Workshop: System Integration: How ET Can Optimize Building Resources
Breakout Session: Utility Programs

Discussion Questions
- How do we baseline customers' basic needs?
- What is the best motivation method for demand response participation? Pay for performance or respond to price incentives?
- What is the best approach to get customers more responsive to dynamic rates?
- What are some ideas to make the best integration practices get to scale in support of customer flexibility and program goals?

Objectives: To create a list of priorities for utility programs for the next 3-5 years and a better understanding of early adopters' drivers. To determine what ETP can do to enable the vision of commercial Grid-interactive Efficient Buildings
Outcome: A list of challenges and opportunities.

Facilitator Summary
Most of the discussion centered on the need for utility incentives to help companies meet their CapEx ROIs/NOIs. This can be either in the form of incentives or much clearer, unchanging TOU rates and/or demand incentives. Also, utility programs need to be easy, simple, one-stop-shop/integrated whole-building, so that have lower transaction costs to participate in. Programs should address main pain point – i.e., offer more technical assistance and support to foster easier integration of various control technologies across systems. This would help develop technologies that would add flexibility to the system load and enhance their commercial uptake. DR offerings are hard to understand and evaluate as constantly change.

Discussion Notes and Comments Submitted – These are unedited draft notes.
Customers need incentives to bring project ROI at 36 months or less. Would love to add solar PV, but hard to get that ROI.

Solar installers in CA save E, but not much Demand nor shift to off-peak times. Combining solar and intelligent building controls can add demand and energy savings resulting in faster payback.

Net operating income is more important than ROI which is focused on initial outlay of capital. Usually property owner cuts the check. Thus have to explain value proposition to the decision maker.

The Center for Emerging Building Technologies is a proving ground for next generation technologies. We also evaluate them at their operating facilities.
- Check GSA.gov/gpg for info on the RFI underway. 2020 examined grid interactive buildings. Selected 4 technologies to start trials at end of 2020. Owners interested in

capturing value of the past decade of investments in smart buildings. We have put equipment across common network across several buildings. IoT and universal translators or open protocols are becoming more commonly available and time synchronized, making it easier to get all data now.

- Originally believed we would get 10% overall building energy savings and 10% in O&M savings from predictive maintenance. RMI.org evaluation found that could save another 25% of cost-effective energy savings. But there is still competition with ROI against other projects.
- Key question is: How can utility incent owner uptake? Smart building investments have been done by larger building property owners. Need large incentives to get their attention to now integrate these past investments. Hardware cost is low; the integration of the hardware is the pain point—and a recurring cost structure.

To get owners attention and buy-in, utilities have to offer incentives that improves the ROI and puts the project ahead for implementation. Many customers have addressed cheaper, low hanging fruit (lights, VFDs). We're now facing large equipment changes—e.g., new chillers that can cost $750k. Likely replacement will only occur when existing equipment's maintenance is too high to keep. Or enable multi-unit purchase to get better price from major manufacturers.

LBNL is developing load shifting HVAC to quantify the economic potential of this load shifting. It's hard to estimate given current and constantly changing DR program rates.

How can utilities incentive us? We are developing a behind the grid HVAC load shifting technology and we are struggling to get clear information from utilities about DR programs and how to apply those in our models to assess potential cost savings of load shifting. We have interviewed building owners about their interest in DR programs. Many say these programs are too complicated and change too often to take seriously.

One big barrier for us as a provider of an energy savings cooling equipment maintenance technology is the widespread lack of any utility incentives for maintenance which is "human behavior that is not likely to be repeated".

Do customers care about DR programs? Previously, energy managers focused on minimizing levelized cost of energy to make tenants life more predictable. Now energy managers need to also examine demand charges and participate in DR programs; interested in more complex options. This requires facility operators to operate in finer way or use machine learning do that. Need greater human skill, and it introduces price uncertainty in operations. Incentive has to be there to make this more complex management worthwhile. Current DR programs are too complex and changing. Nobody at GSA understands them and rely on 3P consultants as only a few, expensive markets it makes sense and good incentives exist. Doesn't seem there will be TOU pricing and new tariffs soon.

