Part 3

Stevens

WITNESS DIRECT TESTIMONY SUMMARY

Witness: Sean Stevens

Title: Director, Electric Distribution Grid Solutions

Summary:

Company Witness Sean Stevens supports the proposed battery energy storage systems ("BESS"), BESS-5: Outage Mitigation and Grid support through a Microgrid Capable BESS and BESS-6: Long Duration Energy Storage in a Behind-the-Meter Application. Company Witness Stevens describes both proposed BESS and provides details regarding the pilot objectives, location, installation, and scale of BESS-5 and BESS-6.

DIRECT TESTIMONY
OF
SEAN STEVENS.
ON BEHALF OF
VIRGINIA ELECTRIC AND POWER COMPANY
BEFORE THE
STATE CORPORATION COMMISSION OF VIRGINIA
CASE NO. PUR-2023-00162

Q. Please state your name, position of employment, and business address.

A. My name is Sean Stevens, and I am Director, Electric Distribution Grid Solutions for Virginia Electric and Power Company ("Dominion Energy Virginia" or the "Company"). My business address is 600 E. Canal St., Richmond, VA. A statement of my background and qualifications is attached as Appendix A.

Q. Please describe your areas of responsibility with the Company.

A. I am responsible for distribution initiatives related to distributed energy resource ("DER") deployment and integration, including potential non-wires alternatives ("NWAs"), battery energy storage system ("BESS") pilot projects and the development and implementation of our DER management system ("DERMS").

Q. What is the purpose of your testimony in this proceeding?

A. I am testifying in support of the Company's application ("Application") (i) for approval to deploy three of the battery energy storage systems ("BESS")—designated BESS-4, BESS-5, and BESS-6—as part of the pilot program for electric power storage batteries (the "Pilot Program") and (ii) for a certificate of public convenience and necessity ("CPCN") to construct and operate BESS-4 at the Company's Darbytown Power Station, to the extent required by the Commission. Specifically, I support the BESS-5: Outage

Mitigation and Grid Support through a Microgrid Capable BESS ("BESS-5"), and BESS-6: Long Duration Energy Storage in a Behind-the-Meter Application ("BESS-6").

Q. During the course of your testimony, will you introduce an exhibit?

A. Yes. Company Exhibit No. ___SS, consisting of Extraordinarily Sensitive Schedule 1 and Confidential/Extraordinarily Sensitive Schedule 2, was prepared under my supervision and direction and is accurate and complete to the best of my knowledge and belief. Schedule 1 is the Electric Power Storage Battery Pilot Program Proposal Summary ("Proposal Summary") for BESS-5. Schedule 2 is the Proposal Summary for BESS-6.

Q. Please describe the proposed BESS-5.

A. BESS-5 will utilize lithium-ion technology and is a 1.9 MW / 3.8 megawatt-hour ("MWh") alternating current ("AC")-coupled BESS. BESS-5 will be classified as a distribution asset with four applications: (i) grid forming outage mitigation; (ii) demand response; (iii) voltage support; and (iv) electric vehicle charging station integration. The total cost for BESS-5 is expected to be approximately $6 million (excluding financing costs). The Company anticipates that the proposed BESS will be in service by third quarter 2025, based upon Commission approval on or before March 31, 2024. More details regarding BESS-5, including the initial metrics and performance data to be evaluated, are included in my Schedule 1.

Q. Where will BESS-5 be located?

A. The proposed BESS will be installed in Chesterfield County at the Company's Electric Distribution Safety & Training facility located. Specifically, this site is located at 11501

Old Stage Road, Chesterfield VA 23836. This property is owned by Dominion Energy Virginia. The location was chosen because it will provide the opportunity to pilot the BESS in a grid-forming environment, pair electric vehicle ("EV") Charging integration with a BESS, and provide access to our Electric Distribution training program for use in training technicians on BESS operations and maintenance. The location for BESS-5 is identified as "Battery Park Location" on the map in my Schedule 1.

Q. Please provide a basic description of what will be required for the installation of the proposed BESS-5 and the estimated physical scale of BESS-5.

A. BESS-5 will be housed in a single enclosure. This 28.8 foot by 5.41 foot by 9.2 foot enclosure will include all batteries and the inverter. The BESS and a 2.5 megavolt ampere ("MVA") pad mounted transformer will sit on separate concrete slab foundations. Applicable conduit, control cable, and appropriate circuit interconnection equipment will be installed to connect the BESS to the grid and provide monitoring and control of the system. The exact design of BESS-5 is subject to final engineering.

