APPENDIX K

Energy Storage System (ESS) Application Requirements / System Operating Characteristics / Market Participation

1. Application Requirements:

a. Provide a general overview / description and associated scope of work for the proposed project. Is the new ESS project associated with a new or existing DG facility?

b. Identify whether this is a stand-alone or hybrid ESS proposal, or a change to the operating characteristics of an existing system. If hybrid, please select your hybrid configuration option:

1. Hybrid Option A - ESS is charged exclusively by the DG
2. Hybrid Option B - ESS will not export to the grid, only DG will.
3. Hybrid Option C - ESS may charge/discharge unrestricted, but grid consumption by ESS is netted out of grid exports.[1]
4. Hybrid Option D - ESS may charge/discharge unrestricted, but any consumption on the account is netted out of grid exports

~~0.~~ N/A - not Value Stack

5.

c. Will the system operate or participate[2] in any of the following:

1. Compensated under a utility tariff(s)? If yes, please specify. Identify any associated use case stacking i.e. parallel standby, net meter, VDER, import only, export only, peak shaving, generator firming, demand response, PQ injection, Microgrid, reactive power control etc.
2. NYISO markets? If yes, please specify which anticipated NYISO market(s).
3. As part of an NWA? If yes, will the inverter be capable of directly supporting simultaneous modes as well as receiving "ad-hoc" commands?
4. A program or market not listed? If yes, please describe.

~~c.~~d. Indicate whether the ES and DG system inverter(s)/converter(s) are DC-coupled or AC-coupled and provide the following:~~.~~

1. ~~AC Coupled Systems~~DER Nameplate Ratings:

~~i. DG inverter rating (kW)~~

i. Storage inverter rating (kW) for AC coupled or stand-alone systems, and

ii. DG inverter rating (kW) for AC coupled systems (if DG present), or

~~ii.~~iii. DG + ESS inverter rating (kW) for DC coupled systems.

[1] ESS may have restricted charge/discharge to be defined in question 2e.

[2] Market participation information is non-binding; however, operating characteristics and market choices will be used for technical study and determine participation specific requirements.

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Commented [CV2]: Required or critical

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Commented [CV3]: required

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Commented [CV4]: I: *Note, multiple Hybrid Options can be selected, however the most impactful option will be used in the Utility's analysis.
R: this is problematic. Staff to investigate further

Commented [CV5R4]: Staff to weigh in further. Initial input indicates no allowing multiple use case studies.

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Commented [CV8R7]: Moved to market participation …

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~~iii. Storage capacity (kWh)~~

~~1. DC Coupled Systems~~

~~v.~~2. DG system size (kW).

~~vi.~~3. Storage system size (kW).

~~vii.~~4. Storage capacity (kWh).

~~. PV + ESS inverter rating (kW)~~

e. Provide specification data/rating sheets for both the AC and/or DC components including the manufacturer, model, and nameplate ratings (kW) of the inverter(s)/converters(s) and controllers for the energy storage and/or DG system, and capacity, of ESS unit(s) (kWh).

f. Indicate the type of energy storage (ES) technology to be used. For example, NaS, dry cell, PB-acid, Li-ion, vanadium flow, etc. ~~Provide data on operating and/or non-operating state of charge indicating energy level requirements relative to the capacity of the battery unit in percent capacity.~~

~~g. Indicate how the ESS will be charged and/or act as a load: (1) electrical grid only, (2) unrestricted charging from electrical grid and/or DG system, (3) restricted charging from electrical grid and/or DG systems, or (4) charging from DG only.~~

~~h. Indicate any impacts of ambient temperatures on charging and discharging capabilities, specifically noting any restrictions on available capacity as a function of temperature and listed on the system facility's nameplate.~~

~~i. Provide details on cycling (anticipated maximum cycles before replacement), depth of discharge restrictions, and overall expected lifetime regarding the energy storage components.~~

~~j. Provide proposed inverter(s) power factor operating range and whether inverter(s) are single quadrant, two-quadrant, or four-quadrant operation.~~

~~k. Identify if inverter analytical models are available for use in the utility's power flow analysis program, and if there are any restrictions on their use.~~

~~l.~~k. Indicate whether the interconnected inverters inverter(s)/converter(s) is/are compliant to the latest versions of the following additional standards. If partially compliant to subsections of the latest standards, please list those subsections:

1. IEEE 1547-2018
2. UL 1741 and its supplement SA

~~0. SunSpec Common Smart Inverter Profile (CSIP) v2.103-15-2018~~

~~n.~~l. ~~Detail any additional integrated protection that is included in the interconnected inverter(s)/converters, outside of standard UL 1741 requirements. For example, describing over/under-voltage/current frequency behavior and reconnection behavior would comply, such as solid-state transfer switching or other.~~

~~**2. System Operating Characteristics:**~~

~~c.~~m. List the system's maximum ~~net export and~~ import in kW AC, including any equipment and ancillary loads (i.e. HVAC) to be installed to facilitate the ESS installation.

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R: this is a required item for utility reporting.

Commented [CV12R11]: See above on Kwh

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R: this is a required item for utility reporting.

Commented [CV14R13]: See above on kwh

Commented [CV15]: Critical, but kwh is not necessarily required for study but needed for reporting. How do we make sure kwh changes are not impactful as a material change?

Commented [CV16R15]: Language will be added to address this under Material Modifications proposed changes.

