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Kiran Kumaraswamy
Market Applications Director
Fluence

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Testimony of Kiran Kumaraswamy, Market Applications Director of Fluence Before the U.S. House, Subcommittee on Energy hearing entitled "Powering America: The Role of Energy Storage in the Nation's Electricity System."

Thank you, Chairman Upton, Ranking Member Rush and Distinguished Members of the Subcommittee. My name is Kiran Kumaraswamy and I am Market Applications Director of Global Market Applications team at Fluence, a Siemens and AES company. I am honored to testify in front of you today on the topic of energy storage and its role in the nation's electricity system.

Background on Fluence

Fluence Energy, LLC ("Fluence") is an energy storage technology and services company jointly owned by Siemens AG and The AES Corporation ("AES"). Fluence combines the engineering, product development, implementation and services capabilities of AES' and Siemens' energy storage teams and is currently engaging in an aggressive expansion of the business backed by the financial support of the two parent organizations.

The market for energy storage is accelerating quickly. Utilities, developers and large energy users worldwide recognize energy storage's value as critical infrastructure that provides greater reliability, resilience and efficiency. Customers are calling for industrial-grade solutions, power sector expertise and financial stability not available from technology startups, battery manufacturers, automakers or others. Fluence was designed as a trusted partner to answer those needs, custom-built to deliver the most comprehensive set of energy storage solutions and services globally.

Fluence's sole focus is accelerating the speed and guiding the direction of global energy network transformation. Backed by the insights, reach and scale of Siemens and AES, we're creating a new generation of solutions and services provider that believes in prioritizing lasting partnerships over delivering products, the desire of users to have

input into their energy choices, and the importance of the entire power ecosystem in forging a path to making a sustainable future model a certainty.

Energy storage is the next big thing in our nation's energy landscape

Electricity networks are as important as the Internet, powering everything we do and fueling the nearly $80 trillion global economy. However, when, where, and how people consume electricity is changing with the rise of renewables and distributed generation.

Countries around the world are making a transition, from centralized power systems designed over a century ago to decentralized and renewable power that's created closer to where it is needed. Coupled with aging infrastructure, this shift is posing significant challenges to communities around the world as they look to modernize their grids for the needs of the next century.

Energy storage allows us to meet those challenges, transforming the way we power our world by making better use of all of the electricity infrastructure assets we are putting on the grid and those we already have in place.

With the introduction of energy storage, we finally have the technical capability to create unbreakable and self-healing **networks** that enable the interaction of microgrids, mini-grids, and fully distributed generation. Energy storage also enables improved system utilization and right-sized investments to reduce system-level costs.

Renewable energy **generation** is leading us towards a cleaner, more sustainable future, but the variability of that generation and the influx of low-cost clean energy is shifting the way all both generation assets and power markets operate. Energy storage is needed to achieve the full potential of renewable energy and to ensure all market participants are able to benefit from this incredible transformation. Energy storage adds much needed capacity, which ensures there will always be power available to meet peak requirements. It also manages short-term variability in the system, by providing grid-stabilizing services in milliseconds and flexibility that is nearly three times as valuable per megawatt as that provided by the fastest gas turbines.

Energy storage is also the unique tool that gives **large energy users** the ability to control when they use grid power or their own reserves, enabling them to gain control over their energy costs. Storage help can protect businesses and other customers from demand charges and variable energy rates to deliver significant savings. Storage

also safeguards their operations against outages, which can potentially result in lost revenue and equipment damage. If an outage occurs, energy storage can quickly and efficiently operate in islanded mode and can be paired with generation to ensure continuous operation.

Fluence brings proven technology solutions and services that overcome the commercial and regulatory barriers that stand in the way of modernizing our energy networks. We are the partner that can deliver energy storage solutions and provide guidance at a global scale with the most experienced and knowledgeable team in the world.

Commercial Applications for Utility-Scale Battery Energy Storage

Energy storage, unlike many single-use assets in our electric power system, can serve a variety of functions on the electric grid. Fluence delivers solutions that provide eight different applications and each of our technology platforms have been designed to stand up to the rigorous needs of these industrial applications. Several of these are illustrated below using real-world deployments already in operation or under construction.

The eight focus applications include Frequency Regulation, Microgrids & Islands, Critical Power, Energy Cost Control, Generation Enhancement, Capacity Peak Power, Renewable Integration, and Transmission & Distribution Enhancement.

