Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
DEPARTMENT OF ENERGY RESOURCES

SOLAR MASSACHUSETTS RENEWABLE TARGET PROGRAM 3.0 (225 CMR 28.00) GUIDELINE

Guideline on Energy Storage

1) Purpose and Background

This document provides guidance regarding the manner in which an Energy Storage System may qualify under the Department of Energy Resource's (Department) Solar Massachusetts Renewable Target (SMART) Program 3.0 under 225 CMR 28.00.

Solar photovoltaic systems are widely recognized as an integral part of the energy generation mix that will help enable reduced emissions over the coming years; however, solar as a standalone technology has operational limitations and impacts that limit deployment and impose diminishing returns on additional installations. Some of the key limitations associated with solar electric generation include: intermittency at multiple levels (e.g., day/night, sunny/cloudy, summer/winter, etc.), duck curves increasing required ramp rates for traditional generators, reverse power flows on the distribution and transmission system, as well as forecasting uncertainties for system operators.

Additionally, the Department's *State of Charge* Study,[1] performed under the Energy Storage Initiative, found that peak demand accounts for a disproportionately high percentage of the ratepayers in the Commonwealth's cost of electricity. Solar alone does not necessarily coincide with peak demands, and as such may not address a root cause of higher electricity costs.

Energy storage can provide a variety of benefits across the electricity supply chain from generation to transmission and distribution. Some of the specific benefits of energy storage when implemented in conjunction with solar photovoltaic systems include: improved power quality (e.g., reduced voltage flicker associated with clouds temporarily shading solar installations),mitigating otherwise unnecessary substation upgrades often associated with installing solar, and the ability to shift solar energy production to peak demand (i.e., prevents reverse power flows and increases value and emissions savings of each kWh produced by solar). While providing these solar specific benefits, energy storage also delivers the benefit of being dispatchable and may also be able to take advantage of other revenue streams, reducing required incentive costs and increasing benefits provided to ratepayers.

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[1] See *State of Charge*, Exec. Sum. at xvi, and Sec. 5. Use Cases of Specific Applications in Massachusetts, in particular, Figs. 5-12; available at https://www.mass.gov/files/2017-07/state-of-charge-report.pdf.

Chapter 75 of the Acts of 2016 directed the Department to establish a long-term sustainable solar incentive program to promote cost-effective solar in the Commonwealth. The Act also directed the Department to differentiate "incentive levels to support diverse installation types and sizes that provide unique benefits."[2] In establishing the SMART Program as required by the Act, the Department considered different incentive levels for a variety of installation types and established adders to Base Compensation Rates for certain facility types, including for Solar Tariff Generation Units that are co-located with Energy Storage Systems.

2) Definition of Energy Storage and Requirement to Pair with Energy Storage

225 CMR 28.02: *Definitions* defines Energy Storage System as follows:

> A commercially available technology that is capable of absorbing energy, storing it for a period of time and thereafter dispatching the energy.

Pursuant to 225 CMR 28.07(4)(e), all STGUs greater than 1,000 kW that do not qualify for a Locational Compensation Rate Adder shall be co-located with an Energy Storage System that meets the eligibility requirements of 225 CMR 28.07(5)(e)1.

a) Exceptions to Energy Storage Requirement for Good Cause.

An STGU shall be exempt from the requirement of 225 CMR 28.07(4)(e) if it can demonstrate to the Department's satisfaction that it should be granted an exception for good cause.

The Department will review all good cause exception requests on a case-by-case basis. If the STGU is seeking an exception for good cause, the Applicant should provide a narrative and supporting documentation to the Department to justify why an exception is warranted. Requests for a good cause exception to the energy storage requirement should be directed to doer.smart@mass.gov.

3) Energy Storage Adder

a) Reserving the Energy Storage Adder

An applicant will reserve its adder multiplier rate upon the initial application for the Energy Storage Adder. However, changes to as-built solar photovoltaic (PV) capacity or the Energy Storage System relative to the information contained in the initial application may result in an increase or decrease to the size of the Energy Storage Adder. Additional information on applying for the Energy Storage Adder is provided in the *Statement of Qualification Reservation Period Guideline.*

b) Energy Storage Adder Formula and Rationale

225 CMR 28.13(3)(e)2. establishes the following formula for determining the value of an Energy

[2] St. 2016, c. 75, § 11(b).

