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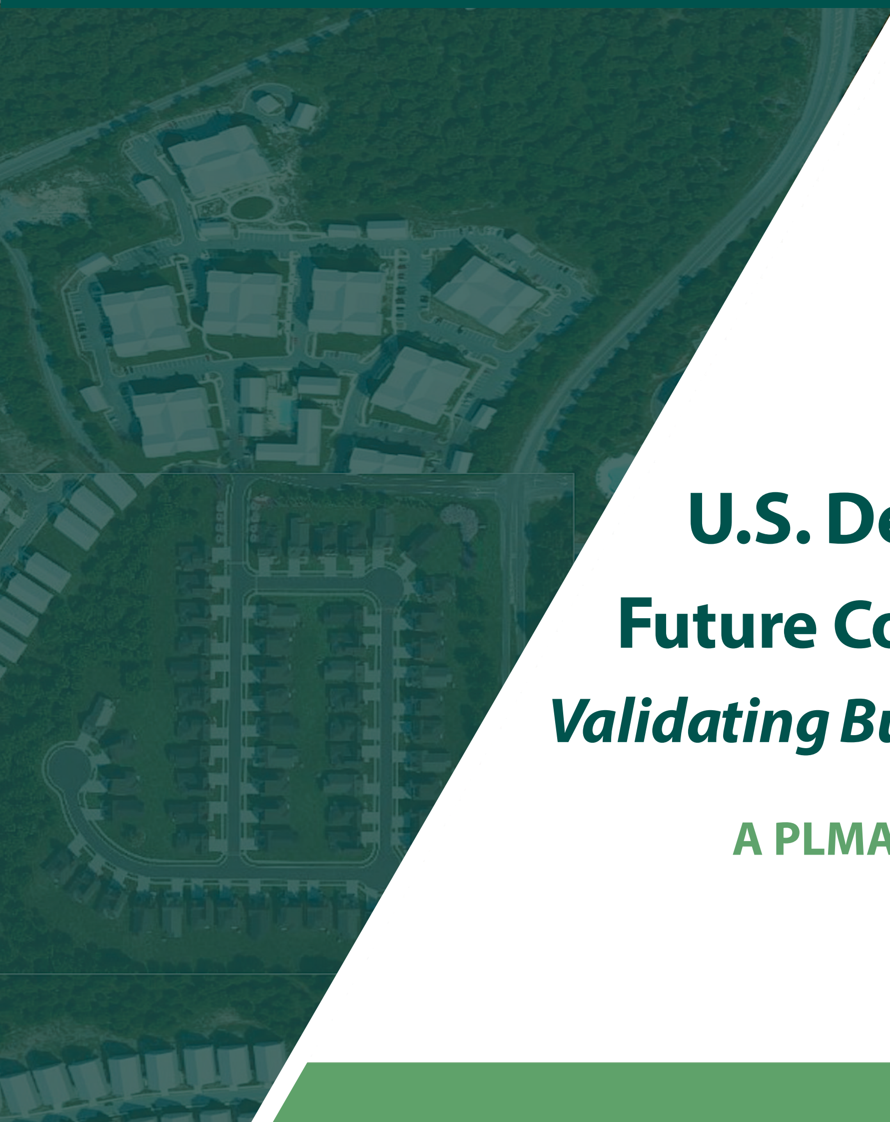

U.S. Department of Energy's Future Connected Communities: *Validating Buildings as a Grid Resource*

A PLMA Webinar Transcript Highlighting DOE FOA 0002206

An Excerpt from
PLMA's Industry Viewpoints
2020 Compendium

DE-FOA-0002206
Connected Communities

Anticipated Schedule:

FOA Issue Date:	10/13/2020
Submission Window for Concept Papers:	10/13/2020 - 02/17/2021
Submission Deadline for Concept Papers:	2/17/2021
Concept Papers will be accepted on a rolling basis until the Concept Paper deadline. Applicants must submit a Concept Paper by 5:00pm ET on the due date listed above to be eligible to submit a Full Application. Concept Papers will be accepted starting on the FOA issue date above and encourage/discourage determinations will be sent within seven calendar days of submission. **Applicants are encouraged to submit Concept Papers as early as possible.**	
Submission Deadline for Full Applications:	03/03/2021
Submission Deadline for Replies to Reviewer Comments:	05/04/2021
Expected Date for EERE Selection Notifications:	07/01/2021
Expected Timeframe for Award Negotiations:	Fall 2021

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U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

FIGURE A.
This chart shows the anticipated schedule for
DOE's Connected Communities Funding Opportunity (FOA) Application.

Source: FOA_Applicant_Webinar (Last updated: 11/12/2020 08:44 AM ET)

This slide and additional FOA information, updates, and instructions can be downloaded from https://eere-exchange.energy.gov/#FoaId9d24afcd-e292-4ea2-a4d3-d36e2b9dd9c7

The following is a transcript of a PLMA Load Management Dialogue (webcast) presented in April 2020. At that time, the U.S. Department of Energy (DOE) was preparing to issue a Request for Information (RFI) in order to inform its planned Funding Opportunity Application (FOA). The FOA was published in October 2020 with a final submission deadline of March 3, 2021.

PLMA offers this transcript, plus access to the original webcast discussion, as an additional resource for organizations responding to DOE's Connected Communities FOA. For more information on the FOA: https://eere-exchange.energy.gov/#FoaId9d24afcd-e292-4ea2-a4d3-d36e2b9dd9c7.