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Commented [CV19R18]: Industry to get clarity

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Commented [CV27R26]: Reword to ensure metering

d.n. Indicate desired ramp rates in kW/second during charging and discharging (worst case will be assumed if not provided). Please attach a charge and discharge data/curve.

e.o. Is the ESS symmetrical or asymmetrical (e.g. charge magnitude equivalent to discharge magnitude)? Provide proposed inverter(s) power factor operating range and anticipated operational setpoints[3] Please also specify the full range of power factor capabilities in the context of the expected two-quadrant or four-quadrant operation.

f.p. Indicate the maximum frequency of change in operating modes (i.e. charging to discharging and vice-versa) that will be allowed based upon control system configurations and associated maximum potential change in power magnitude expressed in equipment limitations such as times per second, minute, hour, or day and kW or % of kW as applicable.

g.q. Indicate any specific operational limitations that will be imposed (e.g. will not charge or discharge across PCC between 2-7 pm on weekdays; ESS will not charge at any time that would increase customers peak demand; etc). Charge/discharge at any time (24-hour) will be assumed if not provided.

h.a. Is the system expected to participate in multiple use cases as part of dual participation or another NWA? If so, will the inverter be capable of directly supporting simultaneous modes as well as receiving "ad-hoc" commands?

List any available inverter ride-through capabilities on grid-island and island-grid transfers. Provide system description and design where multiple components are required or equipment data sheets for manufactured units identifying transfer method of unit (i.e. open, closed, static).

Provide details on standard communication as follows:

j. Provide details on standard communication hardware interfaces that are available, e.g., TCP/IP, serial, etc.

j. Provide details on standard communication protocols that are available, e.g., MODBUS, DNP 3, 2030.5, etc.

j. Provide details on standard communication data models that are available, e.g., 61850-90-7, SunSpec, MESA, 2030.5, OpenADR, etc.

k. Provide details on whether the inverter(s)/converter(s) have any intrinsic grid support functions, such as autonomous or interactive voltage and frequency support. If they do, please describe these functions and default settings.

3. Protection System Verification

a.r. Provide a summary of protection and control scheme functionality and provide details of any integrated protection of control schematics and default settings within controllers.

b.s. Submit control schemes, electrical configurations, and sufficient detail for the utility to review and confirm acceptance of proposal. Detail any integrated control scheme(s) that are included in the interconnected inverter(s)/converters including a sequence of operations for expected events, energy flows, or power restrictions. For example, describing over/under-voltage/current frequency behavior and reconnection behavior would comply, such as solid-state transfer switching or other. Provide descriptions of any software functionality that enables intelligent

[3] Note: final setpoints are subject to change per utilities direction.

Commented [CV28]: Make sure proposed setpoints are provided.

Commented [CV29R28]: Added text and footnote

Commented [CV30]: I: concerned with this request as part of the assessment as it is not known to be a factor in other storage markets. Would like to understand how significant the worse-case scenario would be as an impact to studies. How would this compare to customer load cycle considerations?

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Commented [CV34]: Required.

Commented [CV35R34]: Removed optional segment of question

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Commented [CV36]: I: Are there other operational limits that could be exampled here? For example, one limitation that CA utilities found useful: "ESS will not charge at any time that would increase customers peak demand"

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~~charging and discharging of the ESS using interconnected DG, such as PV.~~ For example, provide details if the ESS can be charged only through the DG input, or if the ESS can be switched to be charged from the line input, or if a control scheme is proposed to prohibit power flow directionality or peak values. ~~provide those details in a sequence of operations.~~ ~~Provide details on grounding of the interconnected energy storage and/or DG system to meet utility effective grounding requirements.~~

~~c.~~t. Provide short circuit current capabilities and harmonic output from the hybrid project or stand-alone storage system.

~~d.~~u. Submit control schemes, electrical configurations and sufficient detail for the utility to review and confirm acceptance of proposal.

If the intended use case for the ESS includes behind-the-meter backup services, please provide a description and documentation illustrating how the entire system disconnects from utility during an outage (e.g. mechanical or electronic, coordination, etc.).

5. Optional Questions:

Questions in this section are not required for a complete application, although any respon~~s~~ses provided may support utility decisions to review the project performance in a manner that could result in less impact to the customer interconnection.

a. Indicate whether the interconnected inverters inverter(s)/converter(s) is/are compliant to the latest versions of the following additional standards. If partially compliant to subsections of the latest standards, please list those subsections:

   a. SunSpec Common Smart Inverter Profile (CSIP) v2.103-15-2018

Any other recognized standard or practice.

operating modes (i.e. charging to discharging and vice-versa) that will be allowed based upon control system configurations.

c. Provide details on standard communication as follows:

   a. hardware interfaces that are available, e.g., TCP/IP, serial, etc.

   b. protocols that are available, e.g., MODBUS, DNP-3, 2030.5, etc.

   ~~a.~~ data models that are available, e.g., 61850-90-7, SunSpec, MESA, 2030.5, OpenADR, etc.

Provide details on whether the inverter(s)/converter(s) have any intrinsic grid support functions, such as autonomous or interactive voltage and frequency support. If they do, please describe these functions and default settings.

Commented [CV44]: Better define ESS control requirements and/or sequence of operations, can utilities reframe this to be more specific as to what is being asked here?

Maybe standardize SOO or better define as we move further down the road.

Commented [CV45R44]: Modified language for improved clarity

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Commented [CV47R46]: Moved to market participation section

Commented [CV48]: Move this to the NWA NYISO category

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