Q. Please describe the proposed BESS-6.

A. BESS-6 will utilize non-lithium-ion technology, utilizing a nickel-hydrogen chemistry, and is a 1.5 MW / 15 megawatt-hour ("MWh") alternating current ("AC")-coupled BESS. BESS-6 will be classified as a distribution asset with five applications: (i) behind-the meter non-lithium ion BESS long duration energy storage; (ii) outage mitigation with grid-forming inverter; (iii) demand response; (iv) voltage support; and (v) integration with back-up diesel generator. The total cost for BESS-6 is expected to be approximately $14.4 million (excluding financing costs). **[BEGIN CONFIDENTIAL INFORMATION].** [redacted]

[redacted] **[END CONFIDENTIAL INFORMATION]**. The Company anticipates that this proposed BESS will be in service by December 31, 2027, based upon Commission approval on or before March 31, 2024. More details regarding BESS-6, including the initial metrics and performance data to be evaluated, are included in my Schedule 2.

Q. What is the location of BESS-6?

A. The proposed BESS will be installed at **[BEGIN CONFIDENTIAL]** [redacted] **[END CONFIDENTIAL]**. This location was chosen because it will provide the opportunity to pilot behind-the-meter integration with a BESS for outage mitigation and customer facility load reduction. A map identifying the location is provided in my Schedule 2. The location for BESS-6 is marked as Location B on the map.

Q. Please provide a basic description of what will be required for the installation of the proposed BESS-6 and the estimated physical scale of BESS-6.

A. All equipment associated with BESS-6 will be housed in a 160 foot by 200-foot property provided by the customer. The proposed BESS-6 will be housed in multiple 7 foot by 8-foot containers that will be mounted on multiple stands, each requiring a concrete foundation. The inverter and a 2 MVA pad mounted transformer will be housed separately from the BESS containers and each requires a concrete foundation of their own. Applicable conduit, control cable, and bus work will be installed to connect the

BESS to the grid and provide adequate monitoring and control of the system. The exact design of BESS-6 is subject to final engineering.

Q. Are BESS-5 and BESS-6 distribution assets representing ordinary extensions or improvements in the usual course of business?

A. Yes, these projects are distribution assets and represent ordinary extensions or improvements in the usual course of business. This is consistent with the Commission's findings in Case No. PUR-2019-00124 regarding BESS-1 and -2, which were of similar size and function.

Q. Has the Company assessed environmental justice considerations in the development of these projects?

A. Yes. Assessing potential impacts from a project on disadvantaged communities often involves analysis of demographic data from geographic areas, like census block groups. However, potential adverse environmental effects from small battery energy storage sites like the one being proposed here are typically limited in severity and distance, such that, the majority of residents within the surrounding census block group area(s) would not be affected.

Information on the Environmental Justice evaluation for BESS-5 and BESS-6 are included in my Schedules 1 and 2, respectively.

Q. Does this conclude your pre-filed direct testimony?

A. Yes, it does.

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APPENDIX A

BACKGROUND AND QUALIFICATIONS OF SEAN STEVENS

Sean Stevens is Director of Electric Distribution Grid Solutions for Dominion Energy Virginia's Power Delivery Group. He is responsible for distribution initiatives related to distributed energy resource deployment, integration, and operations. Mr. Stevens joined Dominion Energy Virginia in 2005 as an Associate Project Designer in Distribution Design and has held various roles in Design, Project Management, Distribution Construction, and Grid Solutions. Mr. Stevens holds a Bachelor of Political Science from Greensboro College.

Electric Power Storage Battery Pilot Program
Proposal Summary

Proposal: BESS-5 – Outage Mitigation and Grid Support through a Microgrid Capable BESS

I. Location. The utility shall provide the location where the utility proposes to install the BESS. If the utility proposes to install a BESS at a customer premises, the utility shall provide the name and address of the customer, a description of the arrangement with the customer allowing collocation on the customer's property, and a description of the proposed ownership of the BESS.

The proposed BESS will be installed in Chesterfield County at the Company's Electric Distribution Safety & Training facility located at 11501 Old Stage Road, Chesterfield VA 23836. The property is owned by Dominion Energy Virginia. The location was chosen because it will provide the opportunity to pilot the BESS in a grid-forming environment, pair electric vehicle ("EV") charging with a BESS, and provide access to the Company's Electric Distribution training program for use in training technicians on BESS operations and maintenance. See Attachment 1 for a map identifying the location of BESS-5. The location for BESS-5 is identified as the "Proposed Battery Yard" on the map.