Storage Adder:

$$\text{Energy Storage Adder} = \left[\frac{\left(\frac{\text{Nominal Rated Power Capacity of Energy Storage System}}{\text{DC Rated Capacity of the Solar Photovoltaic System}}\right)}{\left(\left(\frac{\text{Nominal Rated Power Capacity of Energy Storage System}}{\text{DC Rated Capacity of the Solar Photovoltaic System}}\right) + \exp\left(0.7 - \left(8 \cdot \left(\frac{\text{Nominal Rated Power Capacity of Energy Storage System}}{\text{DC Rated Capacity of the Solar Photovoltaic System}}\right)\right)\right)\right)}\right] \cdot \left[0.8 + \left(0.5 \cdot \ln\left(\frac{\text{Nominal Rated Useful Energy of the Energy Storage System}}{\text{Nominal Rated Power Capacity of Energy Storage System}}\right)\right)\right] \cdot \text{Energy Storage Adder Multiplier}$$

In general, this formula looks at the ratios of storage capacity to PV capacity for STGUs that are co-located with Energy Storage Systems, providing more value to Energy Storage Systems that have a higher rated power capacity and/or a higher rated energy capacity. However, the rate of increase in adder values for larger energy storage power and energy capacities diminishes as one or both increases. This is consistent with the findings of the *State of Charge* Study, which found that short to medium duration Energy Storage Systems provided greater benefits to ratepayers.

The resulting output values of this formula are intended to stimulate the development of Energy Storage Systems paired with STGUs and assist Energy Storage System Owners to overcome the "revenue gap" identified in the Department's *State of Charge* Study.[3] The Department expects that most Energy Storage System owners will look for alternative sources of financing for their solar plus storage projects.

The Department has created a calculator for prospective applicants to determine the potential value of an Energy Storage Adder, as well as a table and chart that illustrate potential adder values for Energy Storage Systems of different sizes. The calculator is available on the Department's website.

c) Standalone DC-coupled Solar with Energy Storage

For DC-coupled STGUs with Energy Storage Systems, there are round-trip efficiency losses resulting in lower generation at the production meter. To compensate STGU owners for the AC equivalent of the renewable energy production of the STGU and to calculate the annual true up payment of the round-trip efficiency losses, an applicant shall use the following formula:

$$\text{Annual True Up Payment} = R_P \cdot \eta_{inv} \cdot \eta_{tran} \cdot \sum_{i=1}^{n} E_i$$

[3] See *State of Charge*, Exec. Sum. at xvi, and Sec. 5. Use Cases of Specific Applications in Massachusetts, in particular, Figs. 5-12; available at https://www.mass.gov/files/2017-07/state-of-charge-report.pdf.

i= the number of intervals in a calendar year

Ei= the 15-minute interval Energy Storage System DC net metered energy output.

Ntran= fixed transformer efficiency factor

Ninv= fixed inverter efficiency factor

Rp= SMART incentive rate for the STGU

The Department shall establish a transformer efficiency factor that shall be fixed for all STGUs and an inverter efficiency factor that will be fixed for the specific inverter utilized by the STGU. The current established transformer efficiency factor is 2.

To receive the annual true up payment, the Energy Storage System's performance data and inverter efficiency factor must be reported to the Department. On an annual basis, the Department will calculate the annual true up payment. Once calculated, the Solar Program Administrator will provide the data to the Department for verification prior to submittal to the appropriate Electric Distribution Company for payment to the STGU Owner.

4) Frequently Asked Questions

a) The following questions and answers are meant to provide clarification to eligibility requirements defined in 225 CMR 28.07(5)(e)1.How is co-located defined?

To be deemed co-located, the STGU and the Energy Storage System must be located on the same or adjacent parcels within the same distribution company's service territory, and must be interconnected to the same common collector located on the same parcel(s) on which the STGU and Energy Storage System facilities are located (i.e., an electric service on such parcel(s) connected to the same circuit at nominal AC voltage or distribution element that serves no other utility customers and no load other than that associated with the parcels on which the STGU(s) and Energy Storage Unit are located).

If a Generation Unit Owner has a separate Interconnection Service Agreement ("ISA") or an amendment to its original ISA for the Energy Storage System, the Owner must also provide that ISA with their application for the Energy Storage Adder.

b) How is nominal rated power capacity of an Energy Storage System defined?

The nominal rated power capacity of an Energy Storage System is the limiting continuous apparent power rating (kVA) of the Energy Storage System's ability to discharge power while grid connected (i.e., the lesser of the inverter or battery continuous power ratings).

c) How is nominal useful energy defined?

Nominal useful energy is the amount of usable energy stored. The usable energy is the amount of kilowatt-hours available to discharge from the Energy Storage System when starting at a full state-of-charge. Other synonymous terms may include usable capacity, usable battery capacity, typical cycle capacity, usable energy, and usable storage capacity.

d) How is the round trip efficiency calculated?

The Energy Storage System round trip efficiency should be listed by the manufacturer and may be verified by the Department by reviewing the interval data that must be provided pursuant to 225 CMR 28.11(3)(a).

e) How does a system generate the data required to be reported under 225 CMR 28.11(3)(a)?

Data generated by system components (e.g., inverter) is acceptable to meet the data provision requirements. Information on the format in which the data must be presented to the Department will be provided in the annual communications from the compliance administrator.

f) How does an Energy Storage System demonstrate compliance with the operational and performance requirements in 225 CMR 28.07(5)(e)1.c.?

