



BPA E3T HVAC Technical Advisory Group Progress Report

February 2010

This report summarizes results of the one-day scoring meeting of the Energy Efficiency Emerging Technology (E3T) program's Heating, Ventilation, and Air Conditioning (HVAC) Technical Advisory Group (TAG), convened on January 11, 2010, via webinar and telephone conference and a subsequent confirmation call on February 12, 2010, at which TAG measure recommendations were finalized. The main goal of these meetings was to score four HVAC measures that received high rankings in the May sessions of the TAG, and to make recommendations for the measures' next steps in the E3T process.

This progress report includes:

- Brief summaries of previous TAG-related work
- Lists of participants in the scoring meeting and in the subsequent confirmation meeting
- An update of the E3T process and progress of the HVAC TAG
- Graphics detailing the measure scoring results from TAG members' surveys
- TAG recommendations for the four measures

Previous Work

In 2009, the E3T Program recruited highly qualified, experienced HVAC specialists to serve on the HVAC Technical Advisory Group (TAG). A TAG meeting was convened, conducted over two days – May 6 and 7 – with most participants connected via webinar and conference call, and a few TAG members gathered in person with staff at the Washington State University Extension Energy Program offices in Olympia, Washington. During those meetings a facilitated brainstorm process was used to create a list of promising measures not yet widely adopted in the Northwest. Participants then voted on a list of measures that combined brainstorm items with other measures from the Regional Technical Forum process.

From those HVAC measures receiving the most votes, four were selected by E3T staff for review in the scoring meeting. High scoring measures not selected may potentially be considered in future TAG cycles. The four measures selected in this cycle were:

- Demand Controlled Ventilation for Commercial Kitchens
- Variable Refrigerant Flow Heat Pumps
- Demand Controlled Ventilation
- Indirect-Direct Evaporative Cooling

Framework Tools

During the summer of 2009 the Framework for the E3T process was completed. The Framework is used as a guide for the E3T process, with which staff, TAG members, and others identify, rank, score, select, and assess emerging energy efficiency technologies. Prior to the scoring meeting, TAG members and E3T staff members drafted extended descriptions for each of the four initial technologies on Measure Information Identification forms ("D1s"). Another survey tool from the Framework, the Measure Benefits – TAG Scorecard ("D3") was adapted for online collection.

In late summer, a group of E3T staff members and regional energy efficiency professionals was convened in a phone conference and webinar format to review the survey questions and the online D3 survey. This was essentially a trial run with an opportunity to assess aspects respondents might find unclear. The most significant change emerging from that test was to split a question asking about energy and demand savings into two questions. Additional comments were received including several noting that the ranges of payback timelines in the answers were not extensive enough and were weighted too heavily to near-term options.

Scoring Meeting

HVAC Technical Advisory Group

January 11, 2010 Scoring Participants and Guests

NAME	ORGANIZATION	LOCATION
David Bisbee	Sacramento Municipal Utility District	Sacramento, CA
David Springer	Davis Energy Group	Davis, CA
Doug Koenen	WSU Extension Energy Program	Olympia, WA
Jack Callahan	BPA Energy Efficiency	Portland, OR
Jack Zeiger*	WSU Extension Energy Program	Olympia, WA
Jared Sheeks	MacDonald Miller Engineers	Seattle, WA
Joel Jackman	Puget Sound Energy	Bellevue, WA
Jonathan Livingston	Livingston Energy Innovations	Mill Valley, CA
Mark Firestone	PAE Consulting Engineers	Portland, OR
Mark Rehley***	Northwest Energy Efficiency Alliance	Portland, OR
Mira Vowles	BPA Energy Efficiency	Portland, OR
Paul Delaney	Southern California Edison	Irwindale, CA
Phoebe Warren	Seattle City Light	Seattle, WA
Rob Penney**	WSU Extension Energy Program	Olympia, WA
Robert Carver	NYSERDA	Troy, NY
Xudong Wang	Air-Conditioning, Heating & Refrigeration Institute	Arlington, VA
* served as facilitator	**served as recorder	***invited guest

Prior to the January 11 scoring meeting, TAG members were given access to Measure Information Identification forms for basic information on the measures under consideration and to the SurveyMonkey tool designed to emulate the Measure Benefits – TAG Scorecard, also known as the D3 scorecard. Members were asked to fill out the online Scorecard survey with the understanding that their answers could be changed after they heard presentations on the measures and TAG discussion during the meeting.