About "Connected Communities"

A Connected Community (CC) is a group of grid-interactive efficient buildings (GEBs) with diverse, flexible end-use equipment and other distributed energy resources (DERs) that collectively work to maximize building, community, and grid efficiency. Under this FOA, DOE will select a portfolio of "Connected Community" projects totaling up to $65 million in varying climates, geographies, building types, building vintages, DERs utility/grid/regulatory structures, and resource bases. Through funding these projects, DOE hopes to find and share technical and market solutions that will increase demand flexibility and energy efficiency. (*source: U.S. Department of Energy*)

Status of the Funding Opportunity Application as of January 2021

The U.S. Department of Energy (DOE) issued a Request for Information (RFI) in March 2020 to fund the expansion of GEB pilots across the U.S. That RFI closed in May 2020 and was followed by the issue of DOE's Funding Application Opportunity (FOA) in October 2020. The complete schedule for the Connected Communities FOA is shown in Figure A.

DE-FOA-0002206
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FIGURE A. Anticipated schedule for DOE's Connected Communities Funding Opportunity Application.

About this PLMA Load Management Dialogue

This webcast discussion was led by PLMA member practitioner Allison Hamilton, a Senior Principal, Markets and Rates with the National Rural Electric Cooperatives Association (NRECA). She was joined by:

David Nemtzow, Director of Building Technologies Office, the U.S. Department of Energy (DOE);

Mary Ann Piette, a Senior Scientist and Director of the Building Technologies and Urban Systems Division at Lawrence Berkeley National Lab (LBNL); and

Teja Kuruganti, a Senior Member of the R&D staff and a Program Manager for sensors and transactive control in buildings at Oak Ridge National Lab (ORNL).

David Nemtzow
U.S. Department of Energy (DOE)

Mary Ann Piette
Lawrence Berkeley National Lab (LBNL)

Teja Kuruganti
Oak Ridge National Lab (ORNL)

Allison Hamilton: This conversation is all about grid-interactive efficient buildings and Connected Communities. Thank you to our guest speakers for providing their perspectives and observations on this important project.

Operationally advanced high performance buildings seem to constantly evolve with the emergence of new building capabilities, as does the way we described them, with terms like "smart," "intelligent," and "connected." Your office, David, DOE's Building Technologies Office, has further defined these as "grid-interactive efficient buildings," with a group of these buildings referred to as a "Connected Community." What is the Grid-interactive Efficiency Building Initiative? What are the unique characteristics of these buildings?

David Nemtzow: I thought you'd never ask! DOE's Building Technologies Office is looking at both the opportunity and the challenge presented by our nation's 125 million buildings. Buildings in total consume just over 74 percent of U.S. electricity. In most of the country, an even larger share of that energy at peak is building-related. As a result, our building stock generates about 35 percent of the country's carbon dioxide emissions, plus, the total bill to heat and cool and power all of these buildings in 2019 was over $414 billion! I expect everyone in the PLMA family already knows a lot of that energy is wasted. But clearly, this situation represents both a challenge and an opportunity for all of us.

We call Grid-interactive Efficient Buildings "GEBs" and in them, we are working to move beyond traditional energy efficiency. Not just in how we find energy efficiency opportunities, but in how we implement them in ways that are helpful to the grid, to peak load management, and to demand response. We evaluate all the ways we can contribute to technology, integration, and business practices so that buildings can become more demand-flexible and more grid-interactive.

At the same time, we want buildings and their owners and occupants to get something out of this deal too. We'd like the grid to be more friendly to buildings and we hope that together, your work and ours will result in buildings that are more dynamic and flexible, and that they can serve as dispatchable grid resources whether it's to trim peaks, to shift time, or to "fill the bellies of ducks." This is needed to improve building resilience, reliability, and affordability, and to reduce emissions.

We are also looking forward to the grid being able to send signals; these may be direct communication signals, price signals, or some other kind. These signals would go to buildings and building operators to let them know when it's most valuable to trim their energy use, and how to do it in a way that will have optimal impact on the affordability of their energy use.

You can see this in Figure 1 which is a schema for a commercial grid-interactive efficient building. We are looking into how we use advanced sensors and controls; how we incorporate the existing thermal mass of buildings to act as de facto energy storage; how we add batteries for dedicated storage; and how we control the HVAC in a way that is sensitive to the occupancy of the space and also the actual population, making HVAC demand-sensitive. The question is how to do this in a way that connects buildings to the utility grid but also remains cognizant of other potential opportunities such as PV on the rooftop or central station, and EV charging. That's how we're thinking about the proposition of making all these buildings more integrated. DOE has published additional GEBs information at www.energy.gov/eere/buildings/GEB.

Allison: If you walked into one of these grid-interactive efficient buildings today, what kind of advancements and operational capabilities would you find? And, what might you find in five or even 10 years from now?

Mary Ann Piette: One exciting thing we're seeing today is how controls are changing the way we think about the use of energy in buildings. For example, we might see a smart thermostat in a home, or a control system in an office building that's able to reset the zone temperature when signals come in from a third party. There's a lot of new technology being developed that allows us to respond to signals to enable interactions between the electric utility and the building owner, which is typically done at the individual building level. Maybe it's a heat pump for space or water heating, or HVAC controls and smart thermostats.

Teja Kuruganti: Physically, you'll see smart devices like efficient heat pump water heaters and HVAC systems with variable frequency drives, solar panels with energy storage systems, and electric vehicles. The key difference is you'll be seeing more sensors that can measure environmental parameters, and that can also show the quantity of energy being used by these devices. HVAC and water heaters will have more data and control interfaces that will make it possible to network them together.

What you won't see, but that also exists, is smart automation that lets buildings function as virtual batteries, and that optimizes the operation of individual homes, and also of whole neighborhoods on the grid. In 10 years from now, smart homes will be ubiquitous. We'll likely be using artificial intelligence and machine learning to embed intelligence into our homes so that they can continuously improve their efficiency and their interactions with the grid.

