

Hybrid Storage Model: Co-located Storage Resources (CSR) Market Design Proposal

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Management Committee

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WebEx

Agenda

- **Project Background**
- **CSR Market Design Proposal Summary**
- **Proposed Tariff Revisions**
- **Next Steps**
- **Appendix I : Previous Presentations**
- **Appendix II: Comprehensive CSR Market Design Proposal**
 - CSR Interconnection Rules Proposal
 - CSR Resource Registration Proposal
 - CSR Capacity Market Participation Proposal
 - CSR Energy Market Participation Proposal

Project Background

A Grid in Transition – The Plan

- Carbon Pricing
- Comprehensive Mitigation Review
- DER Participation Model
- Energy Storage Participation Model
- Hybrid Storage Model

Aligning Competitive Markets and New York State Clean Energy Objectives



- Enhancing Energy & Shortage Pricing
 - Ancillary Services Shortage Pricing
 - Constraint Specific Transmission Shortage Pricing
 - Enhanced Fast Start Pricing
- Review Energy & Ancillary Services Product Design
 - More Granular Operating Reserves
 - Reserve Enhancements for Constrained Areas
 - Reserves for Resource Flexibility

Valuing Resource & Grid Flexibility



- Enhancements to Resource Adequacy Models
- Revise Resource Capacity Ratings to Reflect Reliability Contribution
 - Expanding Capacity Eligibility
 - Tailored Availability Metric
- Capacity Demand Curve Adjustments

Improving Capacity Market Valuation



Project Background

- **This project explores market participation option(s) for co-located front-of-the-meter generators and energy storage resources**
 - Financial incentives, along with improvements in flexibility and availability, are motivating developers to couple generation resources with storage resources
- **Modifications to existing market rules will be developed to accommodate CSR by the end of 2020**

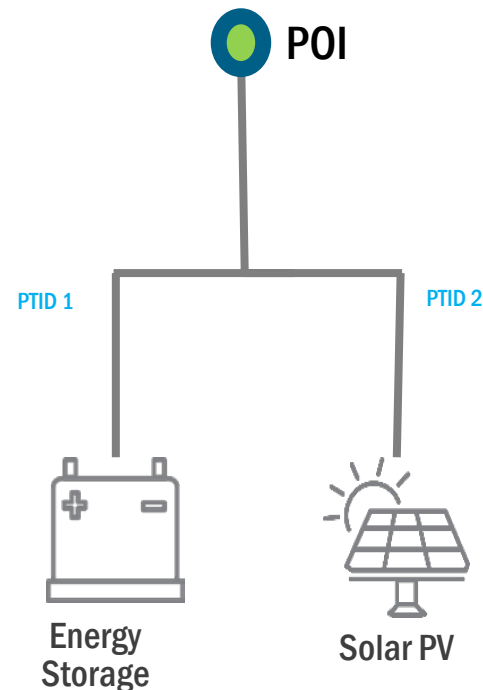
CSR Market Design Proposal Summary

CSR Definitions

- **New terms have been added to Market Administration and Control Area Services Tariff (MST) 2 Definitions:**
 - **Co-located Storage Resources (“CSR”):** A wind or solar Intermittent Power Resource and an Energy Storage Resource that: (a) are both located behind a single Point of Injection (as defined in Section 1.16 of the OATT); (b) participate in the ISO Administered Markets as two distinct Generators; and (c) share a set of CSR Scheduling Limits. Resources that serve a Host Load may not participate in the ISO-Administered Markets as components of a CSR.
 - **CSR Scheduling Limits:** The CSR injection Scheduling Limit sets the maximum, combined Regulation Capacity, Operating Reserve and Energy injection schedules for, and the maximum net injection by a CSR’s Generators. The CSR withdrawal Scheduling Limit sets the maximum, combined Regulation Capacity and Energy withdrawal schedules for, and the maximum net withdrawal by a CSR’s Generators....