	8 - Applications		18 – Use Cases
1	Frequency Regulation	1	Frequency Regulation/Control
		2	Generation Capacity Release
2	Microgrids & Islands	3	Microgrids
		4	Island Dispatch Optimization
3	Critical Power	5	Critical Power
4	Energy Cost Control	6	Energy Cost Control
5	Generation Enhancement	7	Generation Black Start
		8	Spinning Reserves
		9	Storage + Generation
6	Capacity Peak Power	10	Flexible Peaking Capacity
7	Renewable Integration	11	Grid Renewable Integration
		12	Storage + Renewables
8	Transmission & Distribution Enhancement	13	Transmission Capacity Release
		14	Network Peak Load Relief
		15	Congestion Management
		16	Network Black Start
		17	Distribution System Reliability
		18	Frequency Response

Storage as Flexible Peaking Capacity

Two utilities in the western U.S. are leading the way in harnessing energy storage for flexible peaking capacity. In 2014, Southern California Edison (SCE), the largest utility in our most populous state, was facing the retirement of older natural gas-fired power plants and the unexpected retirement of a large nuclear power plant. They needed to select new sources of capacity to meet their customer's needs. SCE ran a procurement solicitation in which energy storage was compared against gas-fired generation, demand response and other resources. They awarded AES the world's first long-term contract to provide peaking capacity from a battery-based energy storage facility in Long Beach, California. This plant will be able to provide 100 megawatts (MW) of power for four continuous hours, directly substituting for the need to build a new gas-fired peaking plant. It was selected by SCE on an economic basis, meaning that it will provide the capacity at a lower net cost to SCE's customers than obtaining the same amount capacity from a traditional gas-fired peaking plant. SCE's decision in this case was a watershed proof point for the economics, scale, and technology maturity of battery-based energy storage to meet electric system needs.

Site of 100 MW AES Alamitos Energy Center – Long Beach, CA

Then in 2016, when a critical natural gas storage facility providing peak reserve capacity near Los Angeles had to be taken out of service, the California Public Utility Commission (CPUC) directed investor-owned electric utilities in southern California to

fast-track additional energy storage options to enhance regional energy reliability. In response, San Diego Gas & Electric (SDG&E) expedited ongoing negotiations and contracted with AES Energy Storage to build two projects for a total of 37.5 MW of 4-hour duration lithium-ion battery energy storage. The larger project, a 30 MW facility built in Escondido, Calif., is currently North America's largest lithium-ion battery installation, and both the Escondido project and a smaller 7.5 MW installation built in El Cajon were completed and online in eight months. SDG&E has already contracted with Fluence for a larger follow-up project, a 40 MW 4-hour duration installation in Fallbrook, which will be part of an 83.5 MW portfolio of additional 4-hour energy storage. Battery-based energy storage can be deployed in months compared to years required for traditional assets, which enabled southern California's utilities unparalleled flexibility to meet their local capacity needs.

30 MW SDG&E Advancion Energy Storage Facility – Escondido, CA

Storage as a Reliable Transmission & Distribution Asset

Arizona Public Service (APS) recently partnered with Fluence to become one of the first electric utilities in the country to choose energy storage to avoid the need to rebuild 20 miles of transmission and distribution poles and wires, which serve a small town 90 miles outside of Phoenix where peak electricity demand is increasing. By placing a relatively modest sized battery array at the end of the last 20-mile segment of power line, APS will save its customers the cost of rebuilding those lines, which cross over

difficult terrain. When not being used to serve customer demand, the battery system will provide additional benefits like voltage regulation and delivery of excess solar power, as well as the capability to add additional storage as needed in lockstep with growth, all at a similar cost. In a number of cases, energy storage enables utilities to defer or avoid entirely investments in a variety of fundamental, single-function grid assets like wires, poles, transformers and substations, and in the process, get the most value from the transmission and distribution lines they already own and use. As communities across the U.S. and elsewhere around the globe work to modernize their electric grids, utilities are beginning to recognize that energy storage offers them new and different options for their infrastructure investment options and strategy.

2 MW APS Advancion Energy Storage Facility – Punkin Center, AZ

Energy storage also has been proposed and selected in regional transmission planning processes in organized markets across the country. In a recent example, the California Independent System Operator (CAISO) in its 2017/18 transmission planning process selected Pacific Gas & Electric (PG&E)'s Oakland Clean Energy Initiative, a portfolio of transmission projects designed to increase reliability in the East Bay area of San Francisco. Energy storage was included in the initiative, along with traditional transmission upgrades, because it was found to be cost-effective compared to other options and will enable the local area to operate without relying on local gas-fired generation in the future. We find this example compelling because it highlights the role that energy storage can play in rebuilding electric networks that serve local communities, providing a cost-effective alternative to traditional options available for upgrading our grid.