David: If I had to pick one technology that I think has promise in this setting, it's thermal energy storage. There's been a lot of exciting progress in storage in

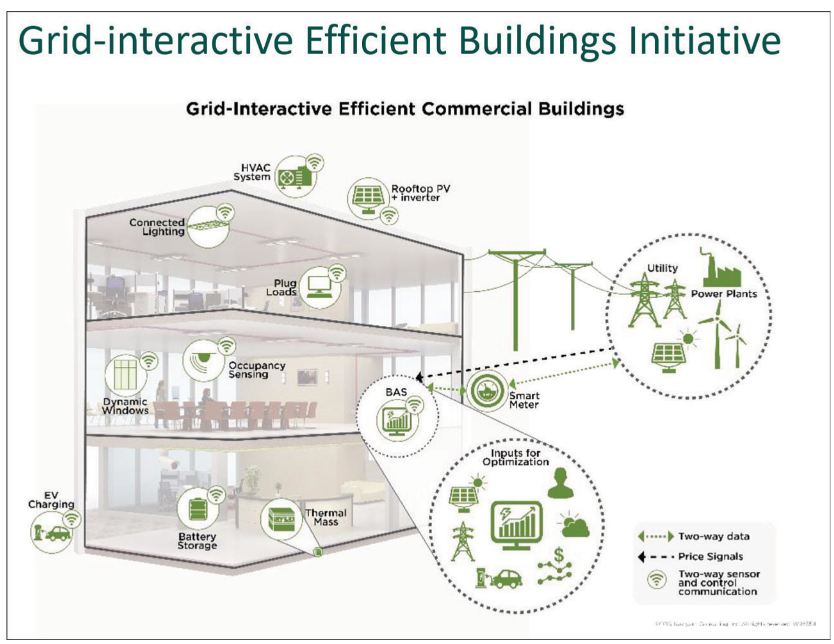

FIGURE 1. View Slide at: https://bit.ly/3b9M02U

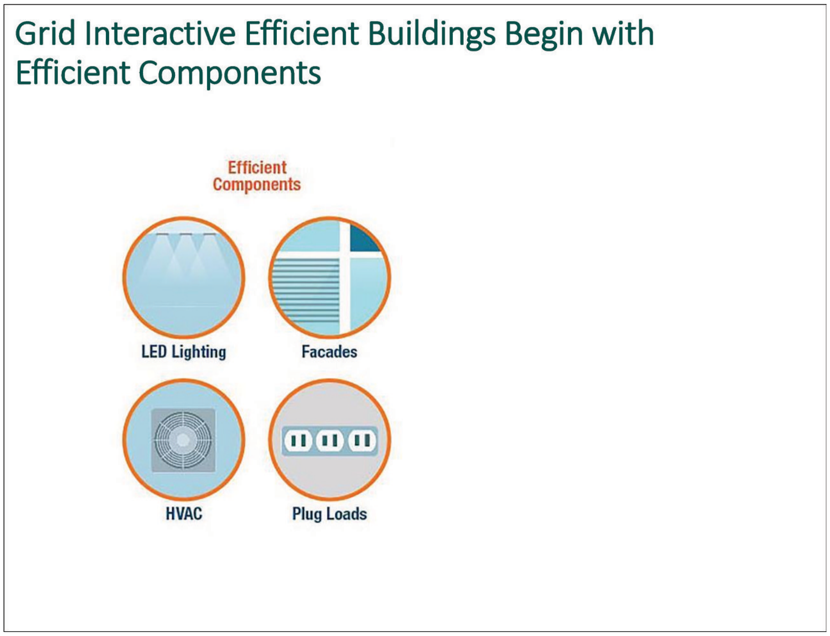

FIGURE 2. View Slide at: https://bit.ly/35abFEO

recent years, despite the fact that thermal has been around forever! We now see opportunities to use the existing thermal properties of buildings and their thermal mass for water heaters and HVAC, or to serve as dedicated thermal storage. Thermal applications are great at "coasting." You can over-cool or overheat when power's cheap and abundant, and then you can cut back later. I hope thermal will be an increasing part of the mix in coming years.

Allison: Can you describe some of the research developments in your current projects that are enhancing energy efficiency and demand flexibility? I understand you have a few testbeds of grid-interactive efficient buildings already set up?

Mary Ann: Yes, as you can see in Figure 2, as we move toward Connected Communities, we begin with the components. We have a long history in the building research community, both at DOE and at the National Labs, of developing low energy technologies dynamic facades, dynamic HVAC systems, energy efficient equipment, and plug loads that can clearly show how energy is being used.

Historically, we've oriented a lot of research toward using less energy anytime. What's changed is that now, we want to understand not just how much energy we are all using but when we're using it. In Figure 3 you can see that more measurement is the key. We're understanding the thermal environment, the HVAC environment, the lighting environment, user comfort, and what the facade is doing. There's a lot of work on going around whole-building systems, way beyond widgets. Figure 4 shows the extent to which we're focused on making sure these whole-building communication devices are actually communicating with the electric grid so that building owners and homeowners are benefiting from both energy efficiency and grid integration.

One of the big research challenges is how to ensure there is synergy between achieving homeowner value and grid and utility value. Figure 5 presents the revolutionary nature of the Connected Communities concept: it's not just about a single building, but a whole group of buildings interacting together. Figure 5 shows an existing residential building retrofit project called "EcoBlock" which is underway in Oakland, California. It's a good example of an advanced, connected community that has been built from the ground up, starting with deep energy efficiency retrofits, to which solar PV and portable tanks have been added. Once you've done the efficiency work, you can put in a smaller set of portable tank systems. This one will have shared storage, but it's also possible to have behind-the-meter distributed energy resources like portable tanks and storage, or these community-scale systems. Both of these are examples of Connected Communities, which may be community-scale solar and storage, or behind-the-meter DER integrated over the set of buildings.