CSR: Market Design Overview

- Each unit within a CSR will have a distinct PTID/bid/schedule/settlement
- A CSR shall be represented by a single Billing Organization and have a single bidding agent
- Each unit will participate under their own participation model. In the illustrative example shown here, Solar PV will participate as an Intermittent Power Resource (IPR) and Energy Storage will participate as an Energy Storage Resource (ESR)
- A CSR scheduling constraint will be used to determine feasible energy and Ancillary Service schedules for units within the CSR
- All units within a CSR will be settled at the same LBMP



CSR: Market Design Overview (cont'd)

- **Only the ESR unit will be eligible to provide Reserves and Regulation**
- **Subject to the existing supplier qualification criteria, both the ESR and IPR unit may be eligible to provide Voltage Support Service**
 - The total MVAR capability from the CSR shall be based on the lesser of the reactive power capability of the individual VSS Supplier(s) or the total Reactive Power capability at the Point of Injection (POI) and not the sum of individual units' capabilities

CSR Interconnection Rules Overview

CRIS and Interconnection Rules for CSRs

- **New projects seeking to become a CSR may submit a single Interconnection Request**
- **For projects already in the Interconnection Queue, proposed transition rules enable projects that currently have separate positions in the Interconnection Queue to combine and proceed under a single Interconnection Request as a CSR if :**
 - Both projects propose to be behind the same Point of Injection,
 - Both projects are in the queue as of the effective date of the tariff revisions, and
 - A single individual or entity submits a revised Interconnection Request for the combined project
- **The CSR (and any other multi-unit facility evaluated as a single project) will have a single Interconnection Agreement (IA)**
- **Each CSR may be studied in the interconnection process as a single facility evaluated at a single CSR ERIS and CRIS value with the ERIS and CRIS allocated to each unit (such that each unit will have its own ERIS and CRIS value)**
 - ERIS for the Intermittent Power Resource cannot exceed the CSR Injection Capability plus the full withdrawal capability of the Energy Storage Resource
 - The sum of CRIS among all units may not exceed the injection limit for the total facility

CSR Capacity Market Participation Proposal

ICAP Mitigation Measures

- All existing supply side mitigation measures will apply
- Each unit within a CSR will be a distinct Examined Facility
- CSRs in Mitigated Capacity Zones will be subject to the mitigation evaluations that pertain to ICAP offering behavior
 - Pivotal Supplier “must offer”
- CSRs in Mitigated Capacity Zones will be subject to the mitigation evaluations that pertain to market entrance/exit
 - Physical Withholding
 - Buyer Side Mitigation
 - Renewable units within CSRs will be eligible for the BSM Renewable Exemption
 - The NYISO’s Market Services Tariff defines an “Exempt Renewable Technology,” in all Mitigated Capacity Zones, as “an Intermittent Power Resource solely powered by wind or solar energy”

CSR ICAP and UCAP Calculations

- Each unit within the CSR will have its own DMNC value. Existing DMNC rules for each resource type will be applicable to units within a CSR
- ICAP and UCAP calculation methods for each unit within a CSR will be similar to existing methods based on resource type, with small adjustments to account for the shared Point of Injection (POI)
- **CSR ESR**
 - $ICAP = \min(CRIS, DMNC)$
 - Adjusted ICAP = ICAP * Duration Adjustment Factor (DAF)¹
 - UCAP = Adjusted ICAP * (1 - Derating Factor)
 - Derating Factor = 1 - Availability Factor (AF)
 - CSR ESR Availability Factor = ESR Unit Availability Factor * CSR Injection Limit Availability Factor
- **CSR Intermittent**
 - $ICAP = \min(CRIS, DMNC)$
 - Adjusted ICAP = ICAP * DAF ²
 - UCAP = Adjusted ICAP * Production Factor (PF)
 - CSR Intermittent Production Factor = average(min(CSR Intermittent Output, CSR Injection Limit)/min(Unit Nameplate, CSR Injection Limit) across performance measurement window

1. It is to be noted that the DAF is 100% for non-duration limited resources
2. Intermittent Power Resources have a DAF of 100% as they are not eligible to elect an Energy Duration Limitation

CSR Bid/Schedule/Notify (B/S/N) Obligations

- **Each unit within a CSR will be subject to B/S/N obligations consistent with existing rules based on resource type**
 - An ESR within a CSR that has an Energy Duration Limitation (EDL) must Bid/Schedule/Notify in the Day-Ahead Market (DAM) for injection of the ICAP Equivalent of UCAP sold (ICE), for each hour of the Peak Load Window (PLW)
 - An ESR within a CSR that has an EDL must also bid the full withdrawal range, i.e. max(negative Installed Capacity Equivalent, Lower Operating Limit), for all hours outside of the Peak Load Window
 - If the ESR does not have an EDL, it must B/S/N ICE injection into the DAM for all hours, consistent with traditional generator requirements
 - Intermittent units within a CSR will not be required to B/S/N in the DAM

