Petition No. 1658
VFS, LLC
University of Connecticut
44 Weaver Road, Storrs (Mansfield), Connecticut

Interrogatories
May 1, 2025

Notice

1. Has VFS, LLC (VFS) received any comments since the petition was submitted to the Council? If so, summarize the comments and state how these comments were addressed.

R1. CT. DEEP has responded and VFS met with representatives from DEEP, and UConn on-site to discuss the project.

Project Development

2. What is the estimated cost of the proposed project?

R2. $2750000.00

3. If the project is approved, identify all permits necessary for construction and operation?

R3. An interconnection application has been submitted to Eversource and is under review. A building permit will be applied for with the UConn Building Dept.

4. Does VFS intend to enter the battery energy storage facility (BESF) into the Energy Storage Solutions Program?

R4. Yes.

5. Referencing Petition p. 4, would the proposed BESF support any of UCONN's green energy goals and objectives, such as its Master Green Energy Plan referenced on p. 3 of Petition 1630: https://portal.ct.gov/csc/3_petitions/petition-nos-1601-1700/pe1630 ?

R5.Yes

6. Referencing Petition p. 4, does the "existing fuel cell" refer to the replacement Doosan Model 400 fuel cell facility in Exempt Modification VFS-078-220321e, approved by the Council in 2022? If not identify the fuel cell that would interconnect with the proposed BESF and provide its generating capacity?

R6. The Fuel Cell referenced in the petition is the replacement fuel cell.

7. Referencing Petition p. 4, the proposed BESF would store excess energy from the existing fuel cell and solar array.
    a) What is the combined generating capacity of the existing fuel cell and solar array?
    Ra. The Fuel Cell produces 460 kW. The solar array is for educational purposes and is not grid connected.
    b) Do the fuel cell and/or solar array serve specific buildings or do they contribute energy to the main UCONN Depot Campus energy supply?
    Rb. The Fuel Cell is grid connected.
    c) If specific building(s), which building(s)? What is the energy baseload (by percentage) of the building(s) provided by these existing facilities?
    Rc. The Fuel Cell is grid connected.

d) Would the BESF be directly connected to existing fuel cell and solar array? If directly connected to the BESF, what energy losses occur due to the transfer of energy from the fuel cell and solar array to the BESF?

Rd. The BESF will be connected to the Depot campus distribution system and not to the fuel cell or solar array directly.

e) Would the BESF provide energy to a specific building or buildings or connect to the main UCONN Depot Campus energy supply? Identify the building(s), if applicable.

Re. The BESF will be connected directly to the Depot campus electrical distribution system.

8. Would any other on-campus generation resources interconnect with the proposed BESF? Would additional interconnections require a larger BESF?

R7. No. There are no additional interconnections at this time.

9. If VFS transfers the facility to another entity, would VFS provide the Council with a written agreement as to the entity responsible for any outstanding conditions of the Declaratory Ruling and quarterly assessment charges under CGS §16-50v(b)(2) that may be associated with this facility, including contact information for the individual acting on behalf of the transferee?

R8. Yes. VFS will provide any required contact information for a new entity and VFSD will retain operational control of the Facility for the full 18 year term.

Proposed Site

10. Submit a map clearly depicting the boundaries of the BESF site. Under Regulations of Connecticut State Agencies (RCSA) §16- 50j-2a(29), "Site" means a contiguous parcel of property with specified boundaries, including, but not limited to, the leased area, right-of-way, access and easements on which a facility and associated equipment is located, shall be located or is proposed to be located.

R10. Once an A2 survey is conducted this will be provided to the Council prior to construction.

11. Provide a site plan with more detail that includes but is not limited to, erosion and sediment controls, limit of disturbance, electrical interconnections, access drive, and facility layout.

R11. A full set of design drawings including erosion and sedimentation controls plans are being developed. Limits of disturbance are less than one acre including trenches.

12. Submit photographs of the proposed site with descriptive captions and/or a map identifying the locations of the photographs.

13. Provide the following:
    a) distance of the nearest building from the nearest part/corner of the battery container.
    Ra. 125' from the CT. Global Fuel Cell Center.
    b) distance of the nearest off-campus residence and residential property line from the nearest part/corner of the battery container; and
    Rb. Over 1200' from 196 Bone Mill Rd.
    c) distance to the nearest on-campus residential building.
    Rc. There are no on-campus residential buildings on the Depot campus.

Proposed Facility and Associated Equipment

14. Petition p. 3 indicates Stark Tech will manufacture the battery storage unit. Petition Attachment 2 indicates the battery units are manufactured by Hithium. Clarify.

R14. Hithium manufactures lithium iron phosphate cells. Stark Tech fabricates the BESF unit as a whole.

15. Referencing Petition p. 4, provide the number of battery racks per battery storage unit, the number of battery modules per battery rack and the number of battery cells per battery module.
R15. There are 8 battery racks per battery storage unit, with one module per rack. Each battery module contains 48 battery cells. There are 5 total units within the container.

