

# E3T Energy Management TAG Recommendations

December 2011

These are recommendations for technologies presented and scored at the E3T Energy Management Technical Advisory Group (EM TAG) scoring session on November 4, 2011, which were confirmed and discussed further during the E3T 2011 EM TAG Recommendations Confirmation call on December 6, 2011.

## Advanced Rooftop Unit Controls with Remote Access and Energy Monitoring -338

Overall Score: 3.4

**Description:** Controllers to retrofit rooftop units to optimize performance and provide web-based energy monitoring and communications capabilities.

### Recommendations:

Research the features of each available model, including checking with other organizations to see what information they have on features, cost, and savings potential for each available controller. Deliver a comprehensive report summarizing secondary research as well as field tests that have been performed, calculation methods, monitoring details, and opportunities for collaboration in field testing. This should include checking with:

- Southern California Edison on the lab testing they are doing on Catalyst and Digi-RTU (Paul Delaney)
  - Snohomish County PUD (Alan Budman)
  - BC Hydro (Irfan Rehmanji)
  - PECI (Reid Hart)
  - NBI (Dan Harris)
  - Omaha Public Power District (Peter Criscione at E Source)
  - TES Engineering (Peter Criscione at E Source)
  - RTF RTUG Working Group, working on standard protocol for savings verification for RTU retrofits (Mark Kendall)
  - Minnesota Energy Center (Reid Hart at PECI)
  - Pacific Northwest National Lab/Catalyst, to be completed by end of January (Srinivas Katipamula)
2. Perform an engineering analysis to determine the climate and applications in which these controllers are most effective, and quantify their relative effectiveness in various conditions. Quantify gas savings separate from electrical savings. Start by:
- Reviewing PNNL's report that was due 12/31/11, which may satisfy this task.
  - Reviewing the report to BPA by Reid Hart on expected values approach for premium ventilation packages in the Northwest. This report, available on the BPA website, addresses what parameters are most likely to deliver effective savings. Reid Hart developed a site-based calculator, which will be available later.

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- Look at RTU servicing pilots that BPA did in 2009 and 2010 and include useful data on RTU baseline energy use that will be included in the final report due 12/31/11.
- 3. If needed, based on research about what testing has been done (see #1 above, particularly RTUG and PNNL), establish a field testing protocol to compare products and to determine the accuracy of energy monitoring, and evaluate the performance of the controllers.
- 4. Consider using engineering calculations to enhance analysis of this technology for addition of specific hardware, such as VSD and integrated economizers. Monitor and evaluate use of this technology to reduce malfunctions and sub-optimal performance.
- 5. Develop a program specification for utility incentives, preferably one that is performance-based rather than prescriptive or features-based.
- 6. If needed, based on research about what pilot studies have been performed (see #1 above), design and implement additional pilot studies. Include training for utilities and contractors on reporting for pilot projects.
- 7. Work on getting this technology provisionally approved by RTF so BPA can initiate a pilot program while continuing to perform field tests to improve the accuracy of results.
- 8. Provide training to installers and contractors to make sure there is adequate infrastructure to ramp up.

### **Product Availability:**

1. Catalyst
2. Digi-RTU
3. Enerfit
4. Optimum Energy's new (unavailable) controller

### **Lower Cost Options:**

- Innotech
- FDSI – provides links for remote data collection
- Pulse – monitoring system add-ons

### **Comments:**

- PNNL's report, for climate zone for Seattle only and four building types—all under 50,000 sf. Next year they'll expand the parameters to include more indoor temperature settings and VSD compressors.
- Jack Callahan: He expects a wide range of savings, and feels that M&V is pretty costly.

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- Irfan Rehmanji: BC Hydro has a pilot at a mall with 26 units, and he agrees with using performance-based spec but also agrees that there is a high degree of variability of savings. Perhaps the spec could use different levels of savings for different building types
- Phoebe Warren: She'd like the specs and application guide to demystify the products where possible.
- Jack Callahan: A product selection and application guide would be nice but not critical; products come and go, so focus on underlying features.
- Jack Callahan: The RTF usually looks for unit energy savings, but the savings for this are too variable. It would probably need to be a standard protocol. Provisional deeming approval would help us get more and better field data.
- Jennifer Williamson: Reid had noted the importance of good installations to get savings.
- Irfan Rehmanji: Each technology involved requires nuances of training; how do we get a handle on that?
- Mark Cherniak: NEEA's work on heat pump trainings might be a good model for this.

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## Low-Cost Energy Management and Control System for Small to Medium Commercial Buildings-347

Overall Score: 3.0

**Description:** Affordable and cost-effective energy management controls and monitoring solutions for small- to medium-sized commercial buildings.