The scoring meeting was held via a conference call augmented by a webinar allowing participants to view and share presentations and other visual materials. After introductions, Mark Rehley from the Northwest Energy Efficiency Alliance spoke about regional organizations and efforts related to emerging technology and the opportunities for collaboration among them. Jonathan Livingston updated TAG members and guests about the development of Framework tools since the last session of the TAG and solicited comments on those in use at the session.

The core of the scoring session was a focus on details of each of the four measures. TAG members and E3T staff gave presentations on each measure. During and after presentations, TAG members asked questions and discussed aspects of the measures within the context of E3T goals. Members were then encouraged to complete or adjust their online Scorecard surveys in light of the discussions. Scorecards submitted by individuals from this TAG before and after the discussion indicate that listening to presentations and participating in discussions does induce TAG members to alter their scoring and offer more comments.

Demand Controlled Ventilation for Commercial Kitchens emerged from the scoring session with a top weighted average score of 3.56 and recorded top scores in six of the nine categories. *Demand Controlled Ventilation in Commercial Buildings* placed second overall with a score of 3.12, only slightly ahead of *Variable Refrigerant Flow Heat Pumps* at 3.01. *Indirect-Direct Evaporative Cooling* ended with an average score of 2.38. Summary quantitative results of that survey are presented in Figures 1 and 2. Qualitative considerations are detailed in the recommendations section at the end of this report.

TAG members and staff were then asked to accept assignments to add detail to the basic description of measures in the E3TNW.org database. Following the meeting, access credentials and instructions were distributed to those who accepted assignments.