16. Provide a specification sheet for the selected battery storage unit.
R16. See attached Spec. sheet.

17. Referencing Petition Attachment 2, why was the 04HC-0344-DC battery selected for this project? What battery chemistry is used in the 04HC-0344-DC battery unit? (e.g. lithium-iron phosphate)
R17. These models meet all industry-standard certifications, including UL9540, and are equipped with an aerosol fire suppression system. Lithium-iron phosphate reduces cell to cell propagation and fire hazard.
18. Would the BESF include night lighting? If yes, for what purpose and how is it activated?
R18. Site lighting will be provided in the BESF yard to allow servicing at night and will be controlled with a site mounted switch.

Energy Output

19. Petition pp. 1 and 3 reference an energy storage capacity of 1,720 kWh for the proposed BESF. Provide the nominal/rated power capacity (maximum rate of discharge in kilowatts) and storage duration (discharge time at rated power in hours) of the BESF.
R19. Discharge rate 850kw, 2 hour discharge rate

20. What is the recharge interval and what factors are considered for the recharge interval? Explain.
R20. Per Battery Manual, once a year, entire cabinet will experience a full discharge and recharge. Normal charge and discharge interval is listed in the manual as monthly. Long term storage charge and discharge is listed in the manual as not operating for greater than 3 months. In the event of long term unuse, the state of charge is to be maintained between 20% and 50%.
21. Referencing Petition p. 4, in addition to excess energy from the existing fuel cell facility and solar array, would the BESF also store energy from the electrical grid?
R21. No. The microgrid controller will initiate charging when excess energy is available from the existing fuel cell.
22. If the BESF is dispatched to discharge its full charge, would any of the battery export capacity be held in reserve to prolong battery life?
R22. The battery will maintain nominal level of charge when at "0 capacity" to prolong battery life by design of the cell manufacturer.

23. What storage capacity losses are anticipated for ambient temperatures below freezing?
R23. No loss of charge is anticipated at ambient temperatures below freezing for the project location. The Battery HVAC will provide adequate heating of the unit at temperatures above –4 Fahrenheit. The Battery will continue to operate to a low of -40 Fahrenheit, with minor trickle discharge effects.
24. What is the discharge cycle for the 04HC-0344-DC battery units e.g. 2-hour or 4-hour?
R24. 2 hours
25. Would the proposed facility be able to supply power to the local distribution grid if all or a portion of stored power is not used at the UCONN Depot Campus?
R25. No.

Electrical Interconnection

26. Has VFS submitted an interconnection application to the utility company? If yes, what is the status? If no, is an interconnection review and approval required?

R26. Yes, an interconnection application has been submitted and is under review by Eversource.

27. How would the BESF interconnect with the existing fuel cell and solar array?

R27. The BESF will be connected in parallel with the distribution circuitry on the campus. The solar array is not connected to the distribution circuitry and is used as an educational tool.

Public Health and Safety

28. Would the project comply with the current Connecticut State Building Code, Connecticut State Fire Prevention Code, National Electrical Code (NEC) and the National Electrical Safety Code (NESC)? What codes and standards apply to battery storage facilities?

R28. The project complies with the 2022 Connecticut State Fire Prevention Code, Chapter 12, Section 1207 Electrical Energy Storage Systems (ESS) and National Electrical Code (NEC), Article 706. The BESF is listed in accordance with UL 9540. **NFPA 855

29. What security measures would be employed to protect the BESF from vandalism or intrusion?

R29. An 8' chain link fence with locked gates will be utilized for security.

30. Would VFS provide on-site training to UCONN personnel and local emergency responders?

R30. VFS always offers on site training for all first responders.

31. Provide a draft emergency response plan specific to the proposed facility that incorporates most recent emergency response guidance from fire safety organizations, the manufacturer, the UCONN Fire Marshal and comments from the local fire department.

R31. VFS and Kinsley are working with the UConn Fire Marshal and facilities management to draft an Emergency Response.

32. Describe how emergency contact information would be made available at the site. Where will written copies of the Emergency Response Plan be located?

R32. Emergency response contact info will be mounted on the fenced enclosure and the Emergency response plan will be on file with the UConn Fire Marshals office and the UConn fire Dept.

33. Referencing Petition p. 3, would the aerosol-based fire suppression system be installed within the battery cabinets? Are aerosol-based fire suppression systems effective in extinguishing a battery fire?

R33. FirePro, see attached documentation. Lithium-Iron Phosphate Batteries require class D fire extinguishers.

34. What is the typical duration of a battery fire before it self-extinguishes?

R34. Lithium Iron Phosphate (LFP) batteries are incombustible, meaning they will not burn when exposed to fire. This is verified through the UL9540 testing.

35. Referencing Petition p. 3, provide more information on how Prismatic LFP cell chemistry prevents thermal runaway.

R35. LFP chemistry has a negative alpha-T coefficient. A spike in temperature doesn't cause enough for adjacent cells to combust.