II. Capacity. The utility shall provide the capacity of the proposed BESS and the aggregate capacity of all proposals approved by the Commission under the Pilot Program for the utility.

The Company proposes to install a 1.9 MW / 3.8 megawatt-hour ("MWh") alternating current ("AC"")-coupled BESS.

To-date, the Commission has approved 16 MW aggregate capacity under the Pilot Program for the utility in Case No. PUR-2019-00124.

III. Technology. The utility shall specify the proposed BESS technology and the manner in which the BESS will be or has been procured.

The proposed BESS will utilize lithium-ion technology. Lithium-ion batteries have high energy density, low self-discharge, and high round-trip efficiency, which make them good candidates for grid-connected stationary storage.

The BESS is being procured using a competitive request for proposal ("RFP") process that includes a fixed price contract for the purchase of the BESS. The RFP specified that the BESS technology shall meet all requirements of UL 1973 – Standard for Safety Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail Applications and UL 9540 - Standard for Energy Storage Systems and Equipment. In addition, the RFP specified that the bidder shall also submit the test reports for the proposed battery technology consistent with UL

9540a - Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems. Six vendors were invited to submit proposals, of which four (4) provided responses. Each proposal was then reviewed for conformity with the technical and business requirements of the RFP. The selected technology was the Tesla Megapack II XL, which provided the lowest cost option and met all safety standards for the Company.

IV. In-Service Date. The utility shall provide the expected date on which the proposed BESS will be placed into service. The in-service date shall serve as the start date for the BESS as part of the Pilot Program. The proposed BESS will be in service for five years unless the utility has provided notice to repurpose or retire the BESS. Each proposal shall include an explanation by the utility for any proposed use of the BESS beyond the five-year duration of the Pilot Program.

The Company anticipates that the proposed BESS will be in service by third quarter 2025, based upon Commission approval on or before March 31, 2024.

The Company will determine the best use of the BESS after the five-year duration of the Pilot Program based on the performance of the BESS and the information learned from the BESS during the course of the Pilot Program. At this time, the Company anticipates that it will continue to use the BESS for microgrid services, assuming that it remains physically capable of further operation. The Company plans to continue to utilize the BESS for training purposes after the five-year pilot concludes. The Company may also explore other uses, such as voltage regulation, peak shaving, phase balancing, and harmonics mitigation depending on the BESS's capabilities at the end of the Pilot Program.

V. Useful Life and Decommissioning. The utility shall provide the projected useful life of the proposed BESS, including known or projected performance degradation and proposed plan for decommissioning at the end of its useful life.

The projected useful life of the proposed BESS is fifteen (15) years.

All batteries will experience some degradation over the course of their lives based on time in service, usage profile (i.e., how frequently it is used, and for what duration), and aggregate energy discharged.

Decommissioning of the proposed BESS will take place once the system has reached the end of its useful life ("EOL"). The EOL decommissioning will be performed by trained and qualified technical resources to reduce the risk of electrical or chemical hazards. The decommissioning costs have been included in the projected costs.

Lithium-ion battery elements include metals such as copper, aluminum, iron, and lithium. The following is a list of steps and considerations that will be performed to prepare and implement a decommissioning plan that complies with applicable laws, regulations, and other site-specific conditions:

- Identify system components to be decommissioned (e.g., battery system, power control system ("PCS"), transformer, thermal management HVAC unit).

- Where possible, discharge batteries to the lowest state of charge ("SOC") possible before disconnection, transportation, recycling, and disposal.
- Procure tools and equipment necessary to support decommissioning of the system (e.g., fork-lift rental for removal of batteries and racks).
- Remove and package battery racks or battery modules with appropriate dangerous goods (hazardous material) labels for shipment.
- Use certified carrier to transport batteries to vendor for disposal.
- Recycle batteries with authorized recyclers, who will provide certificates of recycling and disposal, including any recycling of other miscellaneous materials.

VI. <u>Cost</u>. **The utility shall provide the projected installation cost of the proposed BESS and a detailed analysis of the projected operation and maintenance ("O&M") cost associated with the proposed BESS. This shall include an appropriate cost metric for evaluation based on the proposed objective(s) of the BESS.**

The total cost for BESS-5 is expected to be approximately $6 million (excluding financing costs), as detailed in Figure 1 below. This equates to $3,175/kW or $1,587/kWh. Annual O&M costs are shown in Figure 1 below. These costs also include projected costs for monitoring, analytics, and reporting.

