

**Buildings-to-Grid Oversight Hearing for U.S. Senate Committee on Energy and
Natural Resources**

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Chairman Murkowski, Ranking Member Cantwell and distinguished members of the Senate Committee on Energy and Natural Resources, my name is Tracy West, and I am a director in research and development (R&D) at Southern Company, overseeing the power delivery and end-use research programs. I would like to thank the Committee for the opportunity to speak with you today as we discuss buildings-to-grid integration and how these technologies can bolster the relationship and interaction between customers and their utility.

As you know, the U.S. energy industry is rapidly changing. Drivers include:

- Evolving customer expectations and choices
- New technologies
- Slow economic growth and reduced demand
- Reduced cost and growth of renewables, storage and other distributed infrastructure
- Changes in regulatory policy
- Stakeholder pressure
- New market competitors

Southern Company recognizes that accelerating technology development is more important than ever in this challenging environment. Since the 1960s, Southern Company has managed over \$2.3 billion in R&D investment and remains the industry leader in the U.S. in research, development and deployment of innovative energy technologies. Over the past decade, Southern Company's leveraged R&D investment of \$436 million has returned benefits exceeding \$3.4 billion.

At Southern Company, we put our 9 million customers at the center of everything we do. From operations and maintenance to R&D, America's premier energy company provides 46,000 megawatts of generating capacity, 200,000 miles of power lines and 1,500 million cubic feet of combined natural gas consumption and throughput volume. And through a joint venture, Southern Company and Kinder Morgan share ownership of the 7,000-mile Southern Natural Gas pipeline system and are exploring future infrastructure development opportunities. Southern Company provides clean, safe, reliable and affordable energy through electric operating companies in four states, natural gas distribution companies in seven states, a competitive generation company serving wholesale customers across America and a nationally recognized provider of customized energy solutions.

Through an industry-leading commitment to innovation, Southern Company and its subsidiaries are inventing America's energy future by developing the full portfolio of energy resources, modernizing the grid for resiliency and security, and creating new products and services to benefit our customers.

Today I'm here to share with you Southern Company's buildings-to-grid efforts, and how we're building the future of energy through our diverse, innovative research, development and demonstration portfolio.

Buildings-to-grid communication and integration technologies could revolutionize the way we make, move and sell energy. So what exactly does it mean? Buildings-to-grid communication allows the utility to actively engage with end-use assets scattered across a geographic area, enabling utilities to meet customer demand while employing fewer peaking generation assets or cycling our assets and increasing the resiliency and flexibility of the grid.

I'd like to discuss a handful of our R&D projects currently underway in the buildings-to-grid space. I'm going to start with and spend the most time describing our newest buildings-to-grid initiative – the Smart Neighborhood projects.

Back in 2014, we were having conversations about what the utility industry might look like in the future. These conversations were bracketed by disparate views. On one hand, people thought the industry would remain the same with a focus on centralized power as the low-cost provider. Others recognized rapidly advancing technology and changing economics could drive the industry toward microgrids and distributed energy resources (DER).

As a result, the Smart Neighborhood concept was born.

Two Smart Neighborhoods were proposed to proactively simulate two scenarios for residential customers in a world where DER and microgrids become key to powering the country. The first focuses on a community-scale microgrid, where resources are shared and managed at the neighborhood level to provide cost savings through economies of scale. The second focuses on customer-owned, behind-the-meter DERs that are managed on behalf of the homeowner to reduce energy costs, improve comfort and supply energy to the grid as a resource. By implementing these projects now, we prepare ourselves to remain the energy experts and adapt to maintain our competitive advantage in the utility space. These projects consist of three main pillars:

1. **High-Performance Homes:** Building codes and appliance standards continue to drive energy efficiency changes throughout the country. In anticipation for these changes, these projects include technologies and building practices that are much higher than the

minimum of today. These high-efficiency construction techniques will model the energy performance of homes that will be the norm 20 years from now.

2. **Distributed Energy Resources:** DER assets on both residential and community-scales are a key component to these two projects. As DER costs continue to decrease, these projects allow us to study the impacts of solar panels, natural gas generators and batteries at the edge of our grid, while developing new strategies to integrate them seamlessly into real-time grid operations.
3. **Buildings-to-Grid Communication:** The third pillar is a way to integrate customer resources onto the grid by using their energy flexibility and thermal energy storage (in heat pump water heaters). This integration capability is enabled by the proliferation of low-cost and robust communications, as well as the widespread adoption of the Internet of Things. Shifting toward a utility that can actively engage with assets scattered across a large geographic area will enable us to meet customer demand while employing fewer peaking generation assets and increasing the flexibility and resiliency of the grid.

