Installed Ventum Unit at Innovative Fitness West Vancouver

Improving Indoor Air Quality:
Retrofitting Innovative Fitness West Vancouver

Introduction

The purpose of this white paper is to inform the reader about outdated ventilation systems being used in buildings today and ventilation's role in having a less resilient business. Installing a dedicated outdoor air system[1] (DOAS) unit is a "low-hanging fruit" to significantly improve occupant well-being and building operations by efficiently introducing more fresh air into the building using modern technology.

Oxygen8's objective for the project was to provide a healthy and sustainable space for Innovative Fitness West Vancouver – a small business owned by Keith Sharman, focused on personal training. The studio experienced multiple COVID-19 outbreaks that inhibited its ability to serve clientele confidently and safely. The team at Oxygen8 saw this as an opportunity to retrofit a high occupancy fitness studio by replacing the outdated ventilation system. The overall goal was to provide fresh air to help create a healthier space.

This white paper will cover the background, design, and results of the Innovative Fitness Studio Ventilation Retrofit project and how the retrofit helped Innovative Fitness West Vancouver avoid viral outbreaks and run a successful business amidst an ongoing pandemic. This project was awarded funding by Innovate BC and the National Research Council of Canadadue to its potential to reduce building emissions while improving occupant safety and wellbeing.

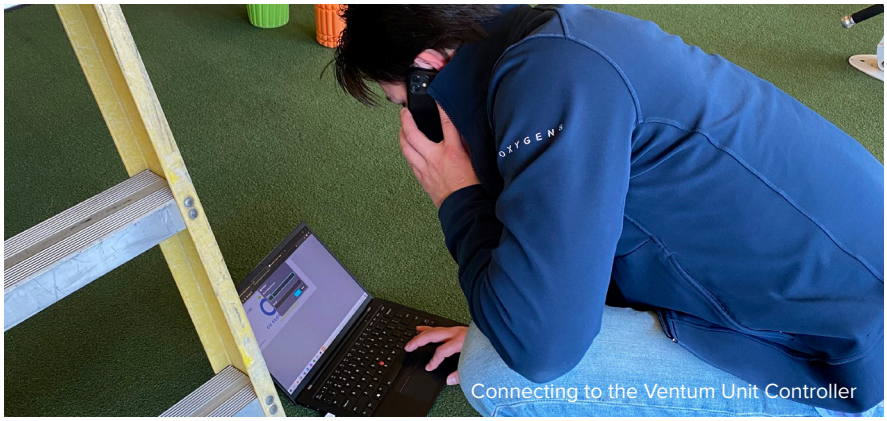
Background

Small businesses are less resilient to changing conditions than large corporations and must be proactive in planning against future obstacles. In Canada, small and medium enterprises (SMEs) employ about 85% of the labour force and are a major driver of the economy[i]. With recent COVID-19 outbreaks, many businesses have had to close their doors or significantly reduce their capacity to operate safely. The uncertainty of future sales and cash flow resulted in SMEs relying on saved money and debt to endure the slow down caused by COVID-19.

Fitness facilities are especially high-risk areas due to their highly populated spaces.

The heavy breathing of people working out produces more aerosols which can increase viral transmission as demonstrated by the multiple gym outbreaks across British Columbia. Many fitness, yoga, and spin studios in older buildings have outdated ventilation systems that do not provide adequate ventilation for ideal indoor air quality. These older ventilation systems have low fan, heating, and cooling efficiencies and often burn natural gas for heating. Most fitness facility owners are unaware of the indoor air quality levels within their own facilities and are paying high gas and electricity bills to condition their inefficient space for thermal comfort.
In the case of Innovative Fitness West Vancouver,

the studio was forced to reduce capacity by half during peaks in COVID-19 cases to protect clientele and employees. This hurt revenue significantly, and as a small business owner, Keith was among the most impacted by the outbreaks.



Connecting to the Ventum Unit Controller

The Challenge

The challenge that Keith faced was an unsafe space for clients and employees and an unclear solution. As a small business owner suffering from the by-products of a global pandemic, Keith required an all-encompassing solution – a low time and money investment, cost savings with minimal impact on workout space, improvements to occupant wellbeing and experience, and most importantly a safe and healthy space for clients and employees.

After the Innovative Fitness West Vancouvre story reached the Oxygen8 team, we knew we had the expertise and solutions to help Keith and his business. This was the perfect opportunity showcase the improvements that come from implementing an all-electric DOAS unit, while providing an easily installed solution designed to protect building occupants from airborne viruses and give the studio the confidence to re-open their doors for business.

Oxygen8 presented the concept of installing a new pre-market DOAS unit called Ventum to the National Research Council of Canada (NRC. The Oxygen8 team was searching for an opportunity to test out Ventum and Innovative Fitness West Vancouver was the perfect application for Ventum's unique technologies. NRC recognized the gaps that Ventum filled in the North American ventilation market for an all-electric, high-efficiency, low-profile energy recovery unit with intelligent controls. Funds were awarded to begin this project right away and replace Keith's outdated ventilation system with a state-of-the-art Ventum unit.