36. Referencing Petition p. 4.
    a) Would smoke from a battery unit fire be considered hazardous and require notification to state and local authorities?

    Ra. Smoke from the battery unit fire should be considered hazardous to local emergency responders, but it does not require any additional notification to authorities.

b) Would smoke from a battery unit fire require area residences to stay in place or evacuate? If yes, who would determine if these actions are necessary and who ensures notifications have been made?
Rb. It would be recommended that residents stay in place in the event of a battery unit fire. Notification to remain in place will be made by local emergency responders.

c) Would the Emergency Response Plan contain a map with addresses of all properties requiring evacuation and/or isolation for certain types of emergencies? What methodology was used to determine the size of the evacuation and isolation zones?
Rc. The Emergency Response Plan would contain a map with addresses requiring isolation in the event of a battery fire. This list includes all residences within 300 feet of the BESF. Individuals at the property should evacuate to a minimum of 150 feet from the BESF and remain indoors when possible. These distances are determined by best practice and manufacturer recommendation.

d) What type of emergency would require the evacuation of all people downwind of the BESF? To what distance from the BESF would evacuation take place in the event of a fire?
Rd. Evacuation for individuals outdoors and downwind of the BESF may be extended to a minimum of 300 feet by local emergency responders if it is determined that the smoke is carrying beyond the initial evacuation zone.

e) Provide an aerial image showing the limits of evacuation and isolation zones.
Re. A representative map is attached. Once the exact final location is determined by UConn an updated site layout showing accurate limits will be given to the council.

37. Are there municipal or UCONN fire water sources located in the immediate vicinity of the proposed facility for response tie-in in the event of a fire? Explain.
R37. Hydrants are located throughout the Depot campus.

38. What is the manufacturer's recommended minimum distance of a battery storage unit to a publicly accessible area?
R38. The Manufacturer recommends 10' minimum clearance to publicly accessible areas.

39. What are the industry Best Management Practices for Electric and Magnetic Fields at battery storage facilities?
R39. Any magnetic interference generated will be subterranean. Electrical interference will be dissipated through proper shielding and grounding practices on the chassis.

Commented [JR1]: update

40. Would the facility be designed with animal deterrents to prevent damage from chewing, nest building, etc.? If yes, describe.
R40. There are no intentional deterrents designed into the BESF however the container housing the system would prevent intrusion. All ventilation openings in the containment will be securely screened.

41. Referencing Petition p. 3, identify the liquid coolant (e.g. water and ethylene glycol). Is the coolant toxic/hazardous? At what operational interval does the coolant require replacement? Does the BESF include a coolant containment system and/or low-level detection system?
R41. 50/50 ethylene glycol-water. If there was a leak in battery side, it would self-contain in the cabinet. Low level detection by loss of pressure.

42. Referencing Petition p. 4, what BESF systems provide 24/7 monitoring? Is there a manned operations center that would perform sensor analysis? Describe how information regarding site operations is relayed to emergency responders, UCONN contacts, and BESF maintenance personnel.
R42.The GridMind integrated controller provides 24/7 availability. A fault would automatically be identified and notification provided at the building management system and to a service

provider. Specific notifications for the UConn fire dept. and UConn Facilities Dept. will be further refined in the final design as required by UConn.

Environmental Effects and Mitigation Measures

43. Referencing Petition Attachments 3 and 7, the site location designations on the respective maps do not match. Clarify.
R43. See attached aerial map for correct location.

44. Is tree clearing proposed for the site? If yes, provide the number of trees greater than 6-inches diameter at breast height.
R44. There is no tree clearing expected for the construction of the Facility

45. Are there any wells on the site or in the vicinity of the site? If so, how would VFS protect the wells and/or water quality from potential construction and operational impacts?
R45. There is an abandoned capped concrete wellhead some 100' from the site which is some 3' above grade. Water service to the campus is provided by a subsidiary of CT. Water Co. from remote off-site well fields.

46. Referencing Petition p. 6, is the site within a water supply aquifer?
R46. Referring to CT. DEEP Aquifer Protection Area Map dated December 23, 2021, the BESF does not fall into the Aquifer Protection areas defined for Mansfield.

47. Referencing Petition p. 6, is the site within a Community Public Water System?
R47. The site is served by two well fields, the Fenton River Wellfield and the Willimantic River Wellfield. Both are owned by UConn and maintained by New England Water Utilities which is a subsidiary of CT. Water Co. Under contract with UConn.

48. Is there a drainage ditch or wetland area east of the site? If yes, what is the distance from the site to this resource?
R48. There is a turf covered swale some 100' from the proposed Facility. There are no wetlands on or near the proposed Facility site.