Figure 1: BESS-5 Cost Breakdown

[EXTRAORDINARILY SENSITIVE INFORMATION REDACTED]

Description	**Cost (1,000s)**
BESS Equipment	[redacted]
Design/Engineering	
Site work/Construction*	
Subtotal	
Contingency (4%)	
Total	**$5,994**

Decommissioning/recycling**	[redacted]
Annual O&M	

* This includes auxiliary equipment needed to install the BESS, which is being provided by the Company.

** Decommissioning is included in the purchase price of the BESS; however, the additional costs shown here reflect the Company's responsibility for paying shipping and handling costs to transport the system back to the vendor at end of life.

VII. <u>Asset Classification</u>. The utility shall indicate its preferred classification of the proposed BESS as a generation, transmission, or distribution asset.

BESS-5 will be classified as a distribution asset.

VIII. <u>Objective</u>. The utility shall specify the objective(s) that the specific proposal will seek to accomplish, including a description of how the specific proposal will accomplish the stated objective(s). Permissible objectives, as listed in Enactment Clause No. 9, include: (i) improved reliability of electrical transmission or distribution systems; (ii) improved integration of different types of renewable resources; (iii) deferred investment in generation, transmission, or distribution of electricity; (iv) reduced need for additional generation of electricity during times of peak demand; or (v) connection to the facilities of a customer receiving generation, transmission, and distribution service from the utility.

The BESS-5 seeks to build on previous pilot projects by showing benefits of battery energy storage as an outage mitigation option, by being the primary back-up power source in the event of a grid outage. By monitoring the grid with an energy controller, the BESS can detect when an outage event occurs and it can activate its inverter grid forming capability, while being isolated from the grid, and provide back-up power for multiple hours to several buildings, if needed. The project will also show "value stacking" abilities by utilizing its inverter grid following capability to provide on-site demand response and reducing peak load times that correlate to decreasing stress on grid equipment and extending the operational life of devices. The BESS will also provide voltage support as a secondary application.

Additionally, the BESS-5 pilot will also be utilized in development of a technician training program to provide training to Company employees on operations and maintenance functions to support the Companies future fleet of BESS deployments. This training program will allow the Company to perform preventative maintenance and system troubleshooting internally, reducing the need for future annual O&M agreements with BESS manufacturers. This program will provide future savings to the Company by developing a trained workforce that can support multiple systems and eliminating the per system costs for annual maintenance. Previous systems have resulted in costs of $25k to $250k per year for O&M services on each individual project. Moreover, O&M services from BESS manufacturers and authorized service contractors cause delay in troubleshooting and recovering the equipment during forced outages due to schedule conflicts and the insufficient workforce. Ultimately the Company looks to reduce or eliminate those costs through the training program that will be developed utilizing the BESS-5 pilot.

The proposed BESS-5 seeks to accomplish the following objectives: (i) improved reliability of electrical transmission or distribution systems; (ii) improved integration of different types of renewable resources; (iii) deferred investment in generation, transmission, or distribution of electricity; and, (iv) reduced need for additional generation of electricity during times of peak demand.

These objectives will be accomplished by the implementation of the following applications:

1. **Primary Application: Grid forming Outage Mitigation**

The BESS will provide back-up power to multiple buildings in the main campus of the DSTC by identifying when an outage has occurred and providing constant voltage and frequency. The BESS will be capable of picking up the load of the campus buildings for multiple hours until the utility power has been restored. By exploring this front of the meter grid-forming application, this project will enhance understanding of microgrid technologies and its impact on the current grid infrastructure.

2. **Secondary Application: Demand Response**

The BESS site controller will be able to receive a signal from The Company's Regional Operations Center (ROC) and be able to drop the buildings connection to the grid and be picked up by the battery. In this manner, system loading relief can be provided without having to decrease customer electricity demand. Also, as a grid following application, a load reduction mode could also be activated where power from the grid is not shut off, but the battery can operate to reduce the power consumption of the buildings and EV chargers, therefore, reducing load stress from the grid and delaying equipment upgrades.