To continue providing value-driven solutions for our customers, we must understand the challenges and opportunities currently unfolding in the industry and how it impacts them. With that, these Smart Neighborhood projects are the first large-scale projects of their kind, integrating connected technologies with DER assets to explore how these independently-tested technologies can benefit both customers and the grid.

Alabama Power's Smart Neighborhood in Birmingham, Alabama, consists of 62 single-family dwellings and a community-scale microgrid located nearby. This project aims to:

- Understand high-performance homes and customer experiences
- Determine which programs and services can provide new energy solutions for customers
- Evaluate community-scale microgrids
- Explore buildings-to-grid opportunities for load shaping within a community-scale microgrid
- Build relationships with homeowners to obtain real-world feedback on new home technologies and future utility business cases

Georgia Power's Smart Neighborhood in Atlanta, Georgia, is made up of 46 townhomes that make up the first phase in a larger community buildout of an additional 224 townhomes and commercial facilities over the next several years. Each townhome will be equipped with rooftop solar, battery energy storage, connected heat pump water heaters and thermostats. The goal of this project is to:

- Understand the impacts of behind-the-meter rooftop solar and battery storage
- Understand the impacts of customers supplying energy back onto the grid
- See how highly-efficient townhomes perform
- Develop new methods to integrate rooftop solar, battery storage and controllable devices to benefit the homeowner and the grid
- Investigate how heat pump water heaters can be used for thermal energy storage

- Investigate future rate design models to incorporate new technologies and customer behaviors

Before concluding this discussion about our Smart Neighborhood efforts, I stress that these projects would not be possible without our partnerships with key stakeholders, research organizations and influencers across the industry. Through funding from the Department of Energy (DOE), Oak Ridge National Laboratory (ORNL) has been developing the control systems, VOLTTRON and CSEISMIC, for the Alabama Smart Neighborhood project. VOLTTRON is the home energy management system that will communicate with the water heater and HVAC systems, and CSEISMIC is the microgrid controller that will control the generation assets and communicate with VOLTTRON. The value of the Alabama project has been strengthened by working across unit lines at DOE. The collaboration between the Buildings Technology Office and the Office of Electricity has been key to enabling the success of this multidisciplinary project.

Successes and obstacles from these projects will be applicable across the country, as the Southeast sets the stage for future Smart Neighborhoods. With these projects, we will be able to envision tomorrow's homes, today.

While these Smart Neighborhood projects are gaining national interest, Southern Company is leading additional buildings-to-grid initiatives that include:

- **Sustainable and Holistic Integration of Energy Storage and Solar PV (SHINES):** This Electric Power Research Institute-led, DOE-funded project is integrating solar PV systems, advanced solar forecasting techniques, load management and energy storage with the power delivery network at three test sites across the country. Southern Company R&D and Gulf Power are performing a residential demonstration at two side-by-side Pensacola homes to better understand the capabilities of residential appliances to respond to grid and solar PV signals.
- **ORNL Grid Modernization Lab Call:** *Unified Control of Connected Loads to Provide Grid Services, Novel Energy Management and Improved Energy Efficiency.* This project looks at a way to upgrade the controls within small commercial convenience stores to use the flexibility and thermal storage capability of refrigeration for non-perishable items (soft drinks, etc.). Southern Company is working with ORNL and Emerson Climate Controls to develop, test and implement this control strategy within our footprint.
- **Integration of Responsive Residential Loads into Distribution Management Systems (IDMS):** In a partnership between ORNL, EPRI and other utilities across the southeast, Southern Company is investigating how a fully open standard-based technology framework can be integrated into our distribution management system. This project will allow us to understand different value streams that connected buildings can offer to the

grid and the appropriate internal function of control and hierarchy of priorities to gain the most beneficial implementation.

- **Water Heaters as Thermal Energy Storage:** We are deploying a small number of grid-interactive water heaters across our service territory to integrate them with our daily grid operations. The work will include open protocols for integration and may be expanded to proprietary algorithms and information exchanges to extract the most value from the water heaters as possible.

At the forefront of technology development for making, moving and selling electricity, Southern Company actively collaborates with other utilities, universities, U.S. government, national labs and vendors. Our leadership and vision helps invent real solutions for America's energy future. We are focused on meeting customers' energy needs today and building the future of energy as we anticipate tomorrow. With these buildings-to-grid projects, Southern Company will remain energy experts and adapt to maintain our competitive advantage in the utility space. As these programs develop and the energy landscape shifts, we intend to lead the change to serve our customers with clean, safe, reliable and affordable energy.

Thank you for the opportunity to testify today – I am looking forward to answering any questions you may have.