49. Provide an aerial photograph that clearly shows the BESF location.
R49. See attached aerial photo

50. Is any portion of the proposed facility site on prime farmland soils? If yes, what is the area of prime farmland soils that would be impacted by development of the project?
R50. The site does not contain any Prime Farmland. The proposed Facility was part of a previously developed facility for the developmentally disabled prior to UConn assuming ownership sometime in the mid 1990's. The property is now used for academic purposes.

Facility Construction

51. What is the land area of the limit of disturbance?
R51. Less than one acre.

52. Would construction comply with the *Connecticut Soil Erosion and Sediment Control Guidelines*, effective March 30, 2024?
R51. Yes. A complete Erosion and Sedimentation Control plan will be included in the final design drawings and will be reviewed and approved by UConn. Prior to construction.

53. Submit a site-specific Fuel Storage and Spill Prevention Control Plan for site construction and operation with worker training and contact information including, but not limited to, regulatory agencies, spill cleanup contractors, and emergency responders.
R52. A full Spill Prevention Control plan will be submitted to the Council and UConn Facilities Dept. prior to the start of construction.

54. Quantify the amounts of cut and fill that would be required to construct the proposed facility. If there is excess cut, will this material be removed from the site or deposited on the site?
R54. Cuts and fills cannot be defined at this time. Geotechnical borings are scheduled to be performed soon. Once the analysis is received an accurate calculation can be performed. As with other project VFS is involved with on the campus, UConn Facilities has provided an area where spoils can be stored for the Universities use in the future. No materials will be removed from campus during the construction process.

55. Where will runoff from the BESF compound be directed? What feature would collect and divert water?
R55. The relatively small amount of storm water draining from the slab would be directed to a stone lined swale.

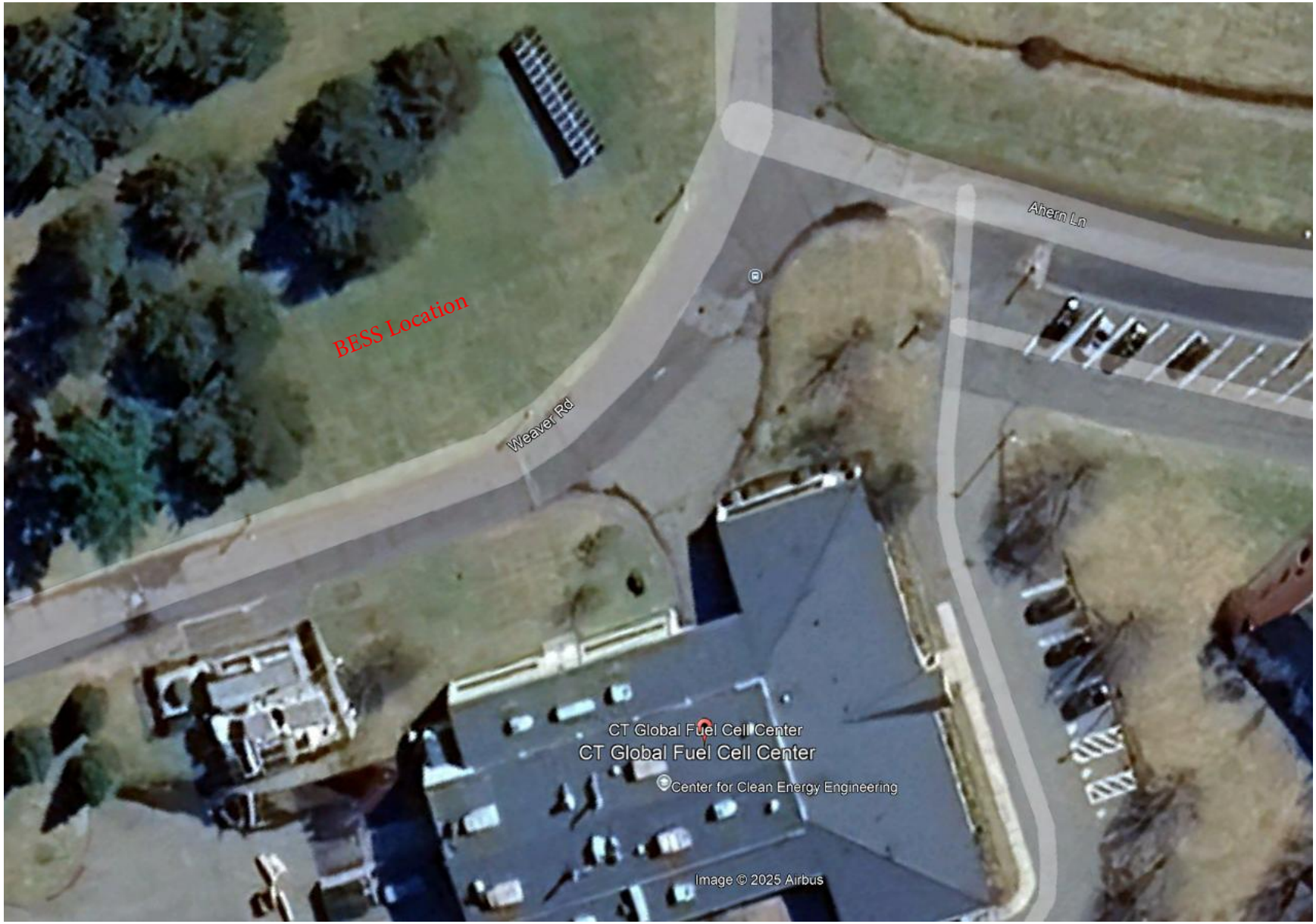
56. What is the anticipated BESF in-service date?
R56. Q3, 2025