Storage to enhance traditional generation assets

Deploying battery energy storage also provides significant value on small, isolated grid systems like those in northern Chile, where AES has deployed three energy storage systems. They work in concert with conventional generation sources to provide grid stability, responding instantly to disturbances in the grid, such as when a large power plant or transmission line suddenly stops working. These applications are similar to how energy storage would be used in island or microgrid applications, where many energy resources need to work in concert with each other. In these cases, energy storage fills the gaps between supply and demand, ensuring the reliable and efficient delivery of electricity and often avoiding the need to burn diesel fuel in generators, the predominant source of fuel in remote areas.

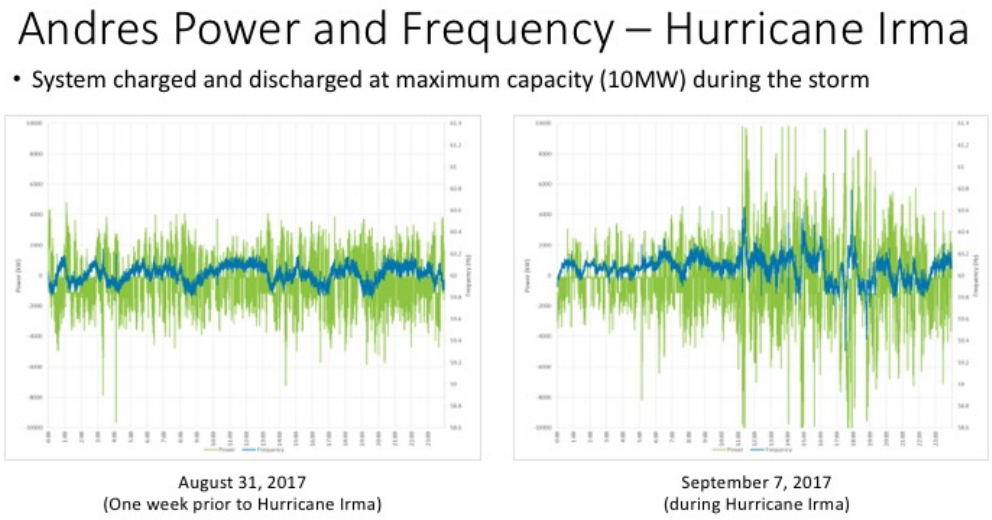
Battery energy storage paired with traditional generators can provide similar benefits on the large connected grids that are common in the United States. For example, SCE has deployed energy storage with a gas turbine at one of its facilities to increase the utilization of an existing gas turbine, while lower emissions and operating costs. The benefits of this hybrid resource are already being realized. Between July and December 2017, battery-based energy storage increased the utilization of the hybrid gas turbine to nearly 100%, compared to approximately 50% for standalone turbines[1]. The hybrid gas turbine was also able to provide the higher value and faster responding grid service known as spinning reserve, compared to standalone turbines that predominantly provide the lower value and slower responding service known as non-spinning reserve. This hybrid approach has resulted in lower fuel use and emissions, as well as higher revenues that were passed along to customers.

Other power plant operators are considering using energy storage to provide black start, a critical grid service that enables the grid to be repowered after a blackout. Traditionally this service has been provided by diesel generation, but the high pollutant emissions of those resources cause them to violate their air permits, particularly in dense urban areas. Energy storage can provide the same service without any direct emissions, enabling generating units to stay in compliance with existing air permits.

[1] http://www3.sce.com/sscc/law/dis/dbattach5e.nsf/0/723BE6C98E04967C8825826E0072B736/$FILE/A1703020-SCE%20Notice%20of%20Ex%20Parte%20Communication%20(4-10-18).pdf

Storage providing frequency regulation and adding system resilience

Energy storage also adds resilience and can protect electric grids during severe weather events. During last year, when Hurricanes Irma and Maria – Category 4 and 3 hurricanes on the Saffir-Simpson scale, respectively – impacted the Dominican Republic on September 7th and 21st, 2017 and stressed the local grid. Fluence's team and AES had just deployed two 10-megawatt energy storage arrays on the Dominican grid, and as each hurricane approached the island, the grid operator requested that both systems be kept online and operational during the storm to help maintain grid stability. Conditions on the Dominican electric grid were volatile during both hurricanes as generation, transmission, and distribution networks were damaged or shut down. Both of the energy storage arrays responded as intended and helped keep the grid operating throughout the storm, even with nearly 40 and 55 percent of the Dominican Republic's generation assets forced to shut down during Hurricane Irma and Hurricane Maria, respectively.