The project constraints drove the design of this project. Originally, 400 cubic feet per minute (CFM) of unfiltered outside air was being drawn into the space through a bulkhead with a maximum occupancy of about 26 people (about 15 CFM/person). However, the fan used to pull the outside air inside had been unknowingly inactive, meaning that the fresh outside air being delivered to the space was negligible.

The significance of having outside air delivered to a space is to dilute airborne pollutants that cause adverse health effects – these pollutants are commonly aerosols, carbon dioxide, volatile organic compounds, or particulate matter produced by coughing, breathing, the outside environment, or the building itself.

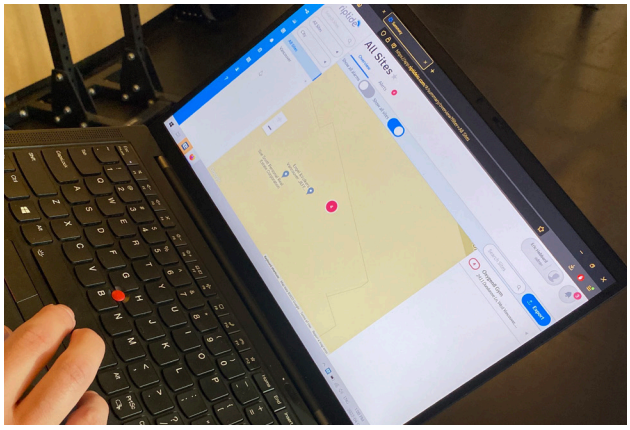
[1]Dedicated Outdoor Air Systems are a type of heating, ventilation and air-conditioning system that consists of two parallel systems: a dedicated system for delivering outdoor air that handles both the latent and sensible loads of conditioning the ventilation air, and a parallel system to handle the loads generated by indoor/process sources and those that pass through the building enclosure.

Benchmarking Indoor Air Quality

If Oxygen8 could prove that Innovative Fitness West Vancouvers' indoor air quality improved as a result of the Ventum unit installation, it would be a testament to Keith's clients and employees of his commitment to their wellbeing and the validity of Ventum for similar applications. To benchmark indoor air quality before the ventilation system upgrade, Oxygen8 installed four in-space air quality sensors to track relative humidity, temperature, CO2, VOCs, and PM using the RESET air monitoring standards.

Riptide Hub Installed in the Studio Office

The Oxygen8 team proudly partnered with Turntide[4] to implement their Riptide Hub, which allows users to log air quality data and access it from the cloud. Oxygen8's commissioning team connected Ventum's smart controller to the Riptide Hub to enable Ventum's variable speed ECM fans to respond to real-time air quality measurements in the space.



Riptide Remote Monitoring

Turntide's cloud system provides a real-time air quality dashboard that is accessible by the building owner. This makes key metrics accessible to owners like Keith, in real-time, which present a full picture of the current indoor air quality.

Since CO2 is a by-product of other pollutant inducing mechanisms (such as breathing), Oxygen8 decided to focus on CO2 concentrations as a method of measuring other pollutants and airborne viruses. A commonly used CO2 limit is 1000 ppm as the maximum for acceptable indoor air quality[5] – the 1000 ppm limit was recently adopted by the Canadian government as the recommended maximum for continuous exposure. In general, occupants will notice a decrease in air quality when CO2 levels are around 600 ppm.

Benchmark readings were gathered at Innovative Fitness West Vancouver between January and April. The findings confirmed our initial suspicions – that this indoor space was not getting enough fresh air to combat viral transmission. This was indicated by high levels of CO2 concentration which averaged at 1100 ppm during busy hours and peaked at 2000-2400 ppm during high occupancy. At these high CO2 concentrations, occupants will feel mental fatigue, dizziness, nausea, and irritation to the throat, eyes, and mouth. This bolstered our resolve in creating a safe and healthy space for Keith's clients and employees.

Design of Ventum

Oxygen8 worked with Keith and a local engineering firm, Integral Engineering, to determine the optimal installation location for the Ventum unit. The low-profile depth (18") of the Ventum unit allowed the unit to be hung from the high ceiling. This helped to minimize the amount of space used by the unit, and to make it a center showpiece of the room.

In terms of the fresh air being introduced to the space, previous findings uncovered the current 400 CFM was both negligible (due to the fan not working) and insufficient for the operations of Keith's business. At

Ceiling Mounted Ventum ERV

400 CFM, there were under two Air Change Hours[6] (ACH) of fresh air. To put this in perspective, the Harvard T.H. Chan School of Public Health recommends six ACH to achieve ideal indoor air quality and designates anything less than three ACH as low. By replacing the outdated HVAC system with a new Ventum unit, Oxygen8 aimed to hit the ideal six ACH by providing up to 1350 CFM of fresh air.

Traditionally, adding additional CFM into a space results in high costs due to large unit sizes, inefficient fans, maintenance, and the conditioning of outside air. Ventum uses unique energy recovery technology[7] that was first popularized in Europe and is now making its debut in North America. The European low-profile design can recover 80% of the sensible and latent energy from the exhaust air, which is used to pre-condition the incoming outside air, significantly reducing the cost of additional outside air. Additionally, Ventum is equipped with high-efficiency fans, and a counterflow ERV core with no moving parts, resulting in minimal energy use and maintenance. With these cost savings, Keith can focus his resources on growing his business.