Facility Maintenance/Decommissioning

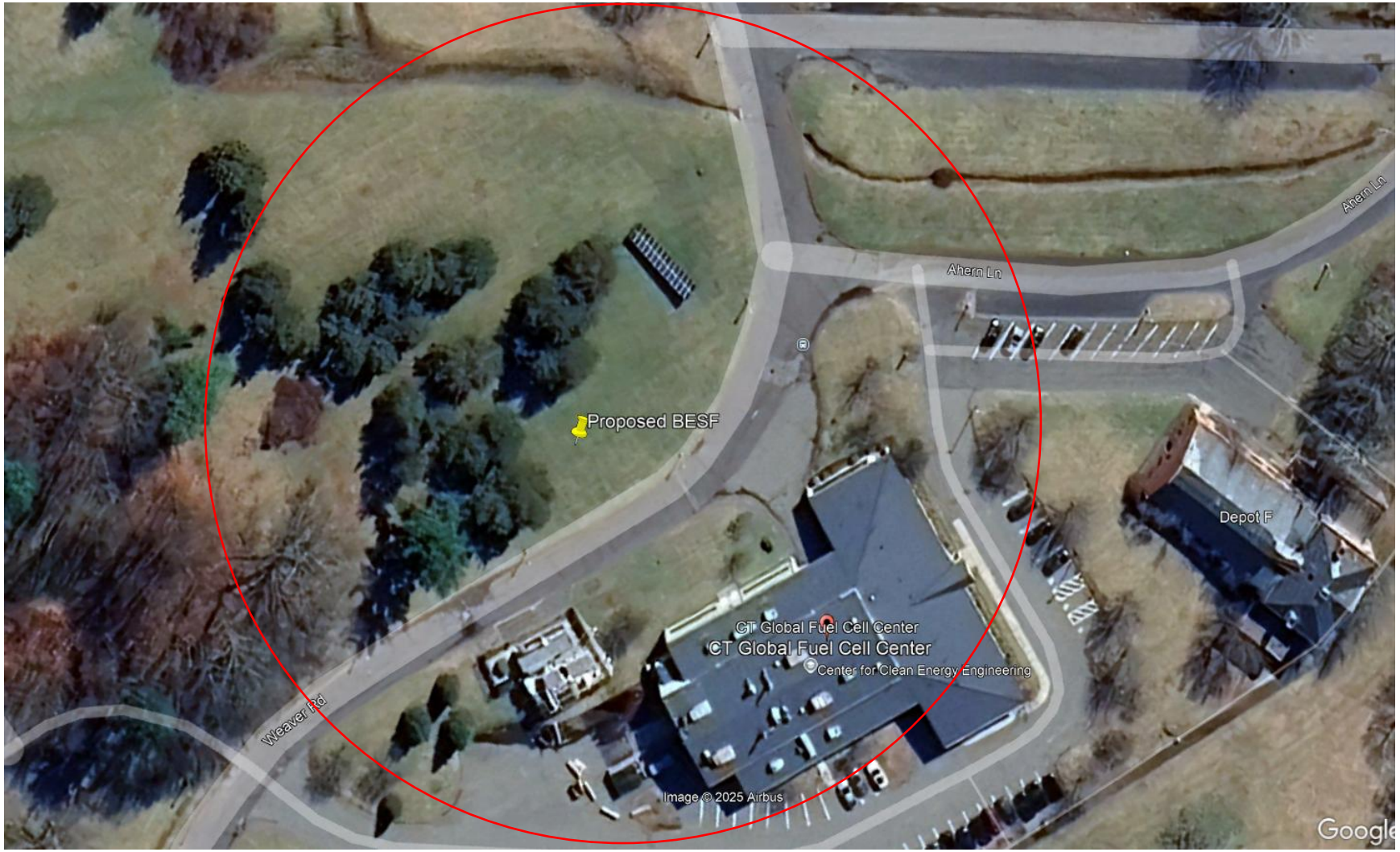
57. Provide a site Operation and Maintenance Plan.
R57. See Attached.
58. Provide the following information:
    a) What is the anticipated annual degradation of battery storage capacity?
    Ra. Battery degradation is roughly 1.2% per year.
    b) At what operational interval is battery capacity is replenishment recommended?
    Rb. Batteries are designed to go to 0%. Depth of discharge can be specified at time of order, and the standard is 100%. Batteries that reach 30% will need to be recharged. Batteries will need to be replaced PER a full rack, individual modules and cells cannot be replaced at this time.
    c) What is the estimated cost of replenishment?
    Rc. Depending on peak demand and the time the charging discharging occurs, replenishment costs for charging / discharging also depend on the use of the BESF.