We have interviewed building owners about DR—most find them too complex and changing to take seriously. Or they have to use 3P to participate in DR but the 3P won't tell you full details to understand the full value.

What about GHG signals—dynamic pricing based on GHG reduction goals? Some UC campuses have GHG targets—how much are they willing to pay to reduce these?

We're trying to decarbonize at UC system. Internal incentives exist to do so. UCM and others use wholesale purchase via Office of President—flat rate utility. Energy charge is flat now. At UCM working w/LBNL on model predictive control program—costs for energy driven by time-demand charges. Most others will be hit w/TOU charges. If it can limit maximum peak demand it can save lots of $. Use thermal storage (Two million-gallon, chilled water tank) to reduce use of chillers during peak load hours. Experimenting w/LBNL and others—to see how much can save and use 5 MW onsite solar to further reduce peak demand for cooling.

Demand charges are the clearest signal.
- But customers agree to fixed tariffs as DR is too complicated.

Participating last 2 years on pilot program "THG". This is an excess supply program, where we receive signal 24 hrs in advance to run chillers or load during certain time frame (e.g., 10-12am to increase it by 500-700kW) and get financial incentive. Sometimes we can't comply, but we hit 1 or 2 out of 3 target events last month. Program seeks to balance the extra solar on the grid to reduce its curtailment. We have a relatively flat load due to having a central plant, where can't do part load, but do offer 500kW to 1MW. Not much ability other than temperature set point changes due to many labs/office type bldgs.

We did a large HVAC upgrade in building. Was hard to work with utility programs as we had to work with various programs as each covers different components; no whole building program available. There was no integration across utility offerings to facilitate participation and garner the full menu of utility support. Thus, we made decisions on our O&M and not just what IOU and CPUC can encourage us to do.
- In the past, worked in a 3P where we learned about the various rebates, so I understand how utility programs work. Yet even with that background I found it hard to work with utility programs.
- Rates vs DR programs—when PG&E came out with new TOU shifted peak to 4-9pm. This led us to decommission our cogeneration plant as new TOU changed long term rate structure and economics of running it. Looking at how to optimize pumping of water at their facilities given new TOU rates. PG&E constantly pushed us to participate in DR-but offerings didn't work for them. The change in rates has pushed them in that direction.
- Started a project 2 years ago. There wasn't a whole building program then. Account Rep can help-but there's no program that captures all the savings. Some of it was fuel switching, as when we decommissioned the cogeneration plant; which further

complicated participation in PG&E programs. As an organization we prefer to approach as one big project—but harder to decipher what load increase or savings ensue from other measures.

Workshop: System Integration: How ET Can Optimize Building Resources
Breakout Session: Enabling Technologies

Discussion Questions
- What would it take for a building to support some level of flexibility?
- What technologies are needed for this to happen (*focus on tech with low behavior change*)?
- What are the best practices for optimizing these technologies?
- What are the data and system integration gaps?

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Facilitator Summary

The group identified two major factors that need to be addressed in order to enable buildings to have some level of flexibility. The first factor is cyber security. Industry stated that they would need a cyber secure network to allow for buildings to be responsive to grid needs. Having buildings on an open network or unsecure network would deter customers from allowing their facilities to be grid enabled.

The second factor is software that controls the whole building. Currently, most building loads are controlled in silos which makes it difficult to reduce load quickly enough to be grid responsive. The group identified the need for software that could integrate building loads into one central control system. The working group provided a couple of examples of current software integration pilots/studies being conducted:

- Logical buildings w/ Comcast – Machine Q
- Kinetic and SlipStream
- UC Merced and LBNL

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Regarding delivery of safe and reliable water to customers: Water/wastewater facilities have sophisticated SCADA. How are utilities/ET working with customers to provide incentives/pilot programs that integrate new, enabling systems w/SCADA?
  o Working with our control groups, developing software technologies intended to work with SCADA systems is difficult. Cyber security is a major barrier.
  o Other utils face the same issue—some have platforms that allow them to do that. Nearby willing to offer 17 MW of overgeneration – but no rate incentive to do that.

- IOUs face the same cyber security issues – need to figure out a path forward to ensure safety, and look for common solutions.

