

**January 28-29, 2015 Technical Meeting:
“Physical Characterization of Connected Buildings Equipment”
Chicago, IL**

Summary of:

**1. Commentary, Questions, Key Points, and Perspectives Shared in
the Discussion Periods Following Presentations**

2. Industry Responses to Questions Posed Prior to the Meeting

DAY 1: January 28th, 2015

Opening Remarks (Joe Hagerman – DOE BTO)

- There may be different levels of being connected. Mentioned that the ASHRAE WG 189.1 was discussing this concept at the current ASHRAE meeting .
- Are existing controls inadequate? Does “connected” need to happen? BTO referred to grid modernization document.
- Vision is that we are trying to make things better and easier to use.

Scope and Status of Ongoing Related Work (Ebony Mayhorn – PNNL)

- Others appear to have been focused entirely on residential. DR has existed for 30 years in commercial equipment but consumers don’t use it because they don’t see the value and there is no focus on consumer satisfaction.
- Commercial is doing DR - a small portion - action is centered around BMS.
- Do we need to characterize new things? I do not understand the need. We have to identify the needs.
- Value must be considered. Can drive innovation by driving cost down to be able to include features that consumers may not yet necessarily appreciate the value of. Need to consider consumer in characterization. Residential consumers are starting to ask for more capability within the last three years. Need to consider the cost to conform to this characterization. Cost needs to be connected to overall value.
- Need to focus on consumer for characterization.

- What is the new need here? We have been turning equipment off and on for 20 years. Residential is willing to be a little uncomfortable to save a few dollars; commercial consumers are not.
- From a characterization standpoint, we should frame baseline. Why not look at the equipment in the 10% of buildings that already have controls. Look for problems and gaps here first.
- How do we address the small mom and pop shops compared to big box stores?
- One “newness” is that equipment turns off and on more effectively. Not just direct load control DR. Real time pricing is coming and focus on DR may be short sighted.
- Utilities are not just focused on DR, they also want more capability to shape load.

Reference Architectures for Bounding Characterization (Ebony Mayhorn – PNNL)

- Who are the users and how do they interact?
- Equipment feedback such as two-way communication is a key; i.e. did I do what I said I would do?
- Thermostats are aggressively targeting consumers. It is important to characterize what the consumers care about, otherwise we are not characterizing anything that matters.
- Capability that routinely has to be verified, rather than having to characterize everything? Suggested that reference architectures only make sense on an equipment specific basis.
- We need to list out the needs that would necessitate reference architectures.
- There is still a need to characterize equipment even if there is a proxy in front of it.
- Have to look at proxy and equipment as separate device, each of which needs characterizing.

Viewpoints on Eligibility Requirements and Approved Response List (Scott Whalen – PNNL)

- Like the idea of an approved list. Look to LEED program. Committee composed of stakeholders gather around the table and pound out minimum baseline criteria. Rewards are given for added features.
- Consider options to test in field rather than test in lab.
- Utilities do not want to pay for testing. Utilities want someone else to confirm the ability so they can rely on it for program development.
- An approved list is not necessary. If the device does not perform a useful function then it won't be produced or sold. Let the utilities define what they need. The functionality has to cater to the market; otherwise it doesn't make sense to add it.
- Recommended CEE as entity to involve with minimum eligibility/approved list.

- Utilities do not want to verify performance. They want to know what the capabilities are and then incentivize the ones that make sense to them.
- What we need is an allowance for various degrees of sophistication. This is because different utilities work in different markets having different local issues to deal with like weather. Hard to define a couple of boxes that satisfy everyone. Not going to be one size fits all. Working toward levels of agreed upon functions is where we should head.
- Low end equipment meets minimum criteria. High end equipment is where the innovation is. No innovation is occurring at the lower end. Want liberty at high end. Characterization only needs to be done for low end because high end will include connected features of low end at a minimum.
- An ASRAC WG is the perfect way to identify minimum eligibility/approved responses.

