Thank you TAG members

Bill Livingood, NREL
Bruce Baccei, SMUD
Cindy Regnier, LBNL
Cindy Strecker, CleaResult
Eric Miller, Benton Rural Electric
Greg Douglass, Sky Heating
Harvey Sachs, ACEEE
Jackie Goss, Energy Trust of Oregon
Jared Sheeks, MacDonald-Miller
Jennifer Anziano, NW Power Council
Jerine Ahmed, So. Cal. Edison
Jerry Austin, Johnson Air Products
John LeCompte, Seattle City Light
Jonathan Heller, Ecotope

Karl Johnson, CIEE
Louis Starr, NEEA
Marcia Karr, WSU Energy Program
Mark Madero, Western Cooling Efficiency Center
Mary Horsey, E Source
Pete Kramer, Trane
Reid Hart, PNNL
Rob Heeb, Oregon Trail Electric
Ron Domitrovic, EPRI
Sinh Tran, Snohomish PUD
Srinivas Katipamula, PNNL
Tom Reddoch, EPRI
Thank you TAG members

E3T Energy Efficiency Emerging Technologies
E3T 2015 Commercial-Sector HVAC TAG

BPA E3T Commercial HVAC Emerging Technology Technical Advisory Group

March 10, 2015 Meeting
Thank you TAG members

Bill Livingood, NREL
Bruce Baccei, SMUD
Cindy Regnier, LBNL
Cindy Strecker, CleaResult
Eric Miller, Benton Rural Electric
Greg Douglass, Sky Heating
Harvey Sachs, ACEEE
Jackie Goss, Energy Trust of Oregon
Jared Sheeks, MacDonald-Miller
Jennifer Anziano, NW Power Council
Jerine Ahmed, So. Cal. Edison
Jerry Austin, Johnson Air Products
John LeCompte, Seattle City Light
Jonathan Heller, Ecotope

Karl Johnson, CIEE
Kramer Peterson, Trane
Louis Starr, NEEA
Marcia Karr, WSU Energy Program
Mark Madero, Western Cooling Efficiency Center
Mary Horsey, E Source
Reid Hart, PNNL
Rob Heeb, Oregon Trail Electric
Ron Domitrovic, EPRI
Sinh Tran, Snohomish PUD
Srinivas Katipamula, PNNL
Tom Reddoch, EPRI
GoToWebinar Logistics

• Please use your Telephone, not the Mic & Speakers! Remember to enter the PIN number!
• Minimize or maximize control panel
• Phone lines are muted
• Please use question field to ask questions during Q & A or if you have any technical issues
## Meeting Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Item</th>
<th>Presenter(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:10</td>
<td>Welcome</td>
<td>Rob Penney</td>
</tr>
<tr>
<td>9:15</td>
<td>Agenda review, logistics</td>
<td>Karen Janowitz and Rob</td>
</tr>
<tr>
<td>9:20</td>
<td>Meeting goals</td>
<td>Karen</td>
</tr>
<tr>
<td>9:25</td>
<td>TAG process &amp; schedule</td>
<td>Karen</td>
</tr>
<tr>
<td>9:35</td>
<td>Value of TAGs in E3T process</td>
<td>Keshmira McVey</td>
</tr>
<tr>
<td>9:45</td>
<td>BPA EE Commercial Sector overview</td>
<td>Erik Boyer</td>
</tr>
<tr>
<td>9:55</td>
<td>TAG scope</td>
<td>Rob Penney</td>
</tr>
<tr>
<td>10:10</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>10:20</td>
<td>Technologies discussion</td>
<td>Rob Penney</td>
</tr>
<tr>
<td>11:50</td>
<td>Rating process and instructions</td>
<td>Karen</td>
</tr>
<tr>
<td>11:55</td>
<td>Wrap-up</td>
<td>Karen and Rob</td>
</tr>
</tbody>
</table>
Today’s Meeting Goals

• Understand TAG process, and its significance within the E3T framework
• Review schedule
• Discuss technologies & strategies (ETs)
• Add ETs not on list, if appropriate
• Begin the rating process
Overview of TAG Process

1. Initial Meeting
   - Brainstorming and Discussion about ETs

2. Showcase Webinar
   - Transfer knowledge
   - Rate/Prioritize

3. Score the ETs
   - Screen/Recommend

4. Meeting to Review Scoring Results
   - Final TAG Review

E3T
Energy Efficiency
Emerging Technologies
## 2015 HVAC TAG Members Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 10</td>
<td>Initial meeting (that’s today!)</td>
</tr>
<tr>
<td>March 16</td>
<td>Rating survey sent to you</td>
</tr>
<tr>
<td>March 18</td>
<td><em>Rating surveys due</em></td>
</tr>
<tr>
<td>April 2</td>
<td>Showcase Webinar Presentations #1</td>
</tr>
<tr>
<td>April 3</td>
<td><em>Presentation #1 scoring surveys due</em></td>
</tr>
<tr>
<td>April 8</td>
<td>Showcase Webinar Presentations #2</td>
</tr>
<tr>
<td>April 9</td>
<td><em>Presentation #2 scoring surveys due</em></td>
</tr>
<tr>
<td>April 14</td>
<td>Final meeting and scoring result discussion</td>
</tr>
</tbody>
</table>
Introduction
Commercial HVAC TAG