### Recommendations:

1. Develop a list of requirements for controls systems with reliable control and monitoring capability that are affordable and cost-effective for application in multi-zone small- to medium-sized commercial buildings. If necessary, provide different requirements for different types and sizes of buildings.
2. Perform secondary research to explore previous work in this area. This should include contacting:
  - o SMUD; they have done some work in this area.
  - o Frank Brown with BPA in Seattle to learn about the Ecofys study of Cypress wireless pneumatic thermostats, bundled with Green Box controller (contact).
3. Identify packaged systems or components that meet the requirements above, including a survey of major controls manufacturers.
4. If we find only components that meet our requirements, develop cost-effective packaged solution(s).
5. To help establish what the target costs of the systems should be, including O&M costs, do a simulation analysis to estimate savings potential for several applications. Include a survey of customer's range of acceptable payback, possibly through ETO's project (Jack Callahan: 2-3 years for most small to medium businesses). Provide target costs for several energy rates.
6. If we do not find any products that meet our requirements, develop a specification and challenge controls manufacturers to meet it as part of a "Controls Challenge."
7. Based on the research above, develop a plan for field testing to determine the performance of the controls and monitoring solutions.
8. If the field tests results indicate cost-effective performance, develop a utility program specification and encourage utilities to provide incentives to building owners who install the packaged solutions.
9. Explore other ways of encouraging building owners to install the systems. For example, provide an energy label that would be recognizable enough in the market to increase rental rates and real estate value.
10. Launch an awareness campaign to educate potential customers, possibly through contractors and service providers, about the benefits of using centralized building controls in the target market.

### Product Availability:

The following is a list of manufacturers that may provide relevant products or solutions:

1. Johnson Controls
2. NEST Labs
3. Kite and Lightning

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4. Parker
5. Trane
6. E2 America
7. Site Controls (bought out by Siemens, focusing on convenience stores, turnkey solutions)
8. Ecobee Advanced Wireless thermostat, for baseboard heaters
9. WEMS (Wireless Energy Management Systems), from UK, for HVAC/lighting controls, claims to be affordable and non-intrusive ([www.wems.co.uk](http://www.wems.co.uk))
10. Honeywell (spider with Tridium interface)?
11. E2 America
12. Site Controls, by Siemens, focusing on convenience stores with turnkey solutions

### Comments:

- Should this also include fault diagnosis, or would that add too much cost?
- Dave Bisbee: SMUD has mostly looked at food and liquor stores, not office buildings and larger buildings.
- Nick O'Neil: ETO is working with Kite products, and will have data by first quarter next year.
- Jack Callahan: The measurement protocol would be at a whole building level. This needs to be a whole buildings solution to get enough savings.
- Jack Callahan: An example of a program specification is the EE Grocer program, which has a list of protocols for selling savings to customers and counting savings, and all this is wrapped up in a program specification. This is typically done by a third party, such as PECI did for EE Grocer. Include what needs to be done at each site with pre-defined measures and solutions.
- Irfan Rehmanji: BC Hydro has trouble reaching small/medium-sized business owners directly, so they reach to contractors and service providers that reach out to appropriate owners.

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## Building Energy Performance Analytics Software and Services -353

Overall Score: 2.4

**Description:** Software packages and services that analyze energy and performance data for fault diagnostics as well as optimizing system performance in large commercial buildings. Some also establish a baseline and calculate savings based on the baseline.

### Recommendations:

1. Perform a literature search to determine what characteristics of the systems are most useful. Include an investigation of commercial programs at Southern California Edison and BC Hydro and look for models establishing standards that could be useful.
2. If the literature search indicates the technology has strong potential for reliable energy savings, perform a survey of facility managers and technicians in buildings where these analytical systems are being used. Find out which systems are working best, determine which features of the analytics systems are most helpful for fault diagnostics and system optimization, and find out how to use them most effectively.
3. Use the results from the survey to design an M&V approach that would estimate the effectiveness of the features with greater accuracy.
4. Design and perform a field test on several buildings to establish savings and cost-effectiveness. Determine if some low-cost systems can provide most of the savings. Might these be more cost-effective solutions than the high-end packages?
5. Develop training programs and an applications guide to help users in the proper selection and effective use of the analytics packages. Develop motivational techniques to encourage effective and persistent use.
6. If the findings from the literature search, survey, and field tests indicate cost-effective energy-saving performance, develop and publish a utility program guide that includes application and design guidelines and incentive criteria.

