

IDEA

PHASE 3 TECHNOLOGY DEMONSTRATION HIGHLIGHT

COMPANY
Mainstream

TECHNOLOGY
Electronically commutated motor and fan assembly

DEMONSTRATION SITE(S)
NYC Department of Sanitation (DSNY) Central Repair Shop
52-35 58th Street
Woodside, NY 11377

DEMONSTRATION PERIOD
August 2019 – October 2020



SYSTEM(S) INVOLVED
HEATING, COOLING, AND VENTILATION



TYPE OF SAVINGS GENERATED
ELECTRICITY

VENDOR'S POTENTIAL FOR SAVINGS

25 – 30%

SAVINGS ACHIEVED IN THIS DEMONSTRATION

33 – 38%



SAVINGS

SIMPLE PAYBACK PERIOD
8 years

Technology Description

Mainstream's electronically commutated (EC) motor and fan assemblies are designed to replace standard belt-driven fans in air-handling units (AHUs). With a brushless design and integrated electronics that run on an AC power supply, EC motors can convert, regulate, and control the power supply within the motor. Unlike standard fan motors which have just two settings, on and off, EC motors operate similarly to variable frequency drives and supply fans with the appropriate current based on actual fan speed requirements. The array provides steady air flow through the AHU while using less electricity and operating more quietly than traditional belt-driven fans. Finally, EC fans have sealed bearings and are direct drive, eliminating the need for belt replacement and periodic greasing, and reducing associated maintenance costs.

Optimal Facility Characteristics

Large facilities with significant electricity demands will realize the most savings from installation of Mainstream EC arrays. The facility does not need a building automation system to see the benefits of the retrofit; however, if remote monitoring and management is desired for the purpose of measurement and verification of savings or control of the array, a wireless internet connection may need to be installed, as was in this demonstration.

Demonstration Results & Discussion

Two fans were selected for installation of the EC fan assemblies, one in the facility's sheet metal shop and the other in the steam shop. One month before the belt-driven fans were removed, Mainstream, together with the demonstration installation partner GRR

Cooling Experts, installed BAPI airflow sensors and WattNode Pulse power meters on the two AHUs as well as a wireless router and internet modem. Interval data from the sensors were transmitted every 15 minutes to the data management software platform Chronicle from Innotech Network to create a baseline of electricity consumption and airflow through the pre-retrofit AHUs. After the two EC fans were installed and commissioned, Mainstream continued to monitor power consumption and airflow for 28 and 33 days. They found that the flow rate remained steady across the belt-driven and EC fans, while the EC fans required significantly less electricity. Based on pre- and post-installation data, Mainstream estimated annual savings of 11,334 kWh, a 38.6% reduction, in the sheet metal shop fan and 5,508 kWh, a 33.3% reduction, in the steam shop fan.

Mainstream also estimated savings as a result of avoiding drive loss, a common inefficiency in belt-driven fans caused by a combination of friction and speed loss. Based on the November 2020 average cost for electricity, Mainstream predicts that by switching to the EC fans, DSNY will save \$1,454.16 per year by avoiding belt drive loss alone.

Recommendations for Implementation

- When planning a project such as fan replacement, the operations and maintenance team should consider replacement of other components in the AHU to make the most of staff time and increase energy savings. In this demonstration, the team also replaced

failed steam control valves, trading out pneumatically actuated valves with more efficient, electronically actuated valves. The valves were tied to the new wireless monitoring system for optimization of both ventilation and temperature control.

- In addition to energy savings, EC fans are significantly quieter than belt-driven fans. Building operators should consider them for AHUs that are in already loud environments or those that have been the source of noise complaints.
- All relevant facility personnel, including the building operator or supervisor, HVAC maintenance staff, and any staff member who may come in contact with the new fans, should participate in vendor training after installation and commissioning is complete. In addition to an overview of the technology and its benefits, training should include explanation of sequence of operation, area personnel functions (user input of temperature and fan control), and safety procedures for access to the fans, specifically for maintenance staff.
- As the AHU fans modulate, it's possible that room air distribution will become inadequate at low fan speeds, resulting in hot or cold spots across the conditioned space. The implementation team recommends that the vendor put a system in place for collecting comfort complaints. If complaints are registered in the treated AHU zones, it may be necessary to further data-log temperatures across the zone to understand if reduced-speed fan operations are the cause.

Energy