~~59.~~ What minimum snow depth would require removal within the BESF compound? At what height could snow block the airflow to the chiller and/or electronic compartments? Who would be responsible for snow removal for the access drive and within the compound?
R59. 18"

~~60.~~ At what time intervals would the transformer, inverter and switchgear need replacement?
R60. Transformer, switchgear have an expected life span exceeding 20 years. The inverters have an expected service life of 10yr warranty, 20yr lifespan


BESS Location
Weaver Rd
Ahern Ln
CT Global Fuel Cell Center
CT Global Fuel Cell Center
Center for Clean Energy Engineering
Image © 2025 Airbus

Aerial Map


Proposed BESF
Ahern Ln
Ahern Ln
Depot F
CT Global Fuel Cell Center
CT Global Fuel Cell Center
Center for Clean Energy Engineering
Weaver Rd
Image © 2025 Airbus
Google

300' Radius

From Weaver Rd and Ahern Rd. looking North towards the site

From Weaver Rd. looking South with fuel cell on right

From Weaver Rd. looking South towards the site

Microgrid on a Skid

What a Microgrid on a Skid Includes:

- Auxiliary Connections
- Controls / Dispatch
- Protective Relaying
- Renewables Integration
- Battery
- Bi-directional Inverter
- Switchgear
- Transformer

Power
reStored.

Product Overview

The Microgrid on a Skid (MGS) is a pre-engineered microgrid designed to seamlessly fit any application. MGS is purpose-built to be the multi-tool of microgrid solutions, bringing unparalleled reliability and speed to value.

With up to 1.5MWh of energy storage per skid, systems are ready to power for multiple use cases:

- Demand Response
- Frequency Response
- Power Factor Correction
- Resiliency
- Decarbonization
- Renewables Smoothing
- Energy Arbitrage
- Resource Adequacy
- Critical Load Support
- Backup Power
- MEP 2040 Design

Single Unit Specifications:

- Up to 1500kWh @ 750kVA
- Handles all standard interconnection voltages
- Full microgrid control functionality

Key Features

- Factory integrated and tested
- Designed and manufactured in the USA
- Virtual power plant enabled
- Economic dispatch software & modeling standard
- Configurations for any application
- Fully functioning microgrid
- Fits in a standard parking space
- Cuts installation costs by up to 65% & installation time by 85%
- 24/7 remote monitoring

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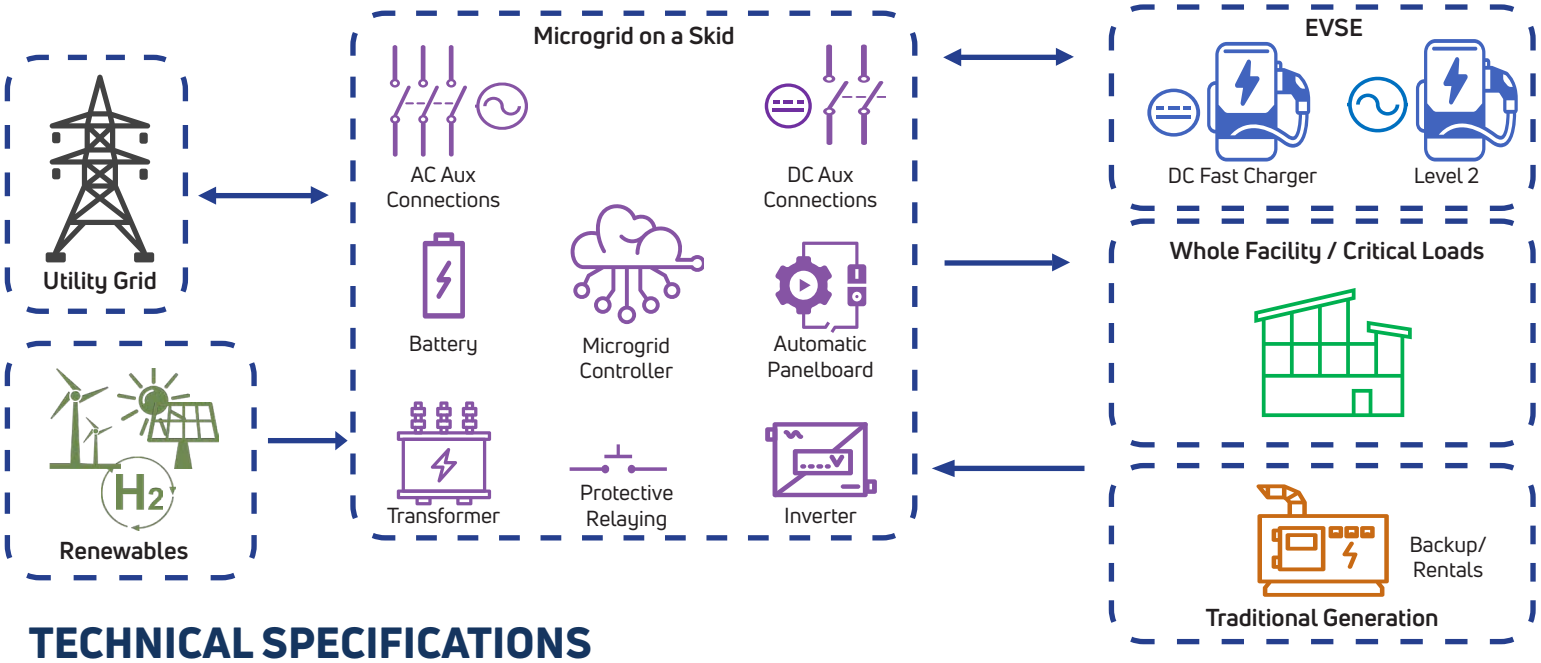
Benefits of Microgrid on a Skid