Technical Advisory Group
March 10, 2015
TAGS - BPA’s Secret Weapon

- Help scan the environment for up and coming technologies
- Use expertise to prioritize the most promising technologies, best practices or protocols
- Identify research questions for further assessment
- Provide guidance on how to best implement recommendations into utility programs
# History of E3T TAGs

* 2009 HVAC  
  2009 Lighting  
* 2010 HVAC  
* 2011 Energy Management  
  2012 LED Lighting  
  2012 FLASHTAG Smart Residential Thermostats  
  2013 Lighting Controls  
* 2013 IT Data Centers  
* 2014 Commercial High Performance Buildings  
  2014 Residential High Performance Buildings

* Had Commercial HVAC Technology Recommendations
## 2009 - 2010 HVAC TAG Recommendations and Follow Up

<table>
<thead>
<tr>
<th>Technology</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Controlled Ventilation</td>
<td>Moved to RTU Controls and Advanced Design</td>
</tr>
<tr>
<td>Demand Controlled Ventilation for Commercial Kitchens</td>
<td>BPA Qualified Measure</td>
</tr>
<tr>
<td>Variable Refrigerant Flow Heat Pumps</td>
<td>ET Field Tests 2013 - 2014</td>
</tr>
<tr>
<td>Variable Capacity Compressors</td>
<td>VCHP Proven Measure EPRI Variable Capacity Heat Pump Technology Transfer Award</td>
</tr>
<tr>
<td>Web Based Small Commercial Thermostats</td>
<td>BPA Qualified Measures for Small Commercial and Schools</td>
</tr>
<tr>
<td>Advanced Design Rooftop HVAC Unit</td>
<td>Watching DOE Advanced RTU Challenge</td>
</tr>
<tr>
<td>Advanced Rooftop Controls</td>
<td>Work lead to ARC Verification Study Utility Grant Program for ARC – Light Fan Savings</td>
</tr>
</tbody>
</table>
About this TAG

- Focus on Commercial HVAC
- 2010 last time we looked at HVAC
- Key objectives:
  - What new technologies or improvements are happening
  - Priorities for research/programs
  - Input to shape innovative program design and delivery for future implementation
E3T’s Definition of ETs

- Commercially available
- Potential energy savings
- Has non-energy benefits
- Shows promise for cost effectiveness
- Opportunities for adoption in the NW
How do TAGs fit into the E3T Framework

Collaboration

Technical Advisory Groups

Lab & Field Tests

Measure Design

Scan

Screen

Assess

New Measure Documentation
BPA Commercial Sector Overview

Commercial market made up of many players with different:
- Characteristics – size, type of business, functions
- Budgets
- Decision chains
- Distribution channels
- Technology options

One size does not fit all when it comes to solutions or measures.
Complexity of the Market

- Higher costs for solutions
- More technology choices
- Technologies more complex – more system focused
- Multi-party decision making in design and build
- Longer sales cycle – planned retrofits

- Huge number of players
- Hard to reach
- Focused on bottom line
- Limited funds
- Limited time

- Segments with different needs
- Expensive equipment
- Retrofit until it can’t be fixed
- Complex solutions

- Larger buildings - Even more complex and expensive solutions
- Multi-decision makers

According to DOE small and medium sized businesses make up 95% of floor space and use 50% of energy for commercial buildings.
HVAC Technologies

- Tend to be part of a system or systems
- Harder to isolate savings
- EE savings may not be key driver
- Slower evolution of products and services development
- Longer market adoption
- More expensive replacement or retrofit costs
Trends in Commercial Measures

Measuring individual widgets or practices to identify savings

Deemed Measures

Custom Projects

Custom Programs

Systems Approach
Whole building
Pay for performance

Sensors and Controls

Interconnected Devices

Enabling Technologies

Wireless

Sub-metering

Monitoring Systems
BPA Commercial HVAC Programs

**Deemed Measures**
- DCV CKV
- Insulation measures

**Custom Projects**
- Streamlined Processes
- Calculators
- Tools i.e. ECAM
- Modeling

**Custom Programs**

**Challenges**
- Harder to find
- Slow Uptake
- Takes resources
- Cannot be easily replicated

Incentivizing individual widgets or practices for savings
Status Quo Just Won’t Do

- Business as usual not bringing the EE savings
- Need new solutions
- New technologies and new ways to deliver measures will be critical to long term success in Commercial Sector
Asking this TAG to Think Outside of the Box

Deliver aMWs savings to the region and incentive dollars to utilities and end users
TAG Scope

• Commercial-sector HVAC
  – Existing ETs, limited market share
• Reduce electric-resistance heat
• Retrofit
• Not in BPA utility programs
• Excluded technologies:
  – Data center
  – Residential only
ETs Brainstorm

E3T Qualifying Criteria

1. **Commercially available and new** – that is, not in common use – in the Northwest.