CSR Energy Market Participation Proposal

Energy Market Bidding for CSRs

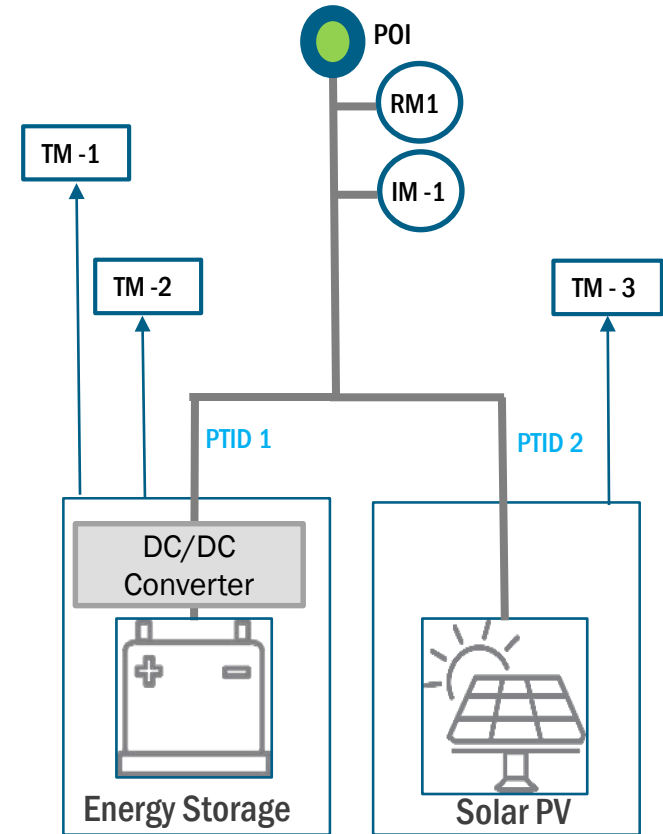
- Each CSR Generator participating in the NYISO wholesale market must submit separate bids. Bidding rules and parameter requirements depends upon the participation model used by the CSR Generators
- CSR Scheduling Limits (injection and withdrawal) must be submitted by each CSR Generator with its Day-Ahead and Real-Time Bids
- Minimum offer size for Energy and Ancillary Services:
 - 1 MW for generation units;
 - 100 kW for ESR unit
- The Bidding process will be same as currently applicable to ESR, solar or wind IPR
- Bid types (e.g., fixed, flexible, self-schedule) available to each resource type within CSRs are consistent with existing Generator bidding rules

Energy Market Scheduling for CSR

- **Basepoints will be sent to individual CSR generators**
- **NYISO will determine energy, reserves and regulation schedule for units within the CSR**
 - The NYISO will use CSR scheduling constraints to determine energy and ancillary services schedules for different units within the CSR
 - Other scheduling constraints applicable to each generation unit shall continue to apply
- **When the total CSR schedules are near the CSR injection Scheduling Limit, the solar or wind IPR unit will be instructed not to exceed its economic basepoint**
 - This instruction will be communicated via a Wind and Solar Output Limit flag

CSR Metering Proposal

Meter Designation	Meter Requirements	Data flows
RM1	Revenue grade; dual – channel meter; reported by a Meter Authority	Hourly data
IM -1	Instantaneous meter	6 second aggregated output telemetry from CSR
TM - 1	SCADA data	ESR State of Charge (SOC) telemetry
TM - 2	SCADA data	6-second aggregated output telemetry from ESR (telemetry should be compensated to the equivalent AC output at the POI)
TM -3	SCADA data	6 second aggregated output telemetry from Solar PV (telemetry should be compensated to the AC equivalent output at the POI)



CSR Metering Proposal (cont'd)

- **Revenue Grade Meter data at the POI will be used for settlement purposes**
 - Hourly injection (MWh) and withdrawal (MWh) will be determined from the revenue grade meter at the POI
 - Each Generator's individual telemetered output will be used to determine the injections and withdrawals (MWh) allocated to the ESR and to the wind or solar IPR
 - All energy withdrawals will be allocated to the ESR
- **NYISO also intends to make certain tariff revisions accepted by FERC in Docket No. ER19-2276 (the NYISO's DER proceeding) effective at the same time as the CSR tariff revisions**
 - The DER tariff revisions NYISO proposes to become effective coincident with CSR are highlighted in yellow in MST 13 for ease of review

CSR Energy Market Settlements

- Settlement will occur at the unit level
- The settlement rules for Generators that participate in a CSR are proposed to be same as those applicable to standalone ESRs and IPRs with the exception noted below
- **TSC (Transmission Service Charges) and NTAC (NYPA Transmission Adjustment Charge) on the ESR unit:**
 - The ESR unit that participates in a CSR will not pay TSC and NTAC when it receives charging energy from its co-located Intermittent Power Resource behind the shared POI/POW. The ESR will still be required to pay TSC and NTAC for the net energy withdrawals from the grid by the combined CSR Generators at the POI/POW if the ESR is not providing a FERC-approved “service”

