Highlights from the E3T 2014 High Performance Commercial Buildings Technical Advisory Group (ComTAG)

Introduction

The E3T High Performance Commercial Buildings TAG first convened February 27, 2014 with a final meeting on April 29, 2014. Between these dates, TAG members identified potential emerging technologies, rated them, and selected a handful for further research and scoring. Presentations were given on the selected technologies at webinars on April 16 and April 24. The process, participants, documents, and webinars are posted on the E3TNW TAG portal – http://e3tnw.org/TAGPortal/2014CommercialBldgTAG.aspx.

Commercial Buildings TAG Focus

By focusing on various aspects of commercial buildings, this TAG differed from previous TAGs that were all on either a specific energy system (HVAC and lighting) or a narrow end use (data centers). If covered in its entirety, this focus would encompass the great majority of all technologies in the E3TNW database. It would also overlap with other TAGs convened in recent years. Therefore, it was narrowed in several aspects listed below while maintaining some flexibility so as not to inordinately constrain discussions, such as including more strategies that will likely be useful to BPA. Narrowing aspects included:

- Minimizing coverage of technologies covered by recent (HVAC, lighting, and IT) TAGs to avoid cost-ineffective repetition of work
- Targeting deep retrofits of small- and medium-sized buildings, with less emphasis on large buildings and new construction, to better meet the current needs of BPA Programs
- Including topics relevant to high-performance buildings that have already implemented measures on the largest energy systems (HVAC and lighting), such as building envelope, daylighting, plug load, and strategies that can complement technologies.

TAG Membership

The 28 members of the TAG included an outstanding collection of senior-level decision makers from top regional and national research organizations working on new and emerging energy efficiency technologies. Participation was voluntary, and yet contributions from these nationally-recognized experts was outstanding.

Organizations represented by ComTAG members included:

American Council for an Energy Efficient Economy
BC Hydro
California Institute for Energy and Environment
California Lighting Technology Center
E Source
Ecova
Electric Power Research Institute
Lawrence Berkeley National Laboratory
McDonough Innovation
McKinstry
National Renewable Energy Laboratory
New Buildings Institute
Northwest Energy Efficiency Alliance
NY State Energy Research and Development Authority
Oregon BEST
Pacific Northwest National Laboratory

PECI
Sacramento Municipal Utility District
Seattle City Light
Seattle Integrated Design Lab
Sera Architects
Southern California Edison
Southface Energy Institute
University of Oregon

TAG Steering Committee

For the first time with a TAG, BPA provided a steering committee comprised of one staff member from BPA Programs, two from the E3T team, and two from PEJD Engineering Services. This steering committee was set up to help guide the TAG process so that end results would advance the plans and needs of BPA Programs staff, who will then hopefully be able to move some of selected technologies into utility conservation programs. The steering committee reviewed the TAG plan, nominated prospective TAG members, and selected the technologies to be researched further and scored. The steering committee brought participation of key stakeholders at BPA to a new level. The committee included Allison Robbins Mace, Commercial and Federal Programs Lead for Programs at BPA headquarters, two engineers with very relevant skills and interests, Erik Boyer and Robert Weber, as well as two representatives from BPA's E3T team, Debra Bristow and Janice Peterson, who acted as steering committee lead. The three most relevant groups within BPA and three of the BPA offices were well represented on the committee and provided valuable support.

TAG Process and Results

The ComTAG members brainstormed, discussed, and rated 45 technologies and strategies. The steering committee then selected six technologies from among the 18 highest-rated technologies as well as the highest rated strategy. Notable among these was mechanical ventilation for nighttime cooling. This was not actually a technology rated by the ComTAG, however it is similar to natural ventilation for cooling (which was rated), and the steering committee wanted to include it anyway. The selected technologies were:

- Natural ventilation for nighttime cooling
- Mechanical ventilation for nighttime cooling
- Interior storm windows
- Daylight redirecting film
- Intelligent outlets
- High performance elevators
- Integrated design strategies

The steering committee decided to save integrated design strategies for a future discussion. Allison Robbins Mace suggested that the Commercial New Construction group would be an appropriate forum for that discussion. Since then, plans were made to convene that group at the WSU Energy Program offices in Olympia and include integrated design strategies in the agenda.

ComTAG volunteers were enlisted to make presentations on the six technologies selected. Two of these developed presentations that were not exactly on the topic assigned, as described in the E3TNW database. As it turns out, however, both presentations contributed real value to the TAG results. The presentation on intelligent outlets focused on smart power strips, and provided useful information on advances in this closely related technology. The presentation on interior storm windows focused on secondary glazing units, which was not in the E3TNW database (but will be

added soon). That presentation demonstrated significant positive potential for the technology. In both cases, the function of the technology presented was the same as that assigned, but the form and application was a bit different. WSU staff responded by quickly developing presentations that focused more specifically on the assigned technologies. After this meeting, ComTAG members were asked to evaluate the pairs of very similar technologies with single scores but address the two technologies separately in the comments as needed. The steering committee was consulted on these decisions.