2. **Quantifiable and reliable electric energy savings** in the Northwest?

3. **Will it work as intended?**
Commercial-Sector HVAC
Emerging Technologies
Discussion and Brainstorm
Rating Criteria

• **Energy Savings** – How significant and reliable are the energy savings per unit?

• **Non-Energy Benefits** – How great are the non-energy advantages for the end user for adopting this technology?

• **Technology Readiness** – How ready are the product(s) and providers to scale up for widespread use in the Pacific Northwest?

• **Ease of Adoption** – How easy is it for the end user to change to the proposed technology?

• **Value** – Considering all costs and all benefits, how good of a buy is this technology for the owner?
Example of Rating Survey

Domestic Water Heating from Condensing Air Conditioning Units - 8

Installation of waste heat recovery units on residential air conditioning condensing (outside) units to supplement domestic water heating.

Click here for technology info.

- 0- I do not support this technology
- 1- I support this technology with significant reservations
- 2- I mildly support this technology
- 3- I support this technology
- 4- I strongly support this technology
- 5- My support for this technology is enthusiastic and unqualified

Your comments are welcome
### 2013 IT TAG Weighted Rankings

<table>
<thead>
<tr>
<th>Title</th>
<th>Average Rating</th>
<th>Highest rating</th>
<th>Lowest rating</th>
<th># Responses</th>
<th>RANK by avg score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-Side Economizer for Data Centers *</td>
<td>4.00</td>
<td>5</td>
<td>1</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Airflow Management in Data Centers *</td>
<td>3.92</td>
<td>5</td>
<td>3</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Server Virtualization *</td>
<td>3.85</td>
<td>5</td>
<td>2</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>High-Efficiency UPS Equipment for a Data Center *</td>
<td>3.85</td>
<td>5</td>
<td>3</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Efficient Power Supplies for Electronic Devices</td>
<td>3.62</td>
<td>5</td>
<td>2</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Premium HVAC Equipment</td>
<td>3.54</td>
<td>5</td>
<td>1</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Ongoing Commissioning of Economizers in a Data Center *</td>
<td>3.38</td>
<td>5</td>
<td>2</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Storage Area Network (SAN) and Network Core Consolidation *</td>
<td>3.36</td>
<td>5</td>
<td>2</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Power Management for IT Equipment *</td>
<td>3.33</td>
<td>5</td>
<td>1</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Solid State Drives (Flash Memory) *</td>
<td>3.23</td>
<td>5</td>
<td>1</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Optimizing Data Center Controls</td>
<td>3.18</td>
<td>5</td>
<td>1</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Direct Server Cabinet Cooling *</td>
<td>2.15</td>
<td>4</td>
<td>2</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>
E3TNW.org

Emerging Technologies Database:

A collection of energy efficiency emerging technologies submitted and scanned by energy experts and engineers, the technologies consist of basic and detailed level information that highlights commercially available electricity saving technologies. You may submit new technologies, use the search and browse features in the above menu, or see the complete list of technologies.

Featured Emerging Technologies

- Lighting Technologies (by Energy System)
- Energy Management Technologies (by Focus Area)
- Residential Technologies (by Sector)
Communications

• Listserv: tag-hvac@listserv.energy.wsu.edu

• Technical Lead: Rob Penney, penneyr@energy.wsu.edu, 360-956-2053

• Communications Lead: Karen Janowitz, janowitzk@energy.wsu.edu, 360-956-2096

• http://E3TNW.org

• The HVAC TAG Portal http://e3tnw.org/TAGPortal/2015HVACCommercialTAG.aspx
HVAC TAG Roles

BPA E3T Steering Committee
- Erik Boyer
- John Wilson
- Janice Peterson
- Mira Vowles
- Chris Wolgamot
- James Anthony

Other BPA E3T Staff
- Keshmira McVey
- Debra Bristow
- Tyler Dillavou
- Jack Callahan
- Bonnie Watson

WSU E3T Staff
- Rob Penney
- Karen Janowitz
- Karen Messmer
- Jennifer Carter
- Lisa Terefenko
- Nels Christianson
Next Steps

• Rating survey sent to you March 16
• Rating survey due back to use March 18

• Discuss ETs with each other -
  tag-hvac@listserv.energy.wsu.edu
THANK YOU!
We so appreciate your participation!