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Testimony of Kiran Kumaraswamy, Vice President, Market Applications at Fluence, Before the U.S. Senate Committee on Energy and Natural Resources Hearing to Examine Expanded Deployment of Grid-Scale Energy Storage

Good morning, Chairman Murkowski, Ranking Member Manchin and Distinguished Members of the Committee. My name is Kiran Kumaraswamy, and I am the Vice President of Market Applications at Fluence, a Siemens and AES company. I also serve as a Member of the Board of Directors for the Energy Storage Association, the leading national voice of the United States energy storage industry. I am honored to testify before you today on the topic of grid-scale energy storage and its current and future 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 the AES and Siemens energy storage teams. We are currently engaged in an aggressive expansion of the business, backed by the financial support of our two parent organizations.

The market for energy storage is accelerating quickly. Utilities, developers and large energy users worldwide recognize the value of energy storage as critical infrastructure providing superior economic value compared with alternative options, as well as greater reliability, resilience and efficiency to their electric power systems. Customers are calling for industrial-grade energy storage solutions, along with power. Fluence has been developed as a trusted partner to answer the needs of utilities, developers and large energy providers, and to deliver the most comprehensive set of custom-built energy storage solutions and services globally.

Fluence's sole focus is accelerating the speed and guiding the direction of the transformation of global energy networks. Backed by the insights, reach and scale of Siemens and AES, we are creating a new generation of solutions and services. Our

vision and strategy are based on prioritizing lasting partnerships, enabling users to have input into their energy choices, and supporting the entire power ecosystem in bringing us to a sustainable future.

Energy storage is on the cutting edge of the global energy transition

The success of Fluence – and the growing energy storage industry we are a part of – puts us on the cutting edge of a global energy transition that is now unstoppable. Energy storage technology is proven, scalable and expanding rapidly to meet a range of critical needs on global electric power grids – grids which are now evolving to meet the complex needs of the 21st century.

Even as countries around the world are transitioning from centralized power systems to decentralized and renewable power, they face significant challenges, often due to aging infrastructure. Bringing increasing amounts of solar and wind power onto the grid means planning for a system in which high levels of power quality are still essential but variability is the norm.

Energy storage allows us to meet such challenges – and transform them into opportunities -- by making better use of all the electricity generation and infrastructure assets we are putting on the grid and those we already have in place. With the introduction of energy storage, we can, for the first time, shift and control, with pinpoint accuracy, the time and location of power delivery. We can improve system utilization and efficiency, and right-size large, fixed-cost investments that customers typically pay for over 20-30 years. The economic value energy storage creates is proving compelling to customers worldwide and is driving the rapid scale-up of the energy storage industry.

In its recent "35x25" report, the Energy Storage Association estimates that by 2025, the U.S. will have 35 gigawatts (GW) of additional energy storage on the grid.[1] Such market growth could provide more than $4 billion in operational cost savings, while creating more than 167,000 jobs, the report says.

These figures are impressive and ambitious, but they also underline a few key points:

First, energy storage unlocks value in all grid assets by improving their utilization – be they traditional thermal plants such as gas or nuclear, renewable sources such as

[1] http://energystorage.org/vision2025

wind and solar, or the transmission and distribution infrastructure that delivers energy to factories, homes and offices. Energy storage is particularly essential to achieve the full potential of renewable energy in the U.S. and around the world, and to ensure all customers can benefit from the economic and environmental advantages of renewable energy. Specifically, energy storage adds much-needed capacity, ensuring power will always be available to meet peak requirements. Storage can also manage short-term variability across the system, providing grid-stabilizing services in milliseconds, and flexibility that is significantly more valuable than even the fastest gas turbines in the market today.

Second and of equal importance for the U.S. economy, energy storage gives large energy users control over their energy costs by allowing them to decide when to use grid power or their own reserves. Further, storage can help protect businesses and other customers from demand charges and variable energy rates. It can also boost resilience, operating in “island” mode to protect business and residential customers against outages and the resulting potential for lost revenue and equipment damage.