Comments on Industry Presentations given by:

Richard Lord	United Technologies
Laura Petrillo-Groh	AHRI
Liana Kiff	Honeywell
Jedediah Bentz	Johnson Controls
Ram Narayanamurthy	EPRI

- Can't use same strategy for small versus large buildings.
- Energy is not a driver for customers. Customers are not going for the low energy solution. They are going for the automation and convenience technology.
- Proprietary interoperability issues need to be addressed. Open does not mean free.
- Need to address new equipment, not legacy equipment. We are looking forward, not backward.
- Why would the food service want refrigerator connected to building? Their livelihood at stake.
- Suggestion to simply add test capability to existing UL testing.
- Utilities cannot handle all of the data from AMI. Do not have processing capability or need from business model standpoint.
- A big challenge is monetizing efficiencies that connected equipment can provide.
- Consumers don't understand the difference between conservation and efficiency.
- Need to recognize that residential, small commercial, and large commercial are very different and have different needs. They must be treated uniquely.
- New construction is a huge missed opportunity to introduce new technology with very little incremental cost.

Industry Responses to Questions Posed Prior to the Meeting:

What can DOE help industry with?

- Challenge industry.
- IT, networking, interoperability, security. Facilitate industry communication to avoid proprietary solutions. Look at proxies and energy management systems (Honeywell).
- Help facilitate collaboration among industry.

Who else should be participating?

- More utilities. Equipment OEM's.
- Canadian and European efforts.
- BOMA.
- Service providers and installers.

What are the key challenges to market uptake?

- Diverse needs and diverse equipment. Cost. Lack of standards. Disagreement on what equipment should be characterized.
- Industries do not understand how to interface with a smart grid. Features and opportunities beyond peak load shedding are not well understood or appreciated by industry or consumers. Most research is focusing on efficiency. Big concerns over privacy and security. Incentives do not provide sufficient motivation.
- Interoperability. What would Google do to monetize opportunities?
- Users do not understand that smart things can exist outside a smart phone.
- Interoperability. Cost of installation. Data reporting.

What is the market uptake timeline?

- Driver is interest in home automation and remote connectivity. Expect to complete DR performance and communication for smart/connected variable capacity unitary HVAC in two years.
- The market is ready if the right product is produced to meet some demand (Honeywell).
- Market may be ready in some instances; with a little education.

DAY 2: January 29th, 2015

General Discussion

- Interoperability needs to be forward looking and not distracted by trying to incorporate legacy equipment.
- Consider working market segments into a maturity model.
- Perspective (lens) will be important for laying out maturity model.
- Dividing markets vertically in maturity model may show that grid services are important to one market (such as large buildings) but not to others (such as small commercial refrigeration).
- There may be more value in characterizing informational responses in the lab rather than physical responses. Consumers want technology and connectivity; not so much energy savings.

Take-away thoughts from Industry Presentations:

- Until demand is monetized by utility then penetration will be limited because incentives are limited.
- “Flexlab” at LBNL is engaged in developing standard metrics.
- Proprietary communication will trump interoperability if manufacturers think that the liability is too high.
- Needs are out there but we don’t have the right product at the right cost.
- Consumers in small commercial are not like residential or large commercial consumers.
- Take small steps to start with because that is at least tractable.
- Highest potential is to find a way to monetize knowledge rather than performance.
- Strongest drivers are the consumer desire for technology, not dollars from utilities.
- DOE value would be to bring in the environmental aspect.
- Scaling good solutions will be a challenge.
- Home automation is leading; energy (and dollar) conservation is secondary.
- Connectivity can integrate consumer preference and increased efficiency.
- We need to think more about how to engage 3rd party test labs and utilities.
- Suggestion to map to verticals and architectures.

Connected Equipment Prioritization

Industry attendees participated in a facilitated discussion with the purpose of prioritizing the order that they would like to see characterization protocols developed for connected equipment. The general consensus of the group is as follows:

Light Commercial

1. Gateway*
2. RTU
3. Lighting

Residential

1. Gateway*
2. A/C
3. Pool pump

By “Gateway” the stakeholders are referring to equipment, such as a thermostat, BEMS, HEMS, or other proxy that acts as an interface for the base equipment.