3. **Tertiary Application: Voltage Support**

As a grid following application, the BESS will also use in-house programming to inject or absorb reactive power to/from the distribution grid. When the BESS is operating in this control mode, over-voltage or under-voltage issues will be mitigated. This additional support can improve the overall system reliability by correcting voltage fluctuations at a faster rate than the traditional voltage control equipment that have extended time delays. A by-product of the BESS voltage support will be less operations of traditional voltage control devices, therefore, extending the operational life of the equipment and deferring potential upgrades.

4. **Quaternary Application: Electric Vehicle Charging Station Integration**

When using a grid following mode, BESS-5 will be integrated with the EV charging stations to avoid additional generation of electricity to support peak EV charging demand. The BESS will have a site controller that will receive the aggregate load measurements from EV charging stations. This controller will also monitor the load conditions and will dispatch the BESS, by providing active power injection, to reduce peak load and decrease the power needed from the grid to feed the site based on load conditions. This will reduce the stress on the equipment on the main circuit and up to the substation; therefore, it will showcase the ability to reduce the net load on the circuit and substation transformer.

IX. <u>Metrics and Performance Data</u>. The utility shall provide the initial metrics that will be used to determine if the proposed BESS is meeting the objective(s) that the proposal seeks to accomplish. Initial metrics may include performance and operational safety metrics.

The following metrics will be used to evaluate the performance of the BESS-5:

Round-trip efficiency - All battery storage systems experience losses. These can result from inefficiencies in the conversion of AC to direct current ("DC") or vice-versa, heating/cooling systems needed to keep the BESS within the proper temperature range, and from losses incurred by electronics used to monitor and manage the battery cells. Efficiency can be calculated by comparing the amount of energy released by the BESS to that which it consumes during charging. In addition, the efficiency can be monitored over time to examine if it changes significantly as the BESS ages.

Durability - The storage capacity of batteries declines with use. This degradation is a function of multiple factors, including the services that the BESS provides, how often it charges/discharges, depth of charge, etc. Degradation will be monitored and reported over time to determine if it is consistent with expected operations.

Availability - Availability of the BESS will be measured by comparing the amount of time that the BESS is available for operations to the total amount of time in the study period, which will be compared to industry expected levels of approximately 98%.

Reliability - Reliability of the building(s) the BESS system serves will be monitored. SAIDI minutes will be used to capture the number of interruptions on the circuit the building is fed from and will then be compared to how often the BESS system goes into microgrid mode during each event. For each SAIDI recordable event, the BESS system will output power, for at least 12 hours with a potential to reach a maximum of 30 hours, to prevent a service interruption.

Active Power Contribution – The on-site load will be monitored for both the buildings and the EV charging. When in grid following mode, the BESS will provide active power when it gets local or remote demand response signals. The local signal will be received when the EV charging reaches peak demand, which will trigger the BESS to provide power to reduce the consumption from the grid. The BESS will also provide power to alleviate high load conditions on the circuit/transformer when the ROC sends a remote signal. For both cases, the local power contribution from the grid will be measured and then compared with the potential grid contribution if the battery was not supplying power.

X. Environmental Justice

Assessing potential impacts from a project on disadvantaged communities often involves analysis of demographic data from geographic areas, like census block groups. However, potential adverse environmental effects from small battery energy storage sites like the one being proposed here are typically limited in severity and distance, such that, the majority of residents within the surrounding census block group area(s) would not be affected. Additionally, the

BESS-5 project has been sited on company-owned land adjacent to an existing training center in a state and county designated industrial area with only industrial neighbors. Therefore, potentially affected communities would be limited to Company employees and visitors to the training center, and any employees of nearby businesses.

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Attachment 1

Electric Power Storage Battery Pilot Program
Proposal Summary

Proposal: BESS-6 – Long Duration Energy Storage in a Behind-the-Meter Application

I. Location. The utility shall provide the location where the utility proposes to install the BESS. If the utility proposes to install a BESS at a customer premises, the utility shall provide the name and address of the customer, a description of the arrangement with the customer allowing collocation on the customer's property, and a description of the proposed ownership of the BESS.

The proposed BESS will be installed **[BEGIN CONFIDENTIAL INFORMATION]** [redacted]

[redacted]

[END CONFIDENTIAL INFORMATION]

II. Capacity. The utility shall provide the capacity of the proposed BESS and the aggregate capacity of all proposals approved by the Commission under the Pilot Program for the utility.

The Company proposes to install a 1.5 MW / 15 megawatt-hour ("MWh") alternating current ("AC")-coupled BESS. To-date, the Commission has approved 16 MW aggregate capacity under the Pilot Program for the utility in Case No. PUR-2019-00124.

