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ClimaStat®

New or Retrofit HVAC System Control
Improved Energy Efficiency Ratio 15–30%

In 2012, Advantek Consulting Engineering, Inc., developers of ClimaStat, completed the first DoD demonstration of the technology on both a new unitary HVAC system at Patrick Air Force Base (PAFB) at Cape Canaveral, Florida, and a retrofit system at the Marine Corps Air Station Beaufort (MCASB) in South Carolina.

▸ MODIFIED DX SYSTEM FOR INCREASED HVAC EFFICIENCY

ClimaStat is an optimized unitary direct expansion (DX) refrigeration-science technology that can be installed on new or retrofit conventional air-conditioning units for more precise system control, energy reduction, and improved fresh air ventilation and dehumidification.

▸ REDUCED ENERGY CONSUMPTION, LOW PAYBACK

Findings included a 15%-to-30% improvement in system integrated energy efficiency ratio (IEER), a 2.6-year payback period for the new equipment, and a 4-year payback period for the retrofit system. A 72% improvement in energy efficiency was calculated when the "as found" MCASB unit was compared with the refurbished, ClimaStat retrofitted HVAC unit.

Technologies Tested

ClimaStat®

- Controls major elements of unitary HVAC equipment more precisely with modification to the DX system.
- Raises energy efficiency by increasing cooling coil velocity and reducing it when dehumidification is needed.
- Improves supply air dehumidification independent of temperature load control.
- Can increase outside air ventilation without adverse effects on hardware reliability.
- Optimizes refrigerant management, reduces compressor run hours and pressure differentials.
- Reduced operational temperatures (average 57°F cooler) may increase compressor life and maintain operational efficiency.
- Optimizable for specific cooling-performance objectives such as satisfying the actual sensible-to-latent ratio.
- Low risk, used for a decade with readily available and serviceable components.

Best suited to:

- All sizes of new and existing unitary HVAC systems in good condition with 5 years service life remaining.
- Arid climates, which will have greater energy efficiency improvement.
- Systems utilizing reheat for humidity or temperature control have added savings (up to 60%).

Limitations:

- Requires regular filter changes and proper coil-temperature-control deadband settings to avoid coil freezing.
- Greater EER improvement in 2-compressor intertwined coil units than in 4-compressor face-split units.

Demonstration Sites: PAFB and MCASB

The MCASB ClimaStat demonstration took place in a large base retail facility conditioned by 11 unitary rooftop cooling/heating units installed in 2003 and, at the time of the demonstration, approaching the end of their useful life. They used standard commercial electric direct expansion equipment for cooling, and natural gas for heating. An Electronics Development Laboratory (EDL) hosted the PAFB ClimaStat demonstration. There, space conditioning was provided by a new 8-ton HVAC unit with humidity control, to which ClimaStat was added after baseline operation data was collected.

INSTALLATION COSTS*

Installation costs include special-order materials, labor, installation, and testing. Reduced costs expected with future economies of scale and when ordering wholesale and in bulk.

NEW EQUIPMENT (PAFB)
$9,190 ($1,081/ton)

RETROFIT (MCASB)
$13,887 ($694/ton)

*Cost information is for reference only. Individual sites should do due diligence to determine local costs.

TYPICAL CAPITAL COSTS*

NEW EQUIPMENT
$112/ton, installed by factory

RETROFIT
$380/ton, with trained team

*At time of demonstration.

ADDITIONAL MILITARY DEPLOYMENTS

- Andrews Air Force Base

Additional Resources

- **EW-201144 FINAL REPORTS AND TECHNOLOGY TRANSFER TOOLS**
  https://serdp-estcp.org/Program-Areas/Energy-and-Water/Energy/Conservation-and-Efficiency/EW-201144

- **TECHNOLOGY USED AT DEMONSTRATION SITE**
  ClimaStat, www.advantekinc.com

NOTE: Before incorporating new technology, refer to Unified Facilities Criteria (UFCs) and other appropriate guidance to ensure compliance with current requirements. https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc

Demonstration Results

ENERGY SAVINGS

- An average of 21% reduced energy consumption relative to baseline equipment.
- PAFB: 24% energy savings on new system—IEER baseline 12.5, ClimaStat 15.9.
- MCASB: 26% energy savings on retrofit; IEER baseline of refurbished unit 9.5, ClimaStat 12.3.
- Energy use reduction up to 60% in systems utilizing reheat for humidity or temperature control.

INSTALLATION

- Retrofit required more service than anticipated to achieve baseline operation.
- Training will reduce installation costs.

OPERATIONS & MAINTENANCE

- No significant downtime on either unit after 8 months.
- Engineered for simplicity and ease of maintenance with readily available and serviceable components.

SYSTEM PERFORMANCE

- 33% increase in dehumidification capacity at PAFB.
- Indoor Air Quality (IAQ) equal to or better than baseline, which was found to be acceptable.

USER SATISFACTION

- Personnel surveys show 10% increase in satisfaction over baseline.

COST-EFFECTIVENESS

- PAFB: 2.6 year payback on new equipment. Adjusted internal rate of return over 10 years, 16.11%.
- MCASB: 4.0 year payback for retrofit unit.
- Cost per ton drops significantly as system size increases. Retrofit of a 20-ton unit is about one-third that of a 5-ton unit.