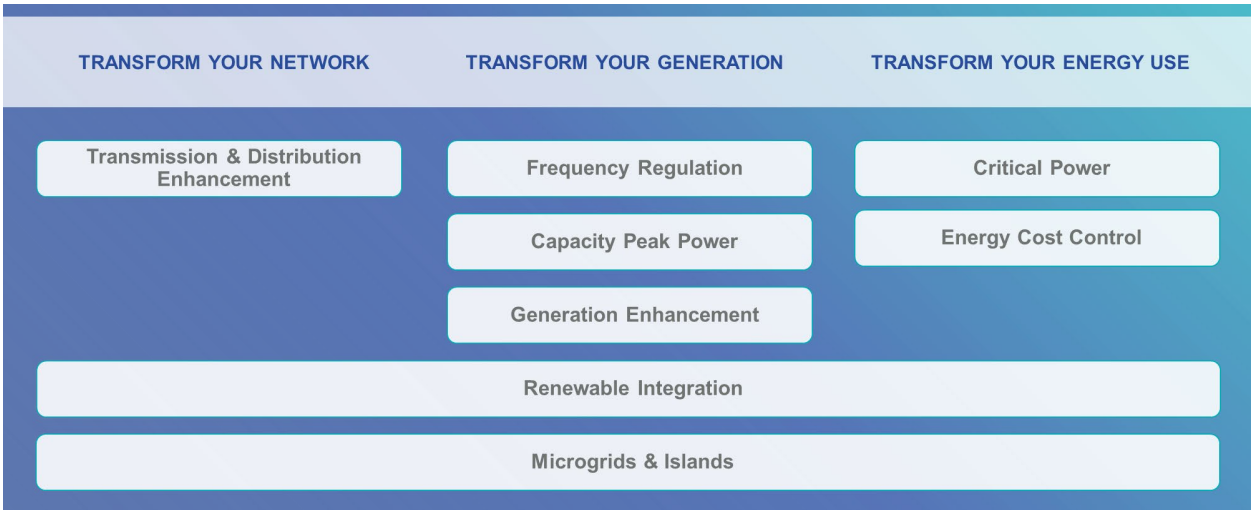
Third, addition of battery energy storage to gas turbines helps such traditional generators become more flexible and provide the higher value and faster-responding grid service known as spinning reserve. In these cases, energy storage fills the gaps between supply and demand, ensuring the reliable and efficient delivery of electricity and often avoiding the need to burn diesel fuel in generators, the predominant source of fuel in remote areas. Such hybrid approaches of adding storage to gas-based resources are continuing in the US and across the world, resulting in lower fuel use and emissions. Deploying battery energy storage also provides significant value on small grid systems located on islands, or in remote or isolated areas 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.

Flexible Applications for Battery Energy Storage

As noted above, the range of applications for energy storage – its flexibility – makes it unique. That is, unlike many single-use, fractionally utilized capital assets in our electric power system, individual storage systems can serve a variety of functions on the electric grid. Fluence delivers solutions that provide eight different applications,

and each of our technology platforms has been designed to stand up to the rigorous needs of these industrial applications.

The figure below details the eight applications our systems can provide today, ranging from real-time, split-second frequency regulation to longer duration support for transmission and distribution systems. The following subsections include brief case studies of relevant, real-world projects provided by Fluence, either already in operation or under construction.



Source: Fluence

Storage Providing Peaking Capacity Gaining Traction Broadly Across the U.S.

California utilities have been at the forefront of a growing trend to use energy storage – rather than traditional natural gas plants – to provide flexible “peaking” power at times of high demand.

In 2014, Southern California Edison (SCE), one of the largest utilities in the U.S, was facing the retirement of older, natural gas-fired power plants and the unexpected retirement of a large nuclear power plant. To select new sources of capacity to meet customers’ needs, SCE ran an all-source procurement process in which energy storage was able to compete against gas-fired generation, demand response and other resources. The result: Based primarily on costs and benefits, SCE awarded AES the nation’s first long-term contract for a battery energy storage facility to provide peaking capacity.