All six of the technologies received a high enough score to reflect strong enough support to be included in recommendations to BPA. These technologies were as follows, including their scores (highest possible score is 5), a highlight of their key features, and a summary of TAG member comments:

- **Interior Storm Windows, score 3.5-**: The presentation by the TAG member focused on secondary glazing units, while WSU staff discussed acrylic interior storm windows. These were scored high because they can double the insulation value of single-pane windows, reduce infiltration from leaky windows considerably, and provide some solar control while costing only about half that of window replacement and having significantly less impact on occupants during installation. The non-energy benefits of improved comfort as well as reduced glare and noise from outside makes them more likely be adopted. Unlike complex control systems, the performance of these can be more easily predicted, and the number of single-pane, leaky windows in the region that could benefit from these technologies is enormous. However, these currently have quite a low penetration rate in the region. The general consensus was that the acrylic interior storm windows are best applied in residential applications while the secondary glazing units are more appropriate for commercial sector applications – TAG comments on which was preferred were mixed.
- **Mechanical Ventilation for Nighttime Cooling, score 3.5**: Expanding the operation of existing air-side economizers to provide "free" nighttime cooling to commercial spaces rather than letting them naturally rise during the night was seen as a useful technology. It is a technology rather than a strategy in that a modification of the economizer's control system is needed to achieve this. It is most cost-effectively applied in climates with large diurnal temperature swings, in buildings with sufficient exposed thermal mass, and on economizers with advanced control systems that can be modified rather than replaced. Given how ubiquitous economizers have become in the region yet how the adoption rate of nighttime cooling is small, this technology was seen as having value in appropriate applicationsand with the same commissioning recommended (and too often not provided) for all economizer applications. Some utility technical support may be needed to help users with implementation.
- **High Performance Elevators, score 3.5**: Elevators are provided in most all multi-story commercial buildings, but the technical potential is not so large because they last for many years and it generally isn't cost-effective to replace them prior to failure. This technology is therefore mostly appropriate for new construction, and most cost-effective in low-rise buildings, where the incumbent technology is less efficient. The non-energy benefits of improvements in speed and dispatch efficiency bode well for adoption, as long as the user interface is intuitive. Energy savings are significant, although a small percentage of overall building energy use, and little utility technical support would likely be needed.
- **Intelligent Outlets, score 3.2**: The original presentation focused on smart power strips, while WSU staff presented on intelligent outlets. It was recognized that plug load management becomes increasingly important as commercial buildings achieve ultra-low energy use by modifications of building envelope, HVAC, and lighting. Intelligent outlets and smart power strips can be used to achieve this. The ComTAG presentations and discussion clarified that selection of appropriate plug

loads is essential to the successful application of these technologies, which studies show can be easily misapplied. Poor application will not only generate few savings, they may also generate great frustration among occupants. Furthermore, these technologies are identified as "transition technologies" to be used while various plug loads gain the capability to manage their energy use more effectively without such external control, but that status of the evolution of these internal controls is seen as early enough to warrant these external controls. Cost effectiveness also reflects the habits of occupants; if they are already thrifty in their use of plug loads, potential savings will be lower. Once plug load selection and operation are analyzed and improved, the need for ongoing management will likely be less and may not be worth continued subscription to a monitoring service. However, the TAG found them of value and it may be useful to modify BPA's current deemed measure for smart power strips, which are currently identified as stand-alone "master-slave" varieties, to include these technologies, which are individually programmable and report wirelessly to a central location. This reporting capability will make verification of savings simple. Identifying and sharing lessons learned on the all-important selection of appropriate plug loads for management may be a useful service of utilities.

- **Natural Ventilation for Nighttime Cooling, score 3.2**: As with mechanical nighttime ventilation cooling, natural ventilation requires large diurnal temperature swings and significant exposed building thermal mass, yet it requires even more of both. It also requires a lack of external noise and allergens and a building specifically and carefully designed for this purpose. Therefore, applications are more limited to new construction in warmer, drier areas and the regional energy savings will most likely be smaller. Additionally, even more utility technical support may be needed to help end use customers implement this due to the nuances of effective building design that can achieve sufficient natural ventilation flow, maintain the insulation levels and air tightness of the building envelope, and avoid potential pitfalls of security breaches and rain intrusion. Effective designs require expertise that needs to be developed and spread in the region and are more customized and harder to replicate. However, if applied well enough to downsize or even eliminate the need for HVAC, this technology can be cost-effective. When done well, this technology may be well received by building occupants, who are happy to assist in manually operating windows in return for fresh, cool air in the mornings and more control over their work environment.
- **Daylight Redirecting Films, score 2.9**: These films have been documented to significantly improve the penetration of daylighting into commercial spaces better than light shelves, and most occupants appreciate natural daylight without glare. However, successful applications depend upon having daylight harvesting controls and dimmable ballasts already in place as well as clerestory, non-view windows more than six feet above the ground—which makes this more appropriate for new construction since most buildings lack these. It is most effective in south-facing windows, which further limits the regional technical potential. However, it seems a good candidate for inclusion in daylighting features to be considered in the future – if costs drop, it may be more cost-effective.

Next Steps

BPA's ComTAG steering committee is convening to discuss the scored technologies, with an eye toward possible future inclusion in programs as a measure. They will themselves be scoring the technologies with a set of criteria intended to help inform the decisions.

The Northwest New Construction Working Group, consisting of members of regional utility organizations will be discussing integrated design strategies.