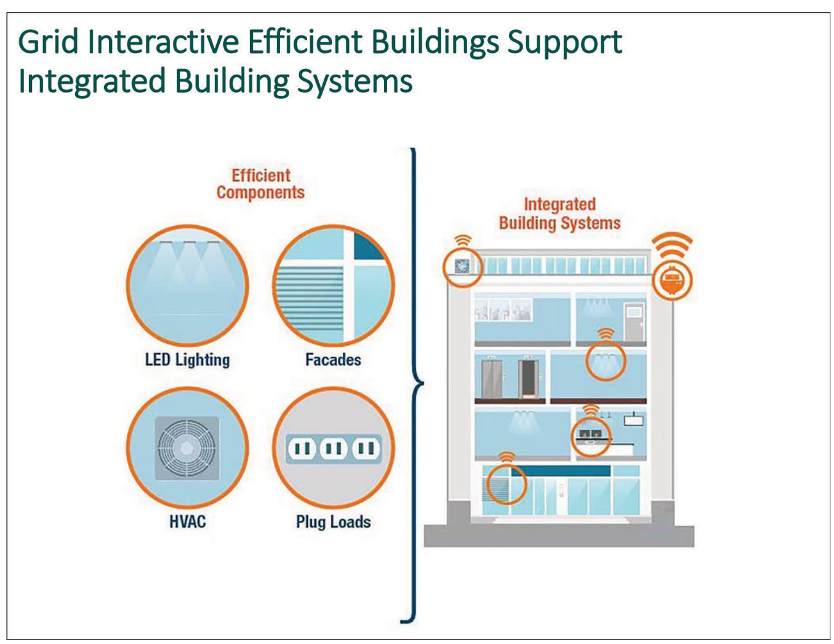

FIGURE 3. View Slide at: https://bit.ly/2Lolecp

A unique aspect of Connected Communities is the way they are controlled as a system. We're looking at the aggregated electric load for a group of homes or a group of buildings, and in the Oakland EcoBlock example in Figure 5, electric vehicles are part of the shared resources too. This project is led by Dr. Sascha von Meier at UC Berkeley. Lawrence Berkeley National Lab is a partner, and project funding was provided by the California Energy Commission. It's a very exciting example of an emerging Connected Community.

Teja: Oak Ridge National Lab is working on two testbeds to serve as a living laboratory for our researchers. We are doing this in partnership with Southern Company, Alabama Power, and Georgia Power, together with DOE's Building Technologies Office. We are exploring two possible futures for neighborhoods: 1) distributed energy resources at community scale, and 2) at the residential level. Both of these testbed neighborhoods include homes with highly efficient envelopes, plus loads that are capable of responding to grid needs while also maintaining occupant comfort. This is achieved through smart automation which accommodates models and optimizations that, in turn, coordinate energy generation, storage, and consumption.

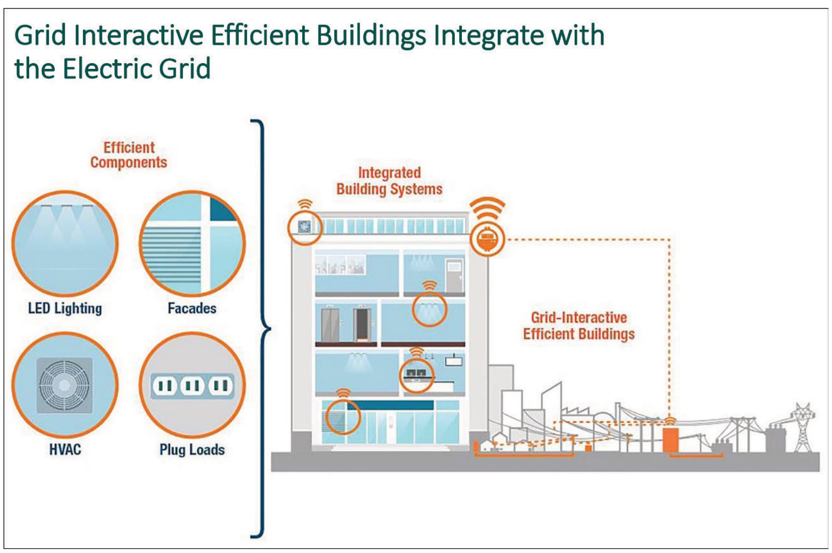

FIGURE 4. View Slide at: https://bit.ly/2LrGOfR

Optimizations benefit both homeowners and utilities. For homeowners, the focus is minimizing energy cost and maximizing comfort. For the utility, its facilitation of a high penetration of DERs with a minimal impact on the distribution circuit. In Figure 6, you can see the 62-home neighborhood that was developed in collaboration with Southern Company and Alabama Power. Each home has a controllable heat pump water heater and a variable frequency drive-enabled HVAC system. All of these homes were built with high efficiency construction techniques and have HERS scores of about 45. Next to the neighborhood is its power system: a microgrid with a PV system of about 300 kW, an energy storage system of 680 kWh, and a 400 kW natural gas generator.

On the right you can see a second look into the future in which each individual home has roof top solar, energy storage, and a controllable load, all under one roof. How do you control the load? How do the homes connect to the distribution system, and what does it take to optimize the operation of these homes together with grid operations? The Alabama Neighborhood, which we've operated for the last 18 months, is pictured in Figure 7. This neighborhood was built with the goal of demonstrating real-time building-to-grid integration while still focusing on energy efficiency.

As shown in Figure 8, all of ORNL's research is driven by use cases that address specific questions, including: 1) Can we quantify the value to the grid of operating microgrids with controllable loads? 2) Can we use these 62 homes to generate macroscopic load shifts that maximize the use of the community microgrid's DERs while also maximizing homeowner comfort? 3) What kind of price or incentive signal do we need to accommodate these new technologies in the mix? Key to this living laboratory demonstration is the question of system-level architectures. Are they scalable? Can we deploy these systems ubiquitously as we implement control at scale for all 62 homes? And, could we potentially scale this to 62 million homes?