Located in Long Beach, the Alamitos energy storage facility is set to break ground later this month and will be able to provide 100 megawatts (MW) of power for four hours. This project demonstrates the economics, scale and technological maturity of battery energy storage to meet electric system needs.

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

Then in 2016, 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) quickly directed investor-owned electric utilities in the affected region to fast-track additional energy storage projects to shore up energy reliability. In response, San Diego Gas & Electric (SDG&E) expedited ongoing negotiations and contracted with AES Energy Storage (now part of Fluence) to build two projects for a total of 37.5 MW of four-hour duration battery energy storage. Located in Escondido and El Cajon, the projects were online in eight months. The 30-MW facility in Escondido remains one of the largest battery storage installations in North America.

SDG&E has already contracted with Fluence for a larger, follow-up project, a 40-MW, four-hour duration installation in Fallbrook, which will be part of an 83.5-MW portfolio of additional four-hour energy storage.

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

When looking at the entire U.S. energy storage market, it is abundantly clear that energy storage is being trusted for bulk infrastructure outside of California. Increasingly, generation-owning utilities are examining and selecting large-scale energy storage in lieu of new natural gas plants to provide for periods of peak demand. In February 2019, Arizona Public Service announced that it had selected 850 MW of energy storage in a head-to-head economic competition against a range of new natural gas peaker plants. In January 2019, Hawaiian Electric announced seven solar-plus-storage projects to provide peak capacity totaling more than 260 MW. And in March 2019, Florida Power & Light announced what is currently the world's largest planned battery, over 400 MW, to provide peak capacity in conjunction with solar.

The chart below shows a selective sample of utilities that have identified storage in their Integrated Resource Plans (IRP).[2] Our focus is to continue to accelerate utilities' adoption of energy storage as an essential component in their resource planning toolkit.

Utility	State
Arizona Public Service	AZ
Salt River Project	AZ
Tucson Electric Power	AZ

[2] Not a comprehensive list, only meant to illustrate examples of select utility IRPs.

Southern California Edison	CA
Pacific Gas and Electric	CA
San Diego Gas & Electric	CA
Xcel	CO, MN
Florida Power & Light	FL
Georgia Power	GA
Hawaiian Electric	HI
Indianapolis Power & Light	IN
Kentucky Power	KY
Consumers Energy	MI
NV Energy	NV
El Paso Electric	NM
Duke Energy	NC
Pacific Power	OR
Portland General Electric	OR
Dominion Energy	VA
Appalachian Power	VA
Puget Sound Energy	WA
Avista	WA

Source: Energy Storage Association

Storage Providing Transmission and Distribution Services

Fluence believes one of the most transformative and valuable uses for energy storage will be in the transmission and distribution sector, allowing utilities to defer or avoid entirely investments in fundamental grid assets such as wires, poles, transformers and substations. Looking ahead, these applications will allow utilities and their customers to get the most efficiency, flexibility and resilience from the transmission and distribution lines they already have and use.