III. Technology. The utility shall specify the proposed BESS technology and the manner in which the BESS will be or has been procured.

The proposed BESS will utilize non-lithium ion technology. Lithium-ion batteries have high energy density, low self-discharge, and high round-trip efficiency, which make them good candidates for grid-connected stationary storage. However, like any form of technology, it would be ideal to utilize multiple different forms of battery storage. As a result, it is imperative to explore different, emerging chemistries to be utilized in a grid-scale battery.

The proposed BESS will be procured through a contract with the manufacturer, EnerVenue. In selecting the technology for this pilot, Dominion Energy Virginia partnered with the Electric Power Research Institute, Inc ("EPRI") to evaluate nine (9) different non-lithium ion BESS technologies. EPRI was brought in as part of the evaluation due to their extensive reach into the electric utility industry that can provide valuable insight into how emerging BESS technologies work. The evaluation process included a review of safety qualifications, estimated costs, physical footprint for space requirements, technology chemistry, self-discharge rates and cycle rates. The EnerVenue system provided the unique capability to be cycled multiple times per day when necessary while also maintaining a low self-discharge rate when idle for long periods of time to be available for backup power support. Additionally, the promising results from initial safety testing for the EnerVenue system indicated a potential ability to site the system on customer property with a lower safety equipment footprint. These factors helped the Company select EnerVenue as the BESS manufacturer for this project.

EnerVenue utilizes a nickel-hydrogen chemistry for their batteries. This chemistry has shown to be a proven technology, with over 50 years being deployed by NASA as a long-duration battery. The battery chemistry has a unique ability to showcase a high safety profile, with no thermal runaway or fire propagation risk being displayed during an open-flame test. These observations are validated by UL 9540A testing and cell-level testing that has been completed. This higher safety profile is in contrast with other battery technologies, which historical experience shows have a higher risk profile that require more expansive safety equipment to mitigate. This makes EnerVenue's BESS a unique fit for a customer-sited battery storage solution.

IV. In-Service Date. The utility shall provide the expected date on which the proposed BESS will be placed into service. The in-service date shall serve as the start date for the BESS as part of the Pilot Program. The proposed BESS will be in service for five years unless the utility has provided notice to repurpose or retire the BESS. Each proposal shall include an explanation by the utility for any proposed use of the BESS beyond the five-year duration of the Pilot Program.

The Company anticipates that the proposed BESS will be in service by December 31, 2027, based upon Commission approval on or before March 31, 2024.

The Company will determine the best use of the BESS after the five-year duration of the Pilot Program based on the performance of the BESS and the information learned from the BESS during the course of the Pilot Program. At this time, the Company anticipates that it will continue to use the BESS for outage support beyond the five-year pilot duration. The Company may also explore other uses, such as voltage regulation, peak shaving, phase balancing, and harmonics mitigation depending on the BESS's capabilities at the end of the Pilot Program.

V. Useful Life and Decommissioning. The utility shall provide the projected useful life of the proposed BESS, including known or projected performance degradation and proposed plan for decommissioning at the end of its useful life.

The projected useful life of the proposed BESS is thirty (30) years.

All batteries will experience some degradation over the course of their lives based on time in service, usage profile (i.e., how frequently it is used, and for what duration), and aggregate energy discharged.

Decommissioning of the proposed BESS will take place once the system has reached the end of its useful life ("EOL"). The EOL decommissioning will be performed by trained and qualified technical resources to reduce the risk of electrical or chemical hazards. The decommissioning costs have been included in the projected costs.

Nickel-hydrogen battery elements include multiple different types of metals. The following is a list of steps and considerations that will be performed to prepare and implement a decommissioning plan that complies with applicable laws, regulations, and other site-specific conditions:

- Identify system components to be decommissioned (e.g., battery system, power control system ("PCS"), transformer).
- Where possible, discharge batteries to the lowest state of charge ("SOC") possible before disconnection, transportation, recycling, and disposal.
- Procure tools and equipment necessary to support decommissioning of the system (e.g., fork-lift rental for removal of batteries and racks).
- Remove and package battery racks or battery modules with appropriate dangerous goods (hazardous material) labels for shipment.
- Use certified carrier to transport batteries to vendor for disposal.

- Recycle batteries with authorized recyclers, who will provide certificates of recycling and disposal, including any recycling of other miscellaneous materials.