### Comments:

- Jack Callahan: This technology can be challenging to clarify and specify.
- Jay Stein: Lower cost products use only utility data and use algorithms to disaggregate data into end uses. This eliminates the cost and hassle of hooking up all the end use metering. But very little of previous field testing measures the real potential of this technology. BC Hydro's done about as much as anyone, and they're not finding much.
- Jack Callahan: What other utilities are looking at that? Graham Hender is the Continuous Optimization program manager who would know.
- Jay Stein: The most useful tool for BPA would be a matrix showing the features of different products.

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## Innovative Behavior Change Techniques-328

Overall Score: 2.2

**Description:** Techniques to educate and motivate the target audience (end users, energy managers, designers, purchasers, and facility managers) to change their behavior and decision-making strategies in order to achieve greater energy savings.

### Recommendations:

1. Because of the complexities, ambiguities, and challenges in predicting and measuring savings, this may not fit well into traditional BPA programs. Explore handing this off to NEEA or investigating through other BPA programs.
2. If BPA decides to move forward with this, clarify the components and strategies of an effective behavior-changing initiative. Consider using ideas about successful behavioral change from other disciplines, such as pollution prevention.
3. Investigate programs that have a strong behavior component, including BC Hydro, Conservation Catalysts (Don Rainey's company), the Energy Trust of Oregon (in participation with BPA, using Strategic Energy Management, formally part of Invensis), Honeywell's Behavioral Change program, Puget Sound Energy, Snohomish County PUD, O Power, Energy Savvy, Saine Engineering, and NEEA's hospital program to see what we can learn from them.
4. If the investigation above indicates a strong potential for significant and measurable energy savings, develop a guidebook of effective behavioral change strategies with summaries of case studies.
5. Develop a protocol for measuring the success of the program in order to provide a means for calculating incentives.
  - o Clarify the energy savings impacts of behavior changes by defining how to account the impact of variable parameters such as occupancy or tenancy rates, weather, production rates, and other energy efficiency efforts such as capital improvements.
  - o Explore the energy accounting software used by resource conservation managers (RCMs) in school districts to see if this could be used to help measure energy savings separate from the impacts of the variables mentioned above.
6. Set up a program of workshops and on-going support to the target audience in achieving effective behavioral changes. Make sure the components of this program are facilitated by people with good technical, communication and motivational skills.

### Comments:

- Don Rainey: It may be worth risking \$50,000 to potentially launch a program that may save millions of dollars. Focus on RCMs, energy managers, and others responsible for managing high energy use; that should at least pay back the investment. He has formal presentations on this he'd be happy to share. Honeywell's Behavioral Change program has found great benefits but they're not very

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forthcoming on the program details. They offer it as an ESCO.

- Don Rainey: Behavioral change has the potential to reduce the total costs of operation beyond energy savings.
- Alan Budman: SnoPUD has a program for schools and one for building re-commissioning that have behavioral components. They have Behavioral Challenge, where customers commit to saving 10% with feedback from SnoPUD
- Irfan Rehmanji: BC Hydro has a work-based conservation program developed with school districts that has now expanded to government facilities. Savings claims are 2-5%. They're trying to get better data to better satisfy program staff. Paul Seo is the Power Smart lead for this.
- Don Rainey: Saine Engineering has collaborative programs for Air Force bases on behavioral change that offer ongoing support, including monthly webinars and face-to-face meetings in addition to regular e-mails.

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## Non-Intrusive Load Monitoring -294

Overall Score: 2.1

**Description:** A method of disaggregating facility loads into individual components by non-intrusive methods without the need for submetering.

### Recommendations:

1. The TAG determined that this is probably not ready for prime time. Continue to monitor available products and results from other studies of this technology, particularly in the commercial sector, until this technology seems more ready for prime time. In particular, find out what results EPRI and Southern California Edison are getting from their investigations.
2. Create a list of available products, and include each product's capabilities, who is working on them, and results of studies or research.

### Comments:

- This may be most useful as a tool for utilities and BPA to reduce costs for large-scale monitoring and to study other energy efficiency measures. This could be useful for research and for behavior change.
- CalSunergy may be willing to do some pilot testing in the NW.
- Jennifer Williamson: Dave Kresta suggested that EPRI is planning research projects, but maybe not in the commercial sector. SCE has a proposal to perform investigations this. NEEA wants to do some lab testing and install some metering in homes next year.
- Jack Callahan: He's interested in this as a cheaper way to do end use monitoring. Mira Vowles is working on a field study with Intel. In addition to these recommendations, which seem appropriate for now, if they find new opportunities to help develop new products, BPA would be very interested in that—for end use load monitoring rather than behavior change.