An Energy Storage System must accomplish <u>one</u> of the following to comply with operational requirements:

1) Be online and able to discharge at least 85% of the time during the Summer and Winter Peak Periods. The Summer and Winter Peak Periods are detailed in 225 CMR 21.05. The Summer Peak Period is from May 15th through September 14th, from 4:00 PM to 8:00 PM. The Winter Peak Period is from December 1st through February 28th, as adjusted by leap years, from 4:00 PM to 8:00 PM.

2) Participate in a demand response program, such as the Distribution Companies' Connected Solutions programs or similar programs approved through the Department of Public Utilities' three-year plans for energy efficiency.

To comply with the performance requirements, the Energy Storage System must dispatch at least 100 complete cycle equivalents per calendar year. The data provided in compliance with 225 CMR 28.11(3)(a) shall demonstrate at least 100 cycles in the first complete calendar year of operation of the Energy Storage System following its Incentive Payment Effective Date.

Data should be submitted in compliance with 225 CMR 28.11(3)(a) in 15-minute increments and in kWh to DOER's third-party administrator by May 1st of each calendar year. Systems that track data on a time schedule more than 15-minutes, such as 1 hour, 1 day, or a summary of discharges will be ruled noncompliant.

The first time an Energy Storage System is: (a) decommissioned; (b) remains non- functional for more than 15% of the hours in the Summer or Winter Peak Period; or (c) does not discharge at least 100 complete cycle equivalents per calendar year, then the STGU may lose its Energy

Storage Adder for an entire calendar year unless it qualifies for an exception under 225 CMR 28.11(3)(b) as detailed in Section 4)j) of this Guideline. If the STGU fails to comply with the operational requirements under 225 CMR 28.07(5)(e)1. a second time, then the Department may permanently disqualify the STGU from continuing to receive the Energy Storage Adder for the remainder of the STGU's tariff term.

g) How is a complete cycle equivalent measured?

A complete cycle equivalent is the amount of useful energy available in a single complete discharge. For example, an Energy Storage System is registered as a 100 kW/ 3 hour duration, then the complete cycle equivalent would be 100 kW x 3 hours = 300 kWh. In order to meet operational requirements, this example system must discharge 30,000 kWh (100 x 300 kWh) annually. Operational requirements and functionality may be confirmed utilizing the data provision requirements in 225 CMR 28.11(3)(a).

h) What if my Energy Storage System does not meet the minimum 2-hour duration eligibility criteria?

If an Energy Storage System co-located with a STGU does not meet the minimum 2 hour duration requirement, an applicant may de-rate the Energy Storage System's nominal rated power capacity for the purpose of calculating the SMART Energy Storage Adder. Note that in this case an applicant is not required to physically change any equipment used, but rather would de-rate the Energy Storage System power value to a point at which the storage has a useful energy duration of 2 hours at the nominal rated power capacity.

i) Can multiple STGUs be co-located with an Energy Storage System? If yes, how is the adder calculated?

An applicant may co-locate multiple STGUs to a single Energy Storage System. In these instances, the combined capacity of the STGUs will be used in the formula for PV capacity (kW DC) in comparison to the Energy Storage System. The resulting adder is then applied to each individual Statement of Qualification.

j) My energy storage system was shut down for more than two months. Are there any ways to prevent losing the adder for the full year?

Applicants may request exceptions to the Operational and Performance Requirements based on unexpected circumstances such as fire, safety concerns, public health concerns, warranty failures, unintended outages, or others as determined by the Department under 225 CMR 28.11(3)(b). Applicants requesting an exception must provide a written request with supporting documentation as part of the annual compliance reporting.

5) Energy Storage Guideline Appendix: Example

Example: A proposed SMART facility Owner applies to install a 200 kW DC building mounted STGU and a 250 kW DC parking canopy, co-located and AC coupled with an Energy Storage

System with a nominal rated power capacity of 200 kVA and a nominal useful energy of 500 kWh.

For Energy Storage Adder calculation purposes, the combined total of the two STGU installations of 450 kW DC is the STGU rated power which the energy storage will be compared against.

To confirm eligibility:

200 kW ES / 450 kW PV = 0.44 = 44%

- ✓ 44% $\geq$ 25%, the system has a 44 percent ratio of energy storage power to solar power, which exceeds the 25 percent minimum eligibility criteria

500 kWh / 200 kW = 2.5 hours

- ✓ 2.5 $\geq$ 2, the Energy Storage System has useful energy of more than a 2 hour duration at the rated power, which meets the eligibility criteria

Variables to be entered into the Energy Storage Adder:

Nominal Rated Power Capacity of Energy Storage System:	200 kW
Nominal Rated Useful Energy of the Energy Storage System:	500 kWh
Storage Hours at rated capacity:	2.5
DC Rated Capacity of the Solar Photovoltaic System:	450 k