Ceiling Mounting the Ventum ERV

Ventum Installation

Oxygen8 partnered with local mechanical contractor, EAS Eco-Air Systems, to install the Ventum unit at Innovative Fitness West Vancouver. For minimal impact on business operations and minimal time investment, Keith and his staff were able to safely operate while the installation took place.
To allow Keith to still run his business during installation, Oxygen8 and Eco-Air performed work during the business's non-peak hours. The installation team cordoned off small areas on the fitness studio floor to install the Ventum unit, leaving ample space for clients and trainers. Special provisions were made to minimize disruptions to the client experience from construction by-products such as noise and dust.

At the beginning of April 2022, the Ventum unit was fully installed and operational – delivering 1350 CFM at six ACH of pre-conditioned fresh air directly to the occupants of Innovative Fitness West Vancouver. From this point on, Keith's business was equipped with an unobtrusive, state-of-the-art ventilation system that provided him the confidence to operate his business safely.

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[2] Ventum is an all-electric, high performance counter-flow core heat and energy recovery ventilation system.

[3] Outdoor Air filtration is important to remove airborne contaminants and particles from outside before entering an indoor space.

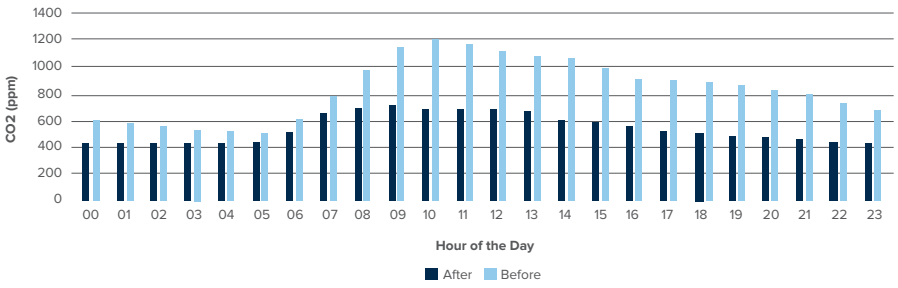
Results

Since the commissioning of the Ventum unit in April, Keith has resumed his business' operations to pre-pandemic capacity. In addition to Keith's new found confidence in the improved indoor air quality, his clients and employees were also taking notice – unsurprisingly, the four in-space air quality monitors also agreed.

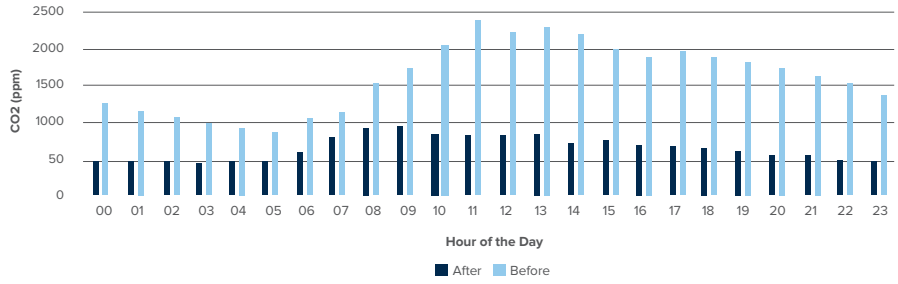
For an accurate comparison, air quality measurements from March and April were used as the before and after installation readings. In March, before the unit was operational, the average CO2 concentrations during busy times were 1100 to 1200 ppm and peaked at 2000 to 2400 ppm at less than two ACH – at these peak levels, occupants may experience headaches, sleepiness, poor concentration, and an increased heart rate.

In contrast, after the unit was operational in April, the average CO2 concentrations during busy times were around 700 ppm and peaked at 800 to 950 ppm at 6 ACH. This results in a decrease of over 40% of average CO2 concentrations. For Keith, this meant a significantly improved occupant experience and minimized airborne viral transmission resulting in a safer and healthier space for a more resilient business.

Since taking the steps to improve the ventilation of Innovative Fitness West Vancouver, the studio has had zero viral outbreaks and significantly improved indoor air quality. This was a highly successful application for Ventum. The transformation of Keith's business to a safe and healthy space for his clients and employees highlights the importance of fresh air in buildings.



CO2 Average Before and After Ventum Installation



CO2 Peaks Before and After Ventum Installation

[4] Riptide is the only cloud-based solution for multi-site operators that integrates any system into one powerful platform
[5] Read more about Sick Building Syndrome here.
[6] Air Change Hours is the number of times that total air volume in a space is completely removed and replaced per hour; a higher value represents better ventilation
[7] Read more about energy recovery technology here.

Conclusion

Keith's success in retrofitting his fitness studio with Oxygen8's Ventum ERV is a testament to building owners everywhere. By incorporating the use of a DOAS unit with energy recovery technology, business owners can save on operating costs while helping to improve the well-being and experience of building occupants.

Works Cited

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