Source: Fluence

State and Federal Policy Can Remove Barriers to Energy Storage

The economics of advanced energy storage have reached the point where storage is a more cost-effective alternative to traditional single-use infrastructure, such as natural gas-fired peaking plants, and can provide critical grid services more effectively and at lower cost. Yet, as the economics of storage have progressed, state and federal regulators have discovered and are removing policy barriers that stand in the way of storage competing on a level playing field.

These barriers to energy storage have taken numerous forms, including market rules that inadvertently exclude energy storage from revenue streams because they were written with other technologies in mind. Fundamentally, policymakers can continue removing barriers to storage by focusing on three major goals: (1) removing barriers to grid and market access, including for storage providing multiple uses; (2) allowing storage to compete in all planning and procurement; and (3) appropriately valuing and compensating storage for the flexibility it provides.

California has led the way in ensuring storage can participate in markets by allowing energy storage to be owned by both utilities and third parties, allowing it to participate in multiple revenue streams, and ensuring that capacity market rules don't unduly discriminate against the characteristics of storage. Ownership models are being tested in multiple states, including Maryland's Public Conference 44 (PC 44) proceeding, which includes a workstream on a single storage asset being owned and shared by two parties. Massachusetts has allowed utilities to own storage, but not more than 20% of the storage in the state. These are just a few of the many examples where states are experimenting with regulatory structures to ensure their businesses and residential consumers benefit from energy storage.

Some states have chosen to set a storage target to increase adoption of technology and realization of potential benefits to ratepayers. This has had the beneficial effect of clarifying the benefits storage can provide to the state and providing confidence to developers that the state is committed to energy storage over the long term. The setting of a target often follows a cost-benefit study for energy storage, as we've seen in states ranging from California to Massachusetts to New York. These targets, whether binding or aspirational, can be a key factor in encouraging utilities, regulators, and stakeholders to modernize their planning and procurement practices to take advantage of energy storage, as well as to focus state regulators on identifying and addressing barriers to deployment. In California, establishing a storage target led to utilities becoming comfortable with buying and operating energy storage, and ultimately led them to adopt storage well ahead of the pace set by the original target.

States are also removing barriers to storage by including it in planning and prudency standards. A model state in this regard is Washington, where the commission has ruled that energy storage must be considered robustly in utilities' integrated resource plans, and that generation procurement needs to happen via technology-neutral requests for proposals (RFPs) to maximize competition. By directing utilities to consider storage

alongside other investment options in generation, transmission, and distribution assets, state regulators are ensuring appropriate competition of solutions for electric grid reliability.

Federal policymakers have also acted to remove barriers to energy storage. We are pleased that the Federal Energy Regulatory Commission finalized Order 841 to ensure fair and equal access for storage resources to compete in wholesale power markets. In addition, we are pleased that FERC finalized Order 845 to better enable storage to connect to the electric grid when co-located at existing power plants. We believe these are important policy initiatives at FERC that can create lasting wholesale market changes that fully value the unique capabilities that storage brings and to encourage consideration of storage use for infrastructure needs. We note that FERC is currently considering requests for rehearing of both Order 841 and Order 845. FERC unanimously approved both Orders after extensive deliberation, and we caution that re-opening them as RTOs seek to finalize compliance would create significant uncertainty for storage developers planning projects in anticipation of their implementation.

Federal policymakers can continue removing barriers to incorporating storage into electric infrastructure as well. We are pleased that FERC has clarified that storage resources serving as a part of transmission infrastructure can seek cost recovery through cost-based and market-based rate structures. As conversations on resilience needs of the grid continue, we encourage FERC and grid operators to go further and include storage as a regular part of transmission planning, as well as establish a clearer regulatory framework for storage as a part of our nation's transmission infrastructure.

Finally, we note that there is uncertainty for storage developers awaiting new guidance from the IRS regarding circumstances under which storage is eligible for the Section 48 investment tax credit. The IRS issued received comments from industry over two years ago in response to its notice of new guidance, and we encourage the Department of Treasury and IRS to accelerate finalization of that guidance. Alternatively, Congress can resolve that uncertainty for the industry by issuing clarifying statutory guidance, such as the bipartisan Energy Storage Tax Incentive and Deployment Act (H.R. 4649). Doing so would remove constraints to storage project development while enabling all grid assets – gas plants, wind plants, and others – to benefit from the addition of energy storage to the electric system.

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Chairman Upton thank you again for the opportunity to testify today – I would like to invite you and the other Members of the Subcommittee to visit any of our storage facilities in the United States. I am happy to take any questions.

Thank you.