VI. Cost. **The utility shall provide the projected installation cost of the proposed BESS and a detailed analysis of the projected operation and maintenance ("O&M") cost associated with the proposed BESS. This shall include an appropriate cost metric for evaluation based on the proposed objective(s) of the BESS.**

The total cost for BESS-6 is expected to be approximately $14.4 million (excluding financing costs), as detailed in Figure 1 below. This equates to $9,610/kW or $961/kWh. Annual O&M costs are shown in Figure 1 below. These costs also include projected costs for monitoring, analytics, and reporting.

Figure 1: BESS-6 Cost Breakdown

[EXTRAORDINARILY SENSITIVE INFORMATION HIGHLIGHTED IN GREEN]

Description	**Cost (1,000s)**
BESS Equipment	[redacted]
Design/Engineering	[redacted]
Site work/Construction*	[redacted]
Technology Integration Support and Analysis	[redacted]
Subtotal	[redacted]
Contingency (4%)	[redacted]
Total	**14,415**

Decommissioning/recycling**	[redacted]
Annual O&M***	[redacted]

* This includes auxiliary equipment needed to install the BESS, which are being provided by the Company.

** Decommissioning is included in the purchase price of the BESS; however, the Company is responsible for paying shipping and handling costs to transport the system back to the vendor at end of life.

***Annual O&M begins year 4. O&M costs for years 1-3 included with the equipment purchase.

VII. <u>IIJA Participation.</u>

[BEGIN CONFIDENTIAL INFORMATION] [redacted]

[redacted]

[redacted]

[redacted] END CONFIDENTIAL INFORMATION]

The DOE selected the project for a full evaluation and "selection interview" in July of this year and final awards notifications are expected in Q3 2023.

VIII. <u>Asset Classification</u>. The utility shall indicate its preferred classification of the proposed BESS as a generation, transmission, or distribution asset.

The BESS will be classified as a distribution asset.

IX. **<u>Objective</u>. The utility shall specify the objective(s) that the specific proposal will seek to accomplish, including a description of how the specific proposal will accomplish the stated objective(s). Permissible objectives, as listed in Enactment Clause No. 9, include: (i) improved reliability of electrical transmission or distribution systems; (ii) improved integration of different types of renewable resources; (iii) deferred investment in generation, transmission, or distribution of electricity; (iv) reduced need for additional generation of electricity during times of peak demand; or (v) connection to the facilities of a customer receiving generation, transmission, and distribution service from the utility.**

The proposed Campus Energy Solutions project looks to expand upon previous pilot projects by displaying the benefits of long-duration, non-lithium-ion battery storage as a source of emergency backup power. By serving as a backup power source, the long-duration energy storage ("LDES") system will improve reliability for the Multipurpose Center by discharging its stored energy during times when the utility feed is lost. Furthermore, the LDES system will have the ability to be dispatched at times when peak time consumption is identified, thereby decreasing the amount of real power drawn from the grid necessary to meet demand. The benefit of reducing demand goes far beyond local load relief. The project will show "value stacking" abilities by reducing peak load times that correlate to decreasing stress on grid equipment and potentially extending the operational life of devices.

In addition to tangible grid support benefits, the proposed project will also increase community engagement by showcasing emerging technologies to the students at the university. This will provide a unique opportunity to generate interest in clean energy technologies for students at the start of their career journey and enhance their desire to become directly involved in the country's transition to a clean energy grid.

The proposed project seeks to accomplish the following objectives: (i) improved reliability of electrical transmission or distribution systems; (iv) reduced need for additional generation of electricity during times of peak demand; and (v) connection to the facilities of a customer receiving distribution service from the utility.

The objectives will be accomplished by the implementation of the following applications:

1. **Primary Application: Behind-the-meter Non-Lithium Ion BESS Long Duration Energy Storage**

Utilizing a non-lithium ion BESS enhances understanding and integration of new energy storage technology. By utilizing a nickel hydrogen battery as the chosen battery chemistry, more options for battery storage technology will be explored for potential future mass deployment. Furthermore, by exploring long duration energy storage as opposed to standard duration, reliability can be improved for the site during longer duration unplanned outages (such as during major storms). Success of this application will potentially allow exploration of providing a long duration, clean energy power source for critical customers in the future.

2. **Secondary Application: Outage Mitigation with Grid-Forming Inverter**

The BESS site controller will detect a loss of the main utility feed and once detected, isolate the campus building from the grid and form a small microgrid. This will allow for reliable and stable power to continue to be provided to the building during an outage. By exploring a grid-forming application, this project will enhance understanding of microgrid technologies and allow for deployment of microgrids in the future to increase grid reliability at other sites.