Scaling requires a hierarchical approach to controls. At a residential level, we've coordinated operations to focus on the homeowner as you can see on the left side of Figure 9. Then we have interfaces to communicate this optimization at a neighborhood scale. Finally, across the bottom of Figure 9, with the grid providing four key services, namely energy efficiency (a primary motive), adaptive load shape, reliability response, and regulation response, we ask, "Can efficiency be optimized as the equipment degrades, and as operational usage patterns change? Can we reliably demonstrate the generation of adaptive load shift? Can these assets provide reliability responses and regulation responses?" Data is key to developing this model of optimization.

Another important highlight is interoperability and cybersecurity, which go hand-in-hand. They need to be addressed in the early stages of defining requirements for a project like this. Once a project is at the pre-deployment stage, they're baked in because many data and control interfaces are already in place.

Allison: What are the differences between the Smart Neighborhood in Alabama and the one you unveiled over the summer? What are some of the key lessons you're hoping to learn? Are there any revelations to date? Have there been any unexpected successes or failures?

Teja: We learned that we can actually deploy efficient construction at the individual home level, and both the technologies and the integration of these technologies, at scale, in the real world. We learned significant load flexibility is available because we pre-heat and pre-cool the homes to ride through peak events. We also learned to do this in a way that reduces back-up generation, reduces storage requirements, and uses thermal mass.

Another key lesson was the need for a scalable, coordinated control framework. Customer education is key and so is tapping into the experiences of our early adopters to learn what went right and what went wrong in the scaling process. In this neighborhood, we've seen ~44 percent energy savings and a ~34 percent reduction in peak demand.

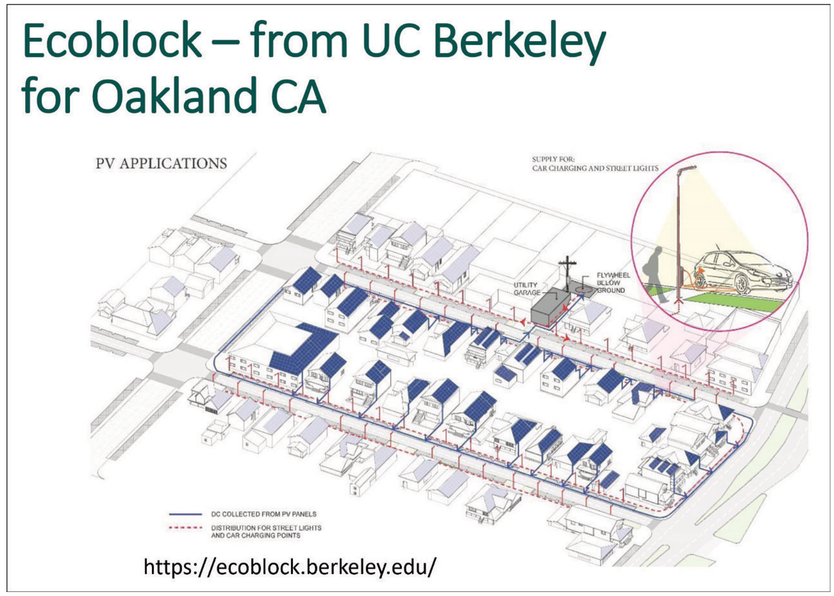

FIGURE 5. View Slide at: https://bit.ly/39iClET

Allison: What is the next research investment in these Connected Communities? David, you flagged the value of including diverse building types, industry players, geographies, climates, and so forth. How does DOE plan to build more of these? Are you looking for utilities in ISOs to lead these projects, or do you see developers or even local municipalities taking them on?

David: The short answer is all of the above. In Figure 10, you can see a collection of Grid-Interactive Efficient Buildings; homes obviously. What can we do with a group of them? DOE's working assumption is the whole is greater than the sum of the parts, and that's what we're testing and field-validating in these projects. We want to document economies of scale, and whether the diverse loads within a community can be used synergistically, especially if a neighborhood or community includes buildings other than just single family homes. Additionally, we want to understand potential infrastructure savings and viable business models.

Figure 6 shows two projects. The one in Alabama has single family homes with a microgrid, community solar, and community battery storage. The one in Georgia has townhomes with rooftop solar. There are similarities and differences. The Alabama project has been very successful. We have a full year of data from the real human beings living there whose energy savings were 44 percent compared to a standard home of the same size and climate conditions in Birmingham, AL. Some of that's traditional efficiency but a lot is due to grid-interactivity "smartness."

FIGURE 6. View Slide at: https://bit.ly/38goNuf

DOE's hopes that through the competitive grant opportunity of the FOA, we can establish more Connected Communities. Communities that include diverse neighborhoods all over the country, and not just in the hot, humid South which has the attributes of capacity and variable renewables. These could be residential communities, and we'd like to see mixed use and commercial communities too. We're interested in campuses where several buildings are owned and controlled by one party, whether a corporate or a healthcare campus or a university. Different kinds of utilities too; they could be co-ops or munis or investor-owned utilities. Certainly, we'd like to look at the nation's 125 million existing buildings, not just the million or so new buildings being built every year. The ability to retrofit existing buildings will continue be important.

Geographic diversity matters to DOE. We think we'll be able to support four to six new projects in partnership with utilities, home builders, researchers, and technology providers. We'd love to see the results of creating a Connected Grid Interactive Community in Phoenix for example, with its hot, dry weather and its high degree of variable renewables. Also in the Pacific Northwest which is quickly outgrowing its hydro-electric systems. And in Maryland which is also AC-dependent and has an increasing degree of variable renewables. Chicago, et cetera. In a diversity of conditions, we are interested in what can we learn, and in what can we demonstrate.

When this is done, we don't want it to be just a fabulous science project. We want everyone who works for a utility, a technology provider, or a PUC to say, " This approach really works and it provides value. Let's try it in our service territory!" DOE wants to see increasing demonstration, increasing validation, increasing communication, and then hopefully these communities will one day be commonplace.