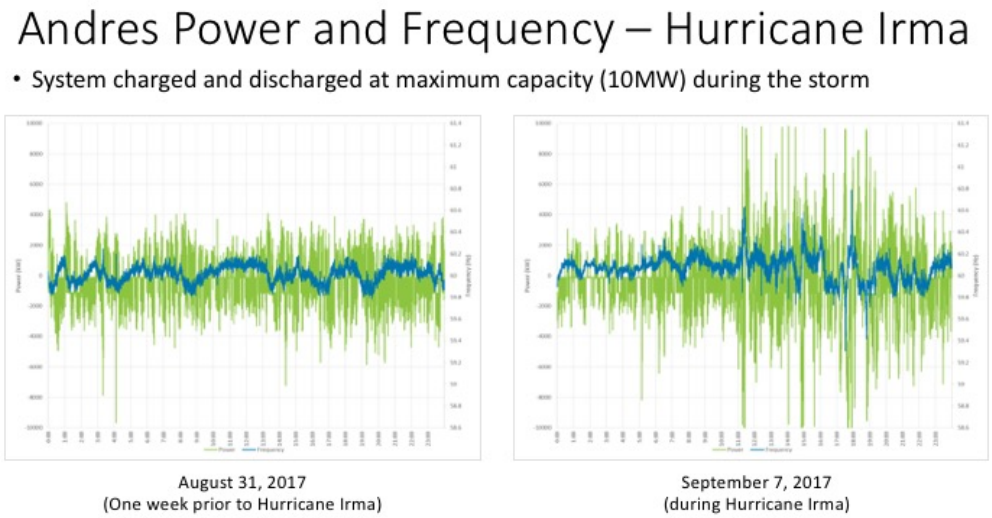
For example, Arizona Public Service (APS) recently partnered with Fluence to become one of the first electric utilities in the country to use energy storage to avoid the need to rebuild 20 miles of transmission and distribution poles and wires. The project placed in service last year was designed to serve the small town of Punkin Center, 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 segment of the 20-mile power line, APS has saved its customers the cost of rebuilding those lines, which lie over difficult terrain.

Energy storage is also playing an increasingly important role in regional transmission planning processes in organized markets across the country and around the world.

Regional market operators across the country including California Independent System Operator (CAISO), Midcontinent Independent System Operator (MISO) and PJM Interconnection (PJM) are actively studying projects proposed as transmission assets or investigating storage as a potential transmission asset.

Storage providing frequency regulation and adding system resilience

Energy storage also adds resilience to electric grids, helping them to both minimize and recover from outages during severe weather events. When the Dominican Republic was hit in September 2017 by Hurricanes Irma and Maria – Category 4 and 3 storms, respectively – AES had just deployed two 10-MW energy storage arrays on the island's grid. As each hurricane approached the island, the grid operator requested that both systems be kept online to support the grid as it managed the wild fluctuations in frequency experienced during the storm, as illustrated below. Both storage arrays responded as intended and helped keep the grid operating throughout the storm, even with 40-55 percent of the Dominican Republic's generation assets forced to shut down.



Source: Fluence

State and Federal Policy Can Remove Barriers to Energy Storage

As the economic, environmental, and resilience benefits of energy storage are becoming widely accepted, policy must continue to evolve to ensure storage can compete on a level playing field. We are happy to see the progress exhibited by policymakers at the state, regional and federal levels thus far to remove these barriers, and we see several additional areas to focus on going forward.

Accurately measuring the capacity value of different durations of energy storage is one critical need to flag. Traditional capacity techniques are unable to measure the value of duration-limited resources such as energy storage, because traditional generators are not duration-limited. However, today leading regional transmission operators (RTOs), independent system operators (ISOs), and utilities are deploying modeling techniques to examine questions such as "how many gigawatts of 4-hour energy storage can I deploy in my system to directly reduce my net peak demand." New York ISO, for instance, has assigned 4-hour energy storage a 90% capacity value, and 6-hour energy storage a 100% capacity value, based on this type of detailed assessment of its system needs. CAISO and the Southwest Power Pool (SPP) have also assigned 4-hour energy storage a 100% capacity value. Recent modeling published by the Energy Storage Association shows similar capacity value is justified in PJM for multiple gigawatts of 4- and 6-hour duration energy storage, though under PJM's current proposal, 4-hour energy storage would only receive a 40% capacity value.