3. **Tertiary Application: Demand Response**

The BESS site controller will be able to receive a signal from the Company's Regional Operations Center (ROC) and be able to drop the building's connection to the grid and be picked up by the battery. In this manner, system loading relief will] be provided without having to decrease customer electricity demand. Also, as a grid following application, a load reduction mode could be activated where power from the grid is not shut off, but the battery can operate to reduce the power consumption of the building. This will decrease load stress from the grid and delay equipment upgrades.

4. **Quaternary Application: Voltage Support**

As a grid following application, the BESS will Inject or absorb reactive power to/from the distribution grid. When the BESS is operating in this control mode, over-voltage or under-voltage issues will be mitigated. This additional reactive power support can improve the overall system reliability by correcting voltage fluctuations at a faster rate than the traditional voltage control equipment that have extended time delays. A by-product of the BESS voltage support will be less operations of traditional voltage control devices, therefore, extending the operational life of the equipment and deferring potential upgrades.

5. **Quinary Application: Integration with Back-Up Diesel Generator**

The BESS shall interact with an existing diesel generator by prioritizing the stored energy of the BESS over the generator in grid-forming mode. When the BESS isolates from the grid and forms a microgrid, it will provide the power necessary to serve the microgrid. Only if/when the BESS runs out of stored energy would the existing diesel generator be used. In this way, a source of clean energy will be utilized to serve the building instead of a more carbon-intensive diesel generator.

X. Metrics and Performance Data. The utility shall provide the initial metrics that will be used to determine if the proposed BESS is meeting the objective(s) that the proposal seeks to accomplish. Initial metrics may include performance and operational safety metrics.

The following metrics will be used to evaluate the performance of the BESS:

Round-trip efficiency - All battery storage systems experience losses. These can result from inefficiencies in the conversion of AC to direct current ("DC") or vice-versa, heating/cooling systems needed to keep the BESS within the proper temperature range, and from losses incurred by electronics used to monitor and manage the battery cells. Efficiency can be calculated by comparing the amount of energy released by the BESS to that which it consumes during charging. In addition, the efficiency can be monitored over time to examine if it changes significantly as the BESS ages.

Durability - The storage capacity of batteries declines with use. This degradation is a function of multiple factors, including the services that the BESS provides, how often it charges/discharges, depth of charge, etc. Degradation will be monitored and reported over time to determine if it is consistent with expected operations.

Availability - Availability of the BESS will be measured by comparing the amount of time that the BESS is available for operations to the total amount of time in the study period, which will be compared to industry expected levels of approximately 98%.

Reliability - Reliability of the building the BESS serves will be monitored. SAIDI minutes will be used to capture the number of interruptions on the main circuit the building is fed from and will then be compared to how often the BESS system goes into microgrid mode during each event. For each SAIDI recordable event, the BESS system will output power for at least 10 hours to prevent a service interruption for the building it serves.

Backup Generator Uses - The site is currently equipped with an on-site backup diesel generator to mitigate outages. With ethe proposed BESS being designed to provide backup power, the number of uses for the backup generator should decrease after the proposed system is online, ideally to zero uses each year.

XI. Environmental Justice

Assessing potential impacts from a project on disadvantaged communities often involves analysis of demographic data from geographic areas, like census block groups. However, potential adverse environmental effects from small, long-duration energy storage (LDES) facilities like the one being proposed here are typically limited in severity and distance, such that, most residents within the surrounding census block group area(s) would not be affected. Additionally, the projects will be sited on **[BEGIN CONFIDENTIAL INFORMATION]** [redacted]

[redacted]

[redacted] **END CONFIDENTIAL INFORMATION]**. It is situated alongside an existing parking lot for the building; the nearest residential buildings are more than 200 feet away on the opposite side of a 4-lane road with a treed median. The facility will be surrounded by a wall style fence that, along with the existing vegetation, will screen the equipment from view while still showcasing the technology through signage and displays. [

Overall, there is no expectation of significant adverse environmental impacts to any surrounding community or EJ community from an LDES facility. However, temporary construction and traffic along with permanent and minor viewshed and noise impacts are possible. Noise from storage sites is described as a low hum, well below a typical backup generator volume.

[BEGIN CONFIDENTIAL INFORMATION] [redacted]

[redacted]

[redacted]

[redacted] **[END CONFIDENTIAL INFORMATION]**