David: Mark Martinez asks the question, how can a building property respond when, as is often the case, utility retail rates and wholesale market signals are at odds with one another and send conflicting signals.

Mark, you live in the heavily regulated world of California, and yes, price signals are very imprecise in this country. I don't have to tell the PLMA members this, but only about two percent of U.S. residential and small business electricity customers have time-sensitive rates. Just about all of them have the opportunity to opt-in to TOUs, but only two percent, plus or minus, actually have them.

Prices are not sending the right signals to many consumers about what electricity is worth at any given time, so what then is the value of saving or shifting or shedding that electricity?

However, what is also important, is that signals are sent to customer outside of just their retail rates. These may be incentives for technologies, incentives for actions. They may be revenue recovery incentives. Southern Company has gotten some revenue recovery for their investments by working with their PUCs. It could be a policy signal that is sent to a retail utility by its PUC or by its state government such as, "Utility, you shall have more renewables, you shall have more storage." Down the road, there may be a policy signal sent that you should do more on grid-interactive buildings. You'll respond using the tools that you have, incentives, and/or technical assistance. We have to look at the whole series of signals and interventions together.

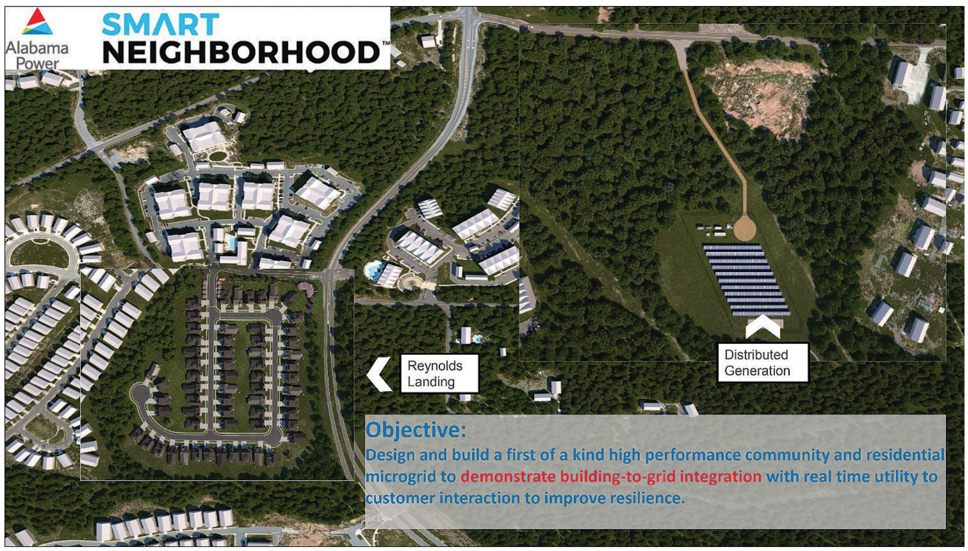

FIGURE 7. View Slide at: https://bit.ly/3hLy9kB

Currently, we're looking at building codes and how these can be made responsive to electric vehicles, to PV and, I hope, to increasing grid-interactivity. I don't know that we're going to see TOU retail rates that solve this, and I do think we'll need to look at all the other mechanisms to make sure they fit and make sense.

Mary Ann: Most of the last decade's demand-side management has been based on energy efficiency, that is, using less energy, so program evaluation metrics are well developed in this area. As demand response programs have evolved, and there's been a lot of DER activity around the country, the metrics have shown themselves to be very different. Historically, they've focused on peak capacity, hot days in the summer. But now we're looking at loads that can shift peak demand, not just shed it.

Load shift is very important when we consider renewable integration on the grid, and even metrics such as greenhouse gases. We've been developing metrics around reducing kWh, reducing kW, and we're also considering metrics like greenhouse gas reductions as part of evaluating a Connected Community.

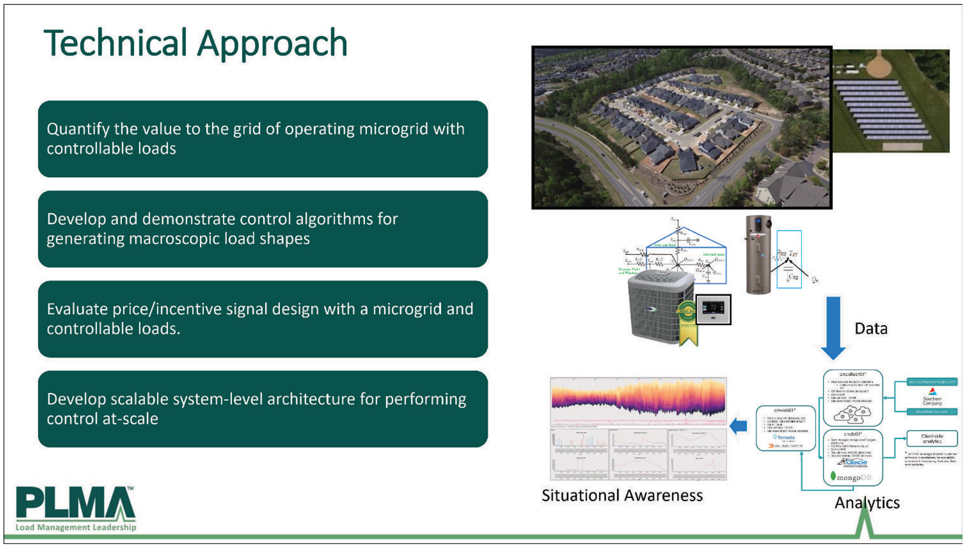

FIGURE 8. View Slide at: https://bit.ly/35eAijL

There's also the cost of service. What does this mean for a utility? With base costs and marginal costs, the electric utility evaluation framework around Connected Communities is of considerable interest to DOE as it determines how to advance these new business models and aggregate these portfolios of investments beyond the traditional EE and DR portfolios.