Microgrids make it possible for the lights to stay on when the power goes out. For moderate-to-large energy consumers, this means ensuring uptime of business-critical loads, all while reducing operating costs and meeting sustainability goals. Systems are shipped to the site pre-built and pre-tested with a single point of connection to the facility, reducing overall project costs and installation time substantially. Implementing a microgrid has never been easier than it is now. Microgrid on a Skid is safe, fast, and reliable.



TECHNICAL SPECIFICATIONS

Item	MGS-0344-XX	MGS-0688-XX	MGS-1032XX	MGS-1376-XX	MGS-1472-XX
System Specifications					
Max Sustained Power	172 kW / kVA	344 kW / kVA	516 kW / kVA	688 kW / kVA	736 kW / kVA
Nominal Energy	344kWh	688kWh	1032kWh	1376kWh	1472kWh
Communication Interferences	RS485, Ethernet, GPRS				
Ambient Operating Temp Range	-13F to 113F				
Communication Protocols	DNP3.0, Modbus, IEC103, IEC104, Web API				
Onboard Controls	Full microgrid and site control				
Degree of Protection	IP54				
Dimension (L*W*H*)	9'L x 12'W x 11.5'H	9'L x 15'W x 11.5'H	9'6"L x 15'W x 11.5'H	9'6"L x 19'W x 11.5'H	9'6"L x 19'W x 11.5'H
Weight	10,890lb	19,200lb	27,700lb	36,500lb	39,900lb
DC Specifications					
Cell Capacity	3.2V / 280 AH				
Battery Chemistry	Lithium Iron Phosphate (LFP)				
Rated Cell Life	70% Retention at 10,000 cycles (0.5C at 77F)				
Rated Charge / Discharge Ratio	0.5C / 0.5C				
Cooling Method	Liquid Cooled				
Energy Cycle Efficiency Type	>94%				
Certifications	IEC62619, UL9540A, UL1973, UL9540				
Max kW DC Aux Connection	172 kW	250 kW	500 kW	500 kW	500 kW
AC Specifications					
Standard Voltage Range	Low Voltage: 480V, 600V Medium Voltage: Standard 5kV and 15kV Classes				
Grid Frequency	60Hz +/- 15%				
Power Factor	0 - 1.00 Leading or Lagging				
Certifications	UL1741SA, IEEE 519, IEEE 1547, NFPA 70, CSA 22.2 #107.1				
Current Harmonics	IEEE 1547 Compliant, <5% TDD				

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UCONN DEPOT BESS Sequence of Operations

1. Existing System Description

UConn Depot campus has a 13.8kV electrical distribution system with an estimated average total load of 660 kW, occasionally peaking at 757 kW. The system distributes power across approximately 25-30 buildings throughout the campus. The system includes an inverter-based Fuel Cell generator (FC) that operates 24/7, providing a maximum output of 460 kW. The FC is grid-following and requires an operational grid to stay in service.

To enhance energy reliability and optimize energy management, an 850 kW Battery Energy Storage System (BESS) and a Recloser are being integrated into the existing system. The BESS will charge and discharge according to predefined exercise cycles and operational requirements, while the recloser will manage the system's response to grid conditions.

2. System Operation

2.1 Power Supply and Control

The Fuel Cell operates continuously, at 460kW on a 24/7 basis in grid interactive mode (utility present). If a grid loss is detected, the FC enters an idle state. The system has an automatic grid reconnect function, which restores power after 5 minutes once the grid stabilizes.

The BESS will function both as a supplemental power source and an energy storage system, responding to commands from external sources. The system will:

- Charge and discharge based on predefined schedules and demand response programs.
- Supplement the Fuel Cell output during peak demand or outages.
- Communicate with external sources via Modbus TCP/IP.