Many of the underlying modeling techniques for assessing the capacity value of energy storage were developed within the U.S. Department of Energy's (DOE) National Renewable Energy Laboratory (NREL). This work is a prime example of how DOE's national laboratories and other research initiatives have provided expertise and support that have been essential to – and are still vitally needed for -- the growth of our industry. We are heartened to see bipartisan efforts to advance grid storage technology development and demonstration, such as through the Promoting Grid Storage Act of 2019 introduced by Senator Smith[3] and the Better Energy Storage Technology (BEST) Act introduced by Senator Collins and Senator Heinrich.[4]

A second critical need is to remove barriers to energy storage being deployed as a transmission asset. The Federal Energy Regulatory Commission (FERC) Order 841 is providing a pathway to remove barriers to energy storage's participation for generator services in wholesale markets. But it does not provide a pathway to ensure energy storage is included in regional transmission planning. FERC has weighed in on this initially via Order 1000, which created a mechanism by which alternatives to transmission wires, including local energy storage, can be proposed as a part of regional transmission planning processes. However, to date, consideration of storage

[3] The bill is supported by Senator Collins, Senator Hirono, Senator Duckworth, Senator Cortez Masto, Senator Stabenow, Senator Heinrich, Senator Gardner, and Senator Hassan.
[4] The bill is supported by Senator Collins, Senator Heinrich, Senator Gardner, Senator Smith, Senator Coons, Senator McSally, and Senator King

options in transmission planning has been minimal. A regulatory construct for storage-as-transmission is largely undeveloped, which is having a direct impact on the ability to install storage for transmission reliability purposes. Our request is for Congress to direct FERC to open dockets on storage-as-transmission, starting with either technical conferences or notices of inquiry to inform any potential rulemakings FERC may determine are merited.

A third critical need is to take advantage of the unique resilience benefits that energy storage provides in disaster response and infrastructure planning. To this end, the Department of Energy could provide significant support in studying and quantifying the value of the resilience that energy storage provides to the electric network. While many grid operators, and state and local governments are examining energy storage for resilience, the lack of defined methods for valuing resilience limits the ability to factor such value into cost-benefit analyses that inform resilience planning, and cost-benefit analyses used in budgeting and procurement decisions.

One concrete pathway to accelerate the development of energy storage in the U.S., and to compensate it for the resilience and reliability benefits it provides, is to include energy storage as an eligible technology for the Section 48 and 25D investment tax credit. To that end, we urge the passage of the bipartisan Energy Storage Tax Incentive and Deployment Act (S.1142 and H.R.2069). Doing so would remove constraints to storage project development while enabling both standalone storage as well as all storage co-located with grid assets – gas plants, wind plants and others – to benefit from the addition of energy storage to the electric system.

While we push hard for progress on each of these critical needs, we want also to recognize the accelerating progress at the federal, regional and state levels. At the federal level, FERC Order 841 has injected needed guidance for wholesale markets to adapt to allow energy storage to compete. We applaud FERC for reaffirming Order 841. At the regional level, we are very encouraged by the progress made in New York to accurately recognize the capacity value of energy storage. We are also pleased by the MISO's commitment to examining pathways to include storage in transmission planning, and CAISO's success in weighing energy storage for transmission needs. At the state level, we applaud the passage of regulatory reform in Colorado to ensure energy storage is included in both generation and transmission planning and procurement. Nevada, New Jersey, New York, Massachusetts, Oregon and California have all established, or will soon establish, state-level targets and timelines for energy storage deployment, which have been major catalysts for the industry. And Maryland has done

innovative work in testing ownership and wholesale market participation models. We believe the leadership demonstrated here provides lessons and best practices for other states to follow. Fluence is among the many industry participants committed to supporting these practices, and helping ensure energy storage is deployed rapidly, smartly and to the benefit of all Americans.

The U.S. currently is the leader in battery storage deployments globally with countries like Korea and China closely following behind. Removing structural barriers in wholesale markets, improving regional planning processes and providing certainty for this industry will continue to help us retain that leadership position. Fluence currently has projects deployed or awarded in 18 countries, from the U.S. and Canada to India and Australia, and we continue adding new employees almost weekly.

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

Thank you.