Allison: How will this effort be different from traditional demand-side aggregations and what is the value proposition for the building occupants and the utility?

David: How many hours do you have for Mary Ann to wax poetic on this topic?!

Mary Ann: The Connected Community is really exciting because it is trying to bundle these offerings which always begin with energy efficiency. A lot of DOE's and LBNL's work is looking at the relationship between energy efficiency and demand response. Where they compete, and where they have synergy. We see customer value when we see utility value, but there's a lot of innovation that needs to happen in the business models for aggregated technology offerings, similar to Teja's residential examples from the Southeast.

What happens when we create a community of office buildings, or a downtown urban area, or a university campus, or a corporate campus, or a military base, or a district heating and cooling system? We already have communities in the U.S. that have district heating and cooling, and some of those are municipal district HVAC systems. The important thing is we're going to control them as a system while we understand the individual building loads and optimize them as aggregated load shapes. Then we'll be able to understand whether we're still providing the same services to the buildings and the homeowners. This is the value stacking idea: there's value to the customer, there's value to the utility, and there's value in these new business and delivery models.

For homeowners, this value has to do with lower and perhaps more predictable bills so they can make choices about when to use energy and how much storage they might want. Homeowners may also benefit from knowing how their community system is doing, and how they're performing as part of that bigger system.

The utility gets a package of technologies that help create a smarter, more connected, more modern grid which helps it ensure supply and demand are better integrated. It also means the local system can be resilient and made "islandable." In this case, if there's a power outage or a storm, the islanded community may have some value in operating. But it doesn't have to be islandable, right? Some of these connected communities will be and others will not. We're working on ways to value resilience as part of a Connected Community.

Allison: As you've all worked on aspects of these projects for years, what do you think is the most exciting opportunity for the Connected Communities Funding Opportunity Announcement (FOA)?

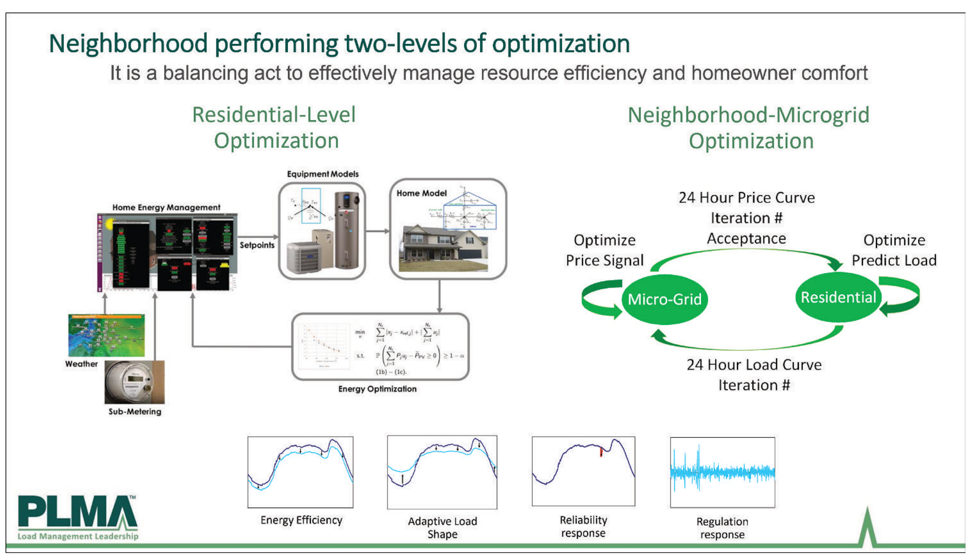

FIGURE 9. View Slide at: https://bit.ly/3naPc0E

David: The Connected Communities FOA [DE-FOA-0002206: Connected Communities https://eere-exchange.energy.gov/#FoaId9d24afcd-e292-4ea2-a4d3-d36e2b9dd9c7], represents a multi-million dollar investment in these communities. The FOA was designed by DOE's Building Technologies Office, together with others at the Department of Energy who work on solar, electric vehicles, and electricity issues.

What I'm most excited about are the business aspects of this project, even more than the technologies. Diversity is key, and I am looking forward to seeing how Connected Communities can best be applied in different situations, different geographies, different service territories, different climates, different building types, different rate structures, and levels of variable renewables penetration.

I am also excited about the opportunities for new teams to come together. Teja spoke about the teams they built in the Southeast, which included a major utility and a national lab. The Atlanta community was built by Pulte Homes, the nation's fourth largest home builder. The Alabama community was built by an important regional home builder and included Rheem and Carrier water heaters, plus other technology providers.

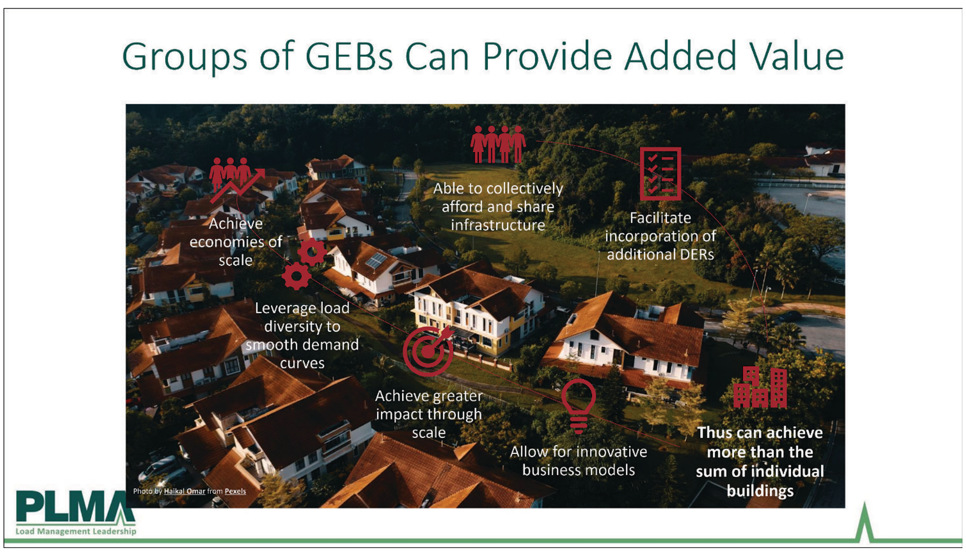

FIGURE 10. View Slide at: https://bit.ly/3pR99vg

Building teams is essential to the future of Connected Communities. We don't want these to be the work of just the Department of Energy, or just the State of Michigan, or just one private sector company, for example. We want them to be team initiatives because we think that's the way of the future.

