ADVANCED COOLING TECHNOLOGIES, INC.

IDEA | **PHASE 3 TECHNOLOGY DEMONSTRATION HIGHLIGHT**

COMPANY
Advanced Cooling Technologies, Inc. (ACT)

TECHNOLOGY
Heat Pipe Air-to-Air Heat Exchanger (AAHX)

DEMONSTRATION SITE(S)
Bedford Clinic, 485 Throop Ave., Brooklyn, NY 11221

DEMONSTRATION PERIOD
November 2017 – December 2018

SYSTEM(S) INVOLVED
HEATING, COOLING

TYPE OF SAVINGS GENERATED
ELECTRICITY, NATURAL GAS

VENDOR'S POTENTIAL FOR SAVINGS
3,614 KWH
2,606 THERMS

SAVINGS ACHIEVED IN THIS DEMONSTRATION*
3,600 KWH
2,600 THERMS

SAVINGS

PROJECTED PAYBACK PERIOD:
Demonstration: 20 years
Typical: 2-5 years

Technology Description

Advanced Cooling Technologies, Inc. (ACT) manufactures a heat pipe air-to-air heat exchanger (AAHX) that recovers sensible heat from the building's conditioned exhaust air stream and transfers it to the unconditioned outside air intake stream.

This transfer yields a pre-heating or pre-cooling effect on the air entering the system and in turn reduces the heating or cooling demand. The heat transfer occurs passively without the need for supplemental electricity or fuel input and does not typically need additional mechanical adjustments after implementation.

Optimal Facility Characteristics

- Facilities that consistently operate with 50-100% outside air (i.e., facilties that do not adjust the percentage of outside air seasonally).
- Facilities with significant heating and/or cooling loads; facilities with air handling units (AHUs) that operate at 5,000 cubic feet per minute (CFM) or greater.
- Building automation system (BAS) must be able to accurately and reliably measure air flow and temperatures at the required measurement points for long-term system monitoring.

* FOR 80/365 DAYS WHEN BAS WAS RECORDING DATA: 72 KWH ELECTRICITY AND 937 THERMS OF NATURAL GAS (3,600 KWH ELECTRICITY AND 2,600 THERMS OF NATURAL GAS WHEN EXTRAPOLATED FOR ONE YEAR).

Demonstration Results & Discussion

- ACT reported that the AAHX was successful in recovering about 60% of heat from exhaust air at the demonstration site across all seasons.
- Throughout much of the measurement period, the systems that controlled the unit were not functioning and the expected operating conditions were not in place, which yielded incomplete datasets. Specific issues included:
  - The BAS was nonfunctioning and flow meters were not calibrated for several months during the measurement period.
  - The unit operated with 30% outside air, suboptimal for the AAHX, and during the measured summer months, outside air intake was reduced to 0% for a few weeks as contruction and remodeling took place in the facility.
- Consistent data was available for a three- to four-month period, during which the AAHX was verified to be operating as expected.
- Savings were not calculated during the cooling season; actual savings were not calculated for the entirety of 2018.
- ACT used the measured savings for the shoulder months (937 therms and 72 kWh) to extrapolate annual savings using typical weather data and operation with 30% outside air.
- The AAHX is expected to save $3,900 annually based on the measured savings during the shoulder months.
- In a retrofit, the AAHX will also increase the overall static pressure of the AHU. Typically, the increase in fan power required to overcome the additional pressure drop is less than 10% of the savings calculated, but this was not measured as part of this project.

Recommendations for Implementation

- The exhaust and intake air streams must be flowing side by side in opposite directions or can be redirected through duct work modifications.
- Heat pipes must be airtight and the exchanger should be tilted such that the condenser side is at a higher elevation than the evaporator side.
- A dynamic, seasonal tilting mechanism should be added for AHUs that implement both heating and cooling.
- To prevent decreased heat exchanger effectiveness, screen filters should be checked and cleaned as necessary during regular maintenance.
- If monitoring is intended after implementation, the facility should have a functioning BAS that is properly calibrated for measuring air flow and temperature at the required locations.