Figure 1. Graphical Representation of Measure Scoring

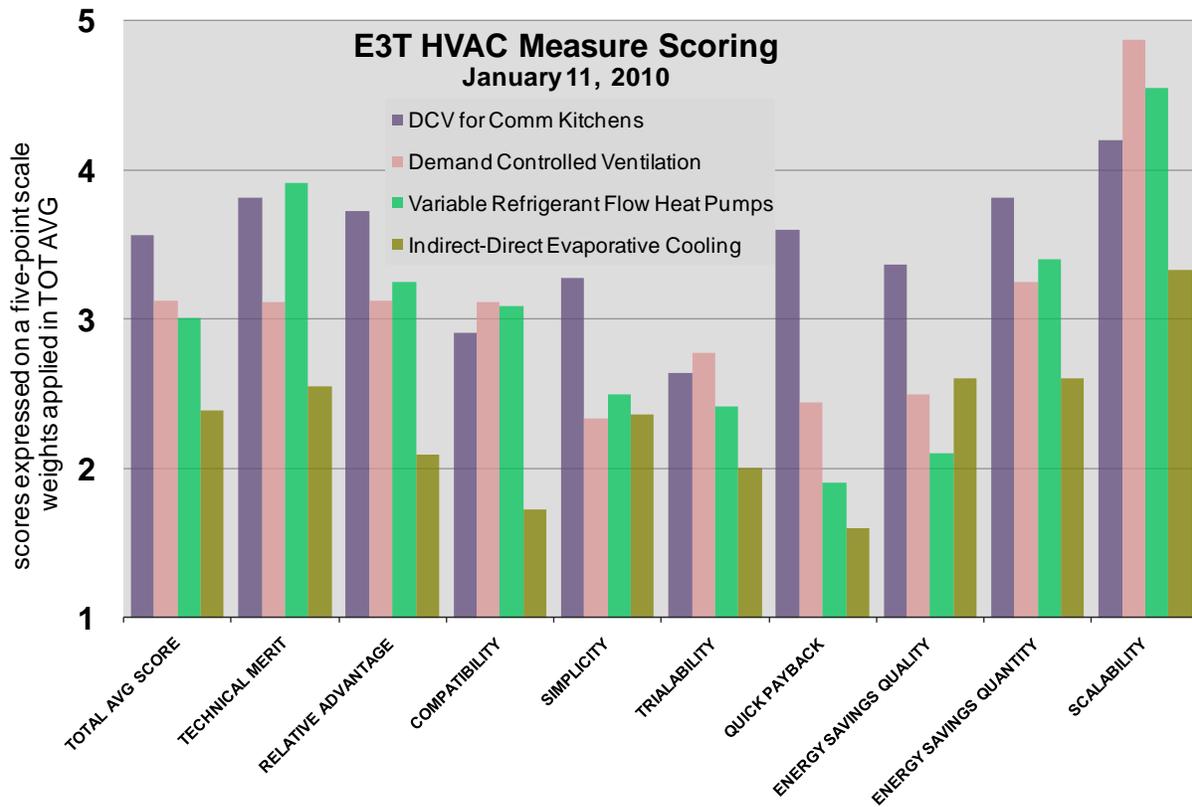


Figure 2. Scoring Detail and Rankings

	DCV for Comm Kitchens	Demand Controlled Ventilation	Variable Refrigerant Flow Heat Pumps	Indirect-Direct Evaporative Cooling	
SCORES	WEIGHTED AVG	3.56	3.12	3.01	2.38
	TECHNICAL MERIT	3.8	3.1	3.9	2.5
	RELATIVE ADVANTAGE	3.7	3.1	3.3	2.1
	COMPATIBILITY	2.9	3.1	3.1	1.7
	SIMPLICITY	3.3	2.3	2.5	2.4
	TRIALABILITY	2.6	2.8	2.4	2.0
	QUICK PAYBACK	3.6	2.4	1.9	1.6
	ENERGY SAVINGS QUALITY	3.4	2.5	2.1	2.6
	ENERGY SAVINGS QUANTITY	3.8	3.3	3.4	2.6
	SCALABILITY	4.2	4.9	4.5	3.3
<i>legend</i>	weight = 1x	weight = 2x			

scores are all expressed on a five-point scale; weights applied in TOT AVG

	DCV for Comm Kitchens	Demand Controlled Ventilation	Variable Refrigerant Flow Heat Pumps	Indirect-Direct Evaporative Cooling	
RANKS	OVERALL	1	2	3	4
	TECHNICAL MERIT	2	3	1	4
	RELATIVE ADVANTAGE	1	3	2	4
	COMPATIBILITY	3	1	2	4
	SIMPLICITY	1	4	2	3
	TRIALABILITY	2	1	3	4
	QUICK PAYBACK	1	2	3	4
	ENERGY SAVINGS QUALITY	1	3	4	2
	ENERGY SAVINGS QUANTITY	1	3	2	4
	SCALABILITY	3	1	2	4
<i>legend</i>	1st place	2nd place	3rd place	other	

Confirmation Meeting

Based on the scoring and comments received during the scoring session, recommendations for next steps for each of the four measures were drafted by E3T staff and distributed to TAG members for review.

On February 12, 2010, a 90 minute meeting via conference call and online webinar was convened to confirm those recommendations. Those present for the confirmation call are listed in the table below.

HVAC Technical Advisory Group

February 12, 2010 Confirmation Meeting Participants and Guests

NAME	ORGANIZATION	LOCATION
Carrie Nelson	BPA Planning & Evaluation	Portland, OR
Charlie Grist	Northwest Power Planning Council	Portland, OR
David Springer	Davis Energy Group	Davis, CA
Jared Sheeks	MacDonald Miller Engineers	Seattle, WA
Jack Callahan	BPA Energy Efficiency	Portland, OR
Jack Zeiger*	WSU Extension Energy Program	Olympia, WA
Mark Firestone	PAE Consulting Engineers	Portland, OR
Mark Rehley	Northwest Energy Efficiency Alliance	Portland, OR
Mira Vowles	BPA Energy Efficiency	Portland, OR
Rob Penney**	WSU Extension Energy Program	Olympia, WA
Robert Carver	NYSERDA	Troy, NY

* served as facilitator

**served as recorder

The confirmation meeting afforded an opportunity for TAG members to review consolidated scores for the measures and to offer input on narratives describing the next steps recommended for the measures currently under consideration. Based on that input, the recommendations on the following two pages were developed for the four measures.

Changes were made to the scoring system between the scoring and confirmation sessions. The key changes were to allow all scores to be expressed on a five point scale, regardless of their weighting, and to eliminate the results and effects on total scores of a survey question regarding demand savings. These changes did not affect the rankings, except to slightly widen the difference between the second and third place measures, which previously had total average scores separated by only a few hundredths of a point.