Mary Ann: This is also an exciting time in the building controls business because of AI and machine learning, as Teja said. We can now collect a lot more data than we could 10 or 15 years ago with the help of the Internet, and due to improvements in our measuring abilities. There are a variety of methods on the control side.

One example is "model predictive control," which is a model that looks at what a building may want to do over the next 24 hours about its heating and cooling needs, water heating needs, and lighting needs, when taking into consideration the outside temperature, the number of people in the building, and the price of electricity.

These machine learning model predictive control systems also try to take into account the mass of the building, whether there's a portable tank on-site, and if there's a storage system. They can create a sequence of operations and set points that try to minimize energy use, minimize the utility bill, and minimize the peak demand. Think of this compared to today; currently when we run a building, we switch systems on and off, and we lack real-time energy feedback as part of the controls. We just use what we want and we pay the bill a month later.

There's another type of control called "agent-based control." The agent-based control does not provide global optimization, but it may optimize a local system and then decide how to participate in the larger optimization. Cybersecurity issues need to be worked out, but there are encryption and authentication systems that enable these transactions and a lot of the interoperability standards to be cybersecure. The National Institute of Standards and Technologies (NIST) and the National Labs are working to ensure machine learning model predictive control systems are cybersecure and interoperable.

When considering direct current (DC) power with a battery and photovoltaics, homeowners may also want to use DC lights or a DC refrigerator. They will save energy because there's no need to convert electricity with an inverter from DC back to AC. There's about 10 percent energy savings to be had by using a DC power source and a DC demand-side system.

Teja: I believe Connected Communities represent a transformation. They have the potential to enable our traditionally load-following grid to engage buildings, with their large energy footprints, to participate in grid activities. This will improve convenience, comfort, and grid operations, but it will also improve resilience. There are also new value streams that arise apart from comfort and convenience. The flexibility we can create in the large building footprints will enable the integration of clean, renewable energy with minimal impact on distribution, especially as we move toward 10, 20, and 30 percent PV penetration.

We'll also see continuous optimization driven by learning, and an increasing number of sensors and controls that make it possible for buildings become aware of their own energy consumption. There are traditional ways of controlling buildings; if you have 100 buildings in a zip code their operations can be controlled by the outside degree temperature. They click on, then the temperature adjusts at the same time without coordination. If we can dispatch that operation in 15 minutes without impacting households, we can also reduce peak load in the same area.

FIGURE 11. View Slide at: https://bit.ly/2XcGQuT

Mary Ann: Let me make a quick comment about aggregators. A lot of aggregator programs provide demand response to utilities into wholesale grid services, but not energy efficiency. This is an opportunity to combine EE and DR. We want the Connected Community models to be scalable. I think that's one of the biggest challenges when we think about issuing these federal monies to understand this technology, and also the business models. How do we scale these systems to create a bigger national opportunity?

David: One question is do these communities have to be geographically contiguous? That's one approach. But is there another market-based, aggregation-based approach in which geography isn't a constraint?

Mary Ann: Another question related to the value proposition is whether a Connected Community in a grid-constrained area can help defer an upgrade to a distribution circuit because we've instead invested in local load shape management?

Teja: If we defer investments in distribution upgrades, as Mary Ann just said, but also successfully facilitate more DER, there's clearly a lot of value there. The research question becomes how does this decision translate into controls and deployment?

We have learning to do about how these controls get deployed, but if we require the homeowner to be technically involved in a lot of decision-making and deployment, that may be a deterrent to their participation. So how can we make this process as seamless as possible? What is the software infrastructure that is needed to scale this?

With the flexibility we're talking about, we need a system that is as simple as providing a homeowner with a battery they can operate. How can I make this thermal battery that David was talking about deliver a response so there's no need to depend on alternative sources to generate it? Creating robustness requires a lot of research both in valuations as Mary Ann was talking about, and in bringing in thermal storage as David was talking about. A lot of these elements have to be addressed at the system level. Whole system integration goes hand-in-hand with the business model of who benefits and how this business model expands. The big challenge lies in developing robust and replicable integration and deployment architectures.

Allison: Thank you again to our panel of experts, David, Mary Ann, and Teja, for sharing your insights and expertise. We'll look forward to hearing more about Connected Communities after the FOA closes and new projects get underway.

About PLMA

PLMA (Peak Load Management Alliance), a 501(c)(6) nonprofit organization, was founded in 1999 as the voice of load management practitioners. Today, PLMA has over 165 members, including private and publicly owned utilities, technology companies, energy and energy solution providers, equipment manufacturers, research and academic organizations, and consultants.

As U.S. and global energy markets evolve, PLMA strives to offer timely programming and training opportunities, well as a forum for its member practitioners to share dynamic load management expertise, including demand response and distributed energy resources. Member practitioners take pride in sharing their knowledge, experience, and ideas with the goal of educating one another on a range of topics. These topics span load management programs, price and rate response, regional regulatory issues, technologies, and much more.

PLMA is inclusive of all member practitioners and encourages any organization with an interest in dynamic energy management to join us.

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To view the recording, please click on https://www.peakload.org/dialogue--validating-buildings-as-grid-resource.