E3T HVAC TAG Recommendations

September 2010

These are recommendations for measures presented and scored at the scoring session August 10, 2010, which were confirmed and discussed further during the E3T 2010 HVAC TAG Measure Recommendations confirmation calls, held August 24 and September 16 2010.

Variable Capacity Compressors-6	**Overall Score: 3.5**

Description:

Variable capacity compressors operate in a "pulsating" fashion to vary the mass flow rate of refrigerant. Doing so allows direct expansion (DX) air conditioning (or heat pump) equipment to be operated as a variable capacity device.

Recommendations:

1. Develop a staged research plan for the recommendations below.
2. Perform a literature search for previous lab and field testing, and contact appropriate organizations such as manufacturers for their literature and assistance.
3. Define appropriate baseline systems for various applications.
4. Estimate distribution of cooling loads in representative regional applications.
5. Perform lab testing as needed, including studying the effects of various types of economizers and variable-speed fans, and the affect of this strategy on maintenance, possibly partnering with other regional efforts.
6. Perform field testing to measure actual performance in the Pacific Northwest to include economizer savings, if any. Include both retrofit and new construction as well as appropriate baseline systems.
7. Explore new competing technologies, such as inverter-driven compressors and Carrier two-stage systems.
8. Develop criteria for estimating savings in a wide variety of different settings (e.g., different building types, sizes, and configurations, and different climate zones) using modeling tools.
9. Compare field and lab data with standard ratings and modeling results.
10. Estimate potential regional savings.
11. Identify key variables for good applications, including non-energy savings and market characteristics.
12. Provide training for designers and code officials so they may better understand rating systems.
13. Evaluate performance from field and lab testing and develop IEER guidelines.
14. Provide IEER performance information and application and implementation guidelines.
15. Provide utility incentives for new construction and retrofit based on the outcome of the field and lab tests.
16. Share research results with RTU Working Group.

Air Side Economizers for Data Centers-119	Overall Score: 3.3

Description:

Install 100% outside-air cooling capability in data centers to provide free cooling where outside air was previously provided only to satisfy the minimum ventilation requirements. Because data centers require air conditioning year-round, significant energy savings can be realized by using outside air for free cooling.

Recommendations:

1. Investigate market penetration, estimating how many economizer systems are currently installed and in use.
2. Perform a comprehensive literature search for relevant research and contact appropriate organizations for additional resources and information.
3. Identify savings potential predictions for various temperature allowances.
4. Provide guidelines on filtration issues to address outside air quality concerns.
5. Provide funding for energy modeling for designers and owners.
6. Identify a number of existing projects, new or retrofit, where economizers are utilized and develop a few case studies.
7. Provide designers, specifiers, and data center owner/operators technical assistance and application information, training, best practices, and guidelines for sequences of operation and control integration. Include some criteria for server temperature and humidity tolerance.
8. Promote the use of robust servers that can tolerate a wider range of temperatures and humidity.
9. Share research results with the RTU Working Group, ASHRAE, and other organizations.
10. Train data center designers through a seminar series, possibly through BetterBricks.
11. Check the building codes in the major jurisdictions in the Northwest to determine which ones already require economizers. If the codes are in place, but economizers are not being installed, why not? If the codes are not being enforced, provide training to local code officials, if necessary.

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Advanced Design Rooftop HVAC Unit-246	**Overall Score: 2.6**

Description:

The Advanced Design Rooftop HVAC Unit offers improved energy performance over the typical "commercial" rooftop unit by enhancing the performance of individual components and configurations, including fans, coils, filters, dampers, compressors, condensers, controls, and airflow path.

Recommendations:

1. Perform the following tasks with a prioritized, staged approach, or perform a scoping study to clarify needed research and develop a prioritized, staged plan for future research within budget guidelines of BPA.
2. Clarify the specific advanced features that should be considered as part of advanced RTUs or performance specifications that should be met for the research below.
3. Perform a market survey of product availability, and sales data for various IEER levels and features.
4. Perform literature search for previous lab and field testing, making calls to appropriate organizations such as manufacturers, utilities, and research organizations.
5. Estimate distribution of cooling loads in representative regional applications.
6. Define appropriate baseline systems for variable applications.
7. Clarify variables and research questions; how much savings can be expected, how well economizer integrated controls impact savings and how are economizers being controlled, etc. Establish priorities for limited research funding.
8. Perform simulation of energy savings potential, improving models, and partnering with CEC or WCEC.
9. Develop a lab test standard specific to the Pacific NW; investigate and build on work done previously by AEC, CEE, DOE, EPA, ACEEE, and PIER.
10. Explore and quantify persistence of energy savings and user impacts on persistence, such as control settings.
11. Identify or develop a recognized performance labeling system (i.e. similar to Energy Star) that provides flexibility for manufacturers to demonstrate compliance.
12. Explore and clarify non-energy benefits as well as impacts on equipment life and maintenance; quantify as possible.
13. Analyze savings potential beyond EER and IEER using lab testing, possibly partnering with labs at California utilities or elsewhere to measure performance at base loads. Then take field measurements, do simulations using expected value method for expected savings potential with various building types and at a range of loads.
14. Clarify which advanced features are responsible for energy savings and how feature impacts interact.
15. Provide a prescriptive specification with compliance paths that can be incentivized.
16. Based on the results of the savings analysis, provide utility incentives for new construction and replacement applications.

Remaining Question:

- What happened with the work in this area done by AEC, CEE, and PIER and why were they apparently not successful?

Web-Based Small Commercial Thermostat-247	**Overall Score: 2.7**

Description:

The proposed measure includes a package of hardware, software, and O&M practices that include:
• Digital "smart thermostats" with a variety of programmable control capabilities.
• An internet connection.
• The internet interface is used by someone who has HVAC optimization knowledge and an interest in the energy efficient operation of the facility.
The focus of this measure is for applications where packaged HVAC equipment is used in small commercial facilities.

Recommendations:

1. Identify competing products, including those from Cooper Industries; attend ASHRAE trade show typically held in the month of January to explore manufacturer's latest relevant products.
2. Perform a comprehensive literature search of previous research on these products and their performance.
3. PG&E currently funds the use of this technology and PSE may be considering it. Find out what convinced them to do that and what their experience has been with them.
4. Solicit feedback on benefits (energy and non-energy) and issues from a small group of building operators managing multiple buildings.
5. Survey how the technology is currently being applied.
6. Estimate when this technology will be ready to be incentivized.
7. Clarify issues and gaps to be addressed in future research.

Remaining Questions:

- What are the real costs? They are currently high but should drop as the application becomes more widespread.
- Are these smart enough to avoid using strip heat on heat pumps?
- How can these be benchmarked?
- BPA is doing some field trials. Are they considering an incentive?
- Do the thermostats cycle fan off or slow the fan down to gain fan energy savings? Will that impact IAQ; are CO2 sensors needed?