Interest was expressed by TAG members on a better understanding of their role in next steps for these measures following the submission of these recommendations to Bonneville Power Administration staff. E3T staff members were asked to determine how to keep TAG members informed of the measures' progress through the overall E3T process.

The E3T Framework (see page 1) details decision points, known as Stage Gates. The first two Stage Gates occur during the TAG process. Five subsequent Stage Gates depend upon scoring, analysis, and approval by Bonneville Power Administration Energy Efficiency staff, E3T staff, and the Regional Technical Forum of the Northwest Power and Conservation Council. E3T staff will develop protocol to keep interested TAG members apprised of post-TAG measure progress, including notification of when measures pass or fail to pass through Stage Gates.

E3T HVAC TAG Recommendations

February 2010

These are recommendations for measures presented and scored at the scoring session January 11, which were confirmed and discussed further during the Measure Recommendations confirmation call of the E3T HVAC TAG, held February 12, 2010.

Demand Controlled Ventilation for Commercial Kitchens	Overall Score: 3.56
Recommendations: <ul style="list-style-type: none">• Do a cost-effectiveness analysis to make sure this makes sense for the Northwest.• Fast Track this measure to get it into programs as quickly as practical using available data.• Consider developing a savings calculator, or verify that the manufacturer’s calculator is accurate for determining estimated savings.• Consider developing specifications to encourage additional manufacturers• Differentiate between new construction (pushing for education and changes in standards and codes) and retrofit (focusing on incentives).	

Demand Controlled Ventilation	Overall Score: 3.12
Recommendations: <ul style="list-style-type: none">• Do a thorough literature search and network with HVAC experts to determine if applications are well-established and cost-effective with accurate measurements of energy savings.• Do some random field checking to see how frequently these systems are operating as designed and working well for the occupants.• If some likely applications are not well established, consider doing a field test to quantify savings.• Determine, through secondary research and field testing, which applications show the most promise.• If not already available, consider publishing an applications and best practices guide. Remaining questions: <ul style="list-style-type: none">• Are CO₂ sensors being maintained and recalibrated on a regular basis? How often are sensors not working correctly? How big of a problem is this?• Is periodic commissioning being done to ensure the systems are operating correctly? How much does the cost of periodic commissioning affect cost-effectiveness calculations?	

E3T HVAC TAG Recommendations

February 2010

Variable Refrigerant Flow Heat Pumps (Multi-Split)	Overall Score: 3.01
<p>Recommendations:</p> <ul style="list-style-type: none">• Interview people in the Northwest who have used this technology to get a sense of what their experience has been and to find out what issues or concerns there may be. Consider writing up a few case studies.• Develop guidelines for demonstration projects.• Identify the best baseline/alternative for determination of energy savings.• Concentrate on commercial applications• Perform field tests in different sizes and types of commercial buildings in the various climate zones in the Northwest, comparing energy use, operations and maintenance costs, and user satisfaction to that of the best baseline technologies.• Examine shortcomings of whole-building simulations.• Develop a specification for mitigating safety issues, monitoring and verification protocol, design guidelines, and commissioning guidelines.• Develop applications guidelines based on what we learn from field tests.• Consider partnering with Will Price at the Eugene Water and Electric Board (EWEB), since he has done some preliminary testing. He would like to help on an advisory committee, and would be happy to look for opportunities for co-funding. <p>Remaining questions:</p> <ul style="list-style-type: none">• In which building and business types is this measure most effective? By how much? Is it always the most efficient?• How do we best deal with excess refrigerant in occupied spaces?• Are there any more field tests in the Northwest besides EWEB?• Do other brands besides Daikin have integrated energy monitoring? How accurate is the integrated monitoring (currently being investigated by EWEB)?	

Indirect-Direct Evaporative Cooler	Overall Score: 2.38
<p>Recommendations:</p> <ul style="list-style-type: none">• Hold off on moving forward with this measure. <p>Previous Recommendations:</p> <ul style="list-style-type: none">• Do a serious engineering analysis of the viability of this measure in different areas west of the mountains. Find and do a case study on existing installations in this climate zone (such as McNeil Island) to confirm the measure's effectiveness and how well it is perceived by occupants.• Otherwise, put this measure on hold for now. Watch what is happening in California. If they have successes down there, and costs come down, then consider it again in the future. <p>Remaining questions:</p> <ul style="list-style-type: none">• Is this measure cost-effective in the Northwest?	