Corporate perspective: opportunity is there for IoT and it does have the ROI – lighting, heating, cooling – because these devices are IP addressable – building system network. For this reason, cyber security is absolutely critical – we will not put anything on our network that is not cyber secure – all of the enabling pieces are there but generally they are still being operated in a siloed manner.

There is an opportunity to control everything in one place. If we brought the equipment into one place as a system instead of siloed (building management operation, real occupancy counting, weather data, various meters on/or not integrated—particularly water, and IAQ— some is or not w/HVAC – all of these are separate), there will be a lot of efficiency gained if converged and normalized. But utilities incentivize widgets and not systems. Utilities would benefit from allowing these pieces to work together and could provide more support to the integration effort. This is the "want" for customers.

Is there anybody building an integration layer? See many vertical bldg. systems with their own control system, but nobody has integrated individual control layers—any movement there?

Examples of work being conducted:
- 4 tecs looking at as part of last year's Gap do that—furthest along with and impressed is from Prescriptive Data – applies machine learning to see how bldg. operator operates across the silos and brings in weather and other data to do even better and create a comprehensive system. Developed by real estate co at instigation of ConEd.
- Kinetic and Slipstream: New Voltron open platform (DOE)
- Logical buildings w/Comcast on Machine Que platform: Lots of sensor network that's put on their own secure network and has gaming attribute so occupants can compete with themselves.
- DSA—IT centric approach—OSI soft. Also working w/DOE – Melrok (AESE integrator—at CA court bldg.), Mateoviva (Europe) in NYC location.

Load management standards OIR going on. As grid becomes more flexible—pricing will as well. By 2025 push to mandate dynamic, real-time pricing and including GHG pricing to all customers. GFO Flexible hub come out. Anybody here explored real-time-pricing and GHG pricing and can bldgs.
- We're working with LBNL on a model as a part of this Hub – we are targeting our central plants. We have a central control system and are looking at different price signals (GHG, RTP, etc.). With our thermal storage tank we can take these signals based on the grids need – we are not looking at this at the building level due to complexity. With a lot of these strategies we are simply taking a signal from the grid, but we need to take into account our system needs – taking signals is dependent on our needs first.

- o We are targeting central plant w/model control—older campus uses simple control-simpler as one type of control system. Looking at a GHG signal or price signal. With recent heat waves grid was asked to reduce load—w/thermal storage we could shut down chillers. Opportunities there, but not bldg. by bldg.—as it's more complicated for them. Targeting the central plant easier. Typically responding to a grid request—but need to have operational flex to see if we want to and can respond to the signal. We couldn't afford to keep chillers off all the time b/c of labs—so operators are still hands-on-to ensure that respond to constraints needed by campus.
- We are taking a similar approach. However, in a small or med commercial building we do not have a system operator. Software is the key piece to all of this with changing incentives, changing programs, etc. Customers can decide to opt-out if need. When dynamic pricing comes on, they can use software to do the calcs. w/ their fixed hardware.

"This discussion mostly focuses on large buildings/campus. Just a reminder that there are >120k mid-sized buildings in CA with no BMS. (and speaking for our customers almost all programs are too complex / time-consuming for those buildings)"

"We think that a large number of small to midsize buildings in food service primarily are running possibly 5 to 6 to perhaps 10 - 12 poorly maintained commercial refrigeration units wasting significant energy."

More than half of commercial load is from small/med accounts. This is the gap. This market is tough to crack but there is a huge amount of potential if we can figure it out. There are very often large entities behind who is operating these office buildings. You would think looking at all buildings would be beneficial to these entities – from the small building perspective – go to the owners and give them an incentive "this is how you will benefit" – what type of outreach is being done at these buildings?

Pushing on the IOUs for more incentives for building integration for small/med buildings would be beneficial. Push utilities to make more incentives available on controls integration on these individual bldgs.

Transitioning to 3P administered programs under IOU management—want to hear the needs here. And hope the implementers will hear the market and develop programs that address these gaps. Hope to see more SMB offers. Tech is often not the issue – it's more tenant/owner issues.

But the strictures that utilities placed on those 3rd party programs made them impossible for the smaller buildings