During charging, the BESS will be treated as a campus load, maintaining a State of Charge (SOC) of 85-100% to ensure availability for potential outages.

2.2 Communications Protocols

The system components communicate using Modbus TCP/IP and Fiber/Digital I/O:

- Recloser SEL 651R – Fiber / Digital I/O
- External Onlogic FR201 – Modbus TCP/IP

- UConn BMS – Modbus TCP/IP
- Fuel Cell – Modbus TCP/IP
- OATI SEL 3360S – Modbus TCP/IP
- Kinsley Cradle Point – Modbus TCP/IP
- BESS Inverter & Battery Combiner – Modbus TCP/IP / Digital I/O
- Individual battery communication via Serial RS-485 (self-contained system).

3. Operational Scenarios

3.1 Normal Discharge with Stable Grid

The Stark BESS main breaker is closed, and the inverter is in a "ready" state. Upon receiving an external discharge command, the BESS will proceed to discharge power according to the setpoint issued, supplementing the Fuel Cell output.

3.2 Grid Outage – BESS Discharge Mode

In the event of a grid failure, the recloser will open, and an external signal will be provided to the BESS, prompting the Inverter to ramp up and operate as an island. This allows the BESS to form an independent grid.

Upon grid return, the recloser will indicate that the grid is stable after a set period (5 minutes, adj.). Upon receipt of the signal, the inverter will shut down immediately, and the recloser will close on an open transition (Fast Transfer). After the system is re-established

EMS controller will have the ability to command the power setpoint of the fuel cell to reduce power if the battery is fully charged and the campus loads are minimal.

3.3 Grid Outage During BESS Charging

If the grid fails while the BESS is charging, the inverter will automatically switch to discharge mode based on SOC levels. If the BESS fails to discharge, an alarm will be generated, indicating a system fault.

3.4 Grid and Fuel Cell Fault Conditions

- Grid Faults: The SEL-651R recloser detects faults such as under/overvoltage or ground faults, triggering an alarm via Modbus TCP/IP. BESS will operate accordingly.
- Fuel Cell Faults: If the Fuel Cell experiences a fault, an alarm is sent to the BESS. Depending on the nature of the fault, the Fuel Cell may restart automatically or require intervention by HyAxiom service. The assumption is that the fuel cell will be

present for microgrid operation; however, if the fuel cell trips out on a fault and does not restart, the BESS will support microgrid mode for as long as the SOC allows.

3.5 BESS System Faults

The BESS monitors system faults, including:

- Communication Failure (Modbus TCP/IP interruptions).
- Breaker Failure (52IT) or UPR detection failures.
- Inverter or battery faults.

4. BESS Charging & Discharging

4.1 Automatic Charging

- Periodic automatic charging can be configured on the BESS using the following setpoints:
    - Daily, weekly or monthly.
    - Charge time interval:
        - Start time of day. (Adj.)
        - Finish time of day. (Adj.)
    - State of charge (SOC) permissive.
- The system follows a controlled charge cycle, ensuring batteries remain within SOC limits (10%-100%). SOC lower limit needs to be sufficient to enter in microgrid mode and be able to bring the fuel cell up to full power. 20% lower limit was discussed.

4.2 Manual/Remote Charging

- Manual charging can be initiated via external command.
- If the BESS is already fully charged, manual charging will be disabled until the next exercise cycle.

4.3 Automatic Discharging

The BESS will automatically enter discharge mode under the following conditions:

- Event-based discharge – Triggered externally, based on grid stability and demand response programs.

- Exercise Mode –
    - If the BESS remains inactive for one month, an alarm will be issued.
    - An exercise software pushbutton command will be provided to prompt the BESS to perform a battery discharge/charge cycle to its manufacturer recommended SOC level to maintain battery health.

4.4 Manual Discharging

- Manual discharge can be used when:
    - External signals are unavailable.
    - Battery exercise is required.
    - Demonstrations or system testing are needed.
- If the system remains idle while in manual mode over the set period, it will automatically revert to Automatic standby mode.

5. System Monitoring & Maintenance

5.1 Exercise Cycle

- An integral counter tracks exercise cycle duration to ensure compliance.

5.2 System Trending & Data Logging

The system logs operational data for one year, including:

- External signals
- BESS mode and SOC/SOH trends
- Charge/discharge cycles
- Battery string voltages

5.3 Alarms & Maintenance Notifications

- Battery Temperature Alarms
- Fully Discharged Notification.
- System Exercise Mode Completion Notification
- Manual Mode Notification
- Monthly Maintenance Reminder

- External Discharge Signal Error.
- Out of Range Command.
- Fuel Cell failed to respond to enable signal

5.4 External Signal Monitoring & Alarms

- External signal high for >24 hours
- External signal remains unchanged for one month.
- More than three charge/discharge cycles occur within 4 hours, the system will trigger a destructive behavior alarm.