. This seamless reduction highlights the effectiveness and practicality of HVAC AI's occupancy-based HVAC optimization.

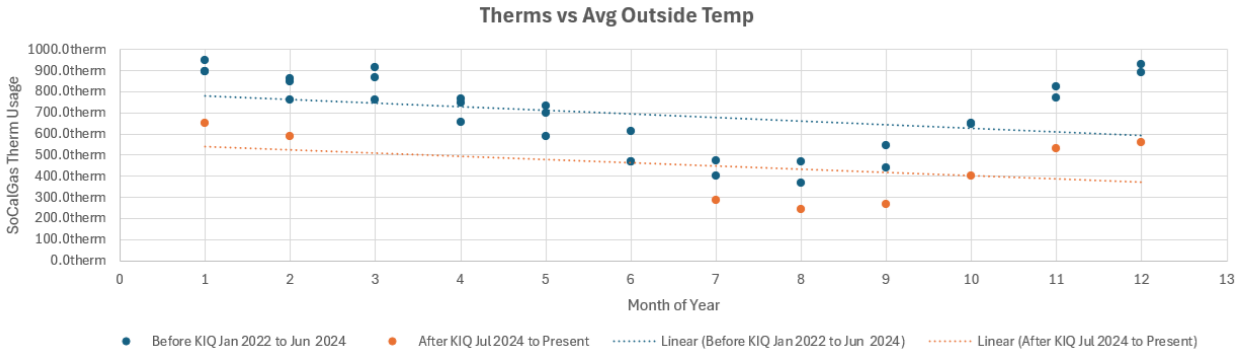


Figure 5 – Scatter plot of Therm usage from January 1, 2022 to February 28, 2025.

Natural gas prices dropped significantly from $2.35 per therm (July 2022–February 2023) to $1.07 per therm (July 2024–February 2025), and HVAC AI's savings calculations conservatively use these lower rates. At the higher historical rates, savings would have exceeded twice the current estimate but even with reduced prices, Lilac Hall saved over $2,000 in therm costs within seven months, with projected annual savings of $3,572 by June 2025.

THERM COST	Date Range	Avg Therm Cost
HVAC AI Off	Jul 2022 to Feb 2023	$2.35
HVAC AI Off	Jul 2023 to Feb 2024	$1.56
HVAC AI On	**Jul 2024 to Feb 2025**	$1.07

Figure 6 – Therm cost for the same time periods which were considered in financial calculations.

Summary of Energy Performance and Results

HVAC AI's implementation at Lilac Hall reduced electricity consumption by 15.1%, saving 14,892 kWh annually ($3,445 or $0.34 per square foot) across 8,000 square feet. Natural gas usage dropped by 35.6%, saving 2,084 therms ($3,572 or $0.36 per square foot). Together, these improvements yield a combined annual energy cost reduction of $7,017 ($0.70 per square foot), delivering significant economic savings and advancing CSUN's sustainability goals.

Return on Investment and Cost Savings

HVAC AI's implementation at Lilac Hall delivers exceptional financial returns, driven by significant energy savings. The project achieves $7,017 in annual energy cost reductions—exceeding initial projections—against annual costs of $1,800 ($1,000 licensing fee, $800 virtual server). This yields a 288% ROI and a payback period of just three months. With no maintenance costs and sustained energy reductions, the software-only solution is projected to save over $26,000 in five years. Across the 10,000 square foot area, CSUN realizes $0.70 per square foot in savings, highlighting the economic and sustainability benefits of HVAC AI's data-driven, occupancy-based approach.

Conclusion: The Future of Occupancy-Based Energy Management

The success of the Lilac Hall project demonstrates the immense potential of occupancy-based energy management. By utilizing real-time occupancy data and machine learning occupancy models to inform HVAC adjustments, CSUN achieved meaningful reductions in energy consumption and costs, all without requiring additional construction or system overhauls. The combination of rapid ROI, seamless integration with existing infrastructure, and ongoing energy savings makes HVAC AI a highly effective solution for universities and commercial buildings seeking to enhance their sustainability efforts.

As CSUN looks to the future, the success of HVAC AI's deployment at Lilac Hall provides a strong foundation for expanding similar initiatives across the campus. Other buildings with networked occupancy sensors and BACnet-enabled HVAC systems could benefit from the same approach, further reducing the university's environmental impact and operational costs.