Energy Market Mitigation for CSR

- **CSR Scheduling Limit will be subject to existing Energy market physical withholding rules**
- **Units within the CSRs shall be subjected to the existing mitigation rules**

Proposed Tariff Changes

Proposed Energy Market Tariff Changes

- **CSR Interconnection related tariff changes have been proposed to following sections and are posted with today's ICAPWG/MIWG meeting materials :**
 - OATT 25.6; 25.7; 25.8; 25.9; 25.11; 30.1; 30.3; 30.4; 30.14; 32.1; 32.4; 32.5
- **CSR Capacity Market related tariff changes have been proposed to the following sections and are posted with today's meeting materials**
 - MST 5.12; 5.18; 23.2; 23.4
- **CSR Energy Market related tariff changes have been proposed to following sections and are posted with today's meeting materials :**
 - MST 2.1; 2.3; 2.9; 2.15; 4.1; 4.2; 4.4; 5.18; 8.2; 13.1; 13.2; 15.2; 15.4; 17.1; 23.2; 23.3
 - OATT 2.7; 38.3
- **Conforming changes will be made to OATT definitions, or a cross-reference to the MST definition will be added to the OATT**

Next Steps

Next Steps

- **BIC vote**
 - Target date is November 11, 2020
- **MC vote**
 - Target date is November 18, 2020
- **FERC filing**
 - Early February 2021
 - The NYISO intends to request an effective date of 60 days from the FERC filing for the interconnection provisions of the proposal.
 - The provisions NYISO asks to take effect 60 days from the FERC filing will include tariff changes that are necessary to implement the interconnection rules as intended, which will also include tariff changes made to the Buyer Side Mitigation rules.
- **Deployment**
 - Q4 2021

Our mission, in collaboration with our stakeholders, is to serve the public interest and provide benefit to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policymakers, stakeholders and investors in the power system



Appendix – I : Previous Presentations

Previous Presentations on Market Design Proposal and Tariff revisions

Date	Working Group	Discussion Points and Links to Materials
01-13-20	ICAPWG/MIWG	Hybrid Storage Model Project Kick-Off https://www.nyiso.com/documents/20142/10252714/Hybrid%20Storage%20Model_MIWG_Jan%2013%202019.pdf/caf29abe-a431-a2d1-358d-43326153824a
04-14-20	ICAPWG/MIWG	Hybrid Storage Model – Initial Market Design Concept Overview https://www.nyiso.com/documents/20142/11904936/Hybrid%20Storage%20Model%20MIWG%2004142020%20Final.pdf/08841944-5251-4497-c52b-105151f150ad
05-11-20	ICAPWG/MIWG	Hybrid Storage Interconnection Proposal https://www.nyiso.com/documents/20142/12465245/Hybrid%20Storage%20Interconnection_0511%20MIWG_ICAPWG_FINAL.pdf/0740db02-ac07-e7f4-42b4-0b17da0e82eb
06-30-20	ICAPWG/MIWG	Hybrid Storage: Proposal for participation options https://www.nyiso.com/documents/20142/13434223/Hybrid%20Storage%206.30.2020%20ICAPWG_MIWG%20draft%20v5_final.pdf/176a272a-cc21-08ef-749a-c4a157fe2bc3
07-22-20	ICAPWG/MIWG	Hybrid Storage: Energy Market Participation rules for Co-located Storage Resources https://www.nyiso.com/documents/20142/13960166/Hybrid%20Storage%20ICAPWG%20MIWG%2007.22.20%20Energy%20Market%20Rules%20%20final.pdf/89700275-108e-8002-1e44-aaffe1712f0e
07-22-20	ICAPWG/MIWG	Hybrid Storage Model: Interconnection and Capacity https://www.nyiso.com/documents/20142/13960166/Hybrid%20Storage%20Interconnection%20and%20Capacity_07222020%20MIWG_FINAL.pdf/e3ba434d-a7ac-21d2-855d-c9cb249da614

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Previous Presentations on Market Design Proposal and Tariff revisions(cont'd)

Date	Working Group	Discussion Points and Links to Materials
08-10-20	ICAPWG/MIWG	Hybrid Storage: Market Design for Co-located Storage Resources https://www.nyiso.com/documents/20142/14404876/Hybrid%20Storage%20ICAPWG%20MIWG%20081020%20final.pdf/f414f66a-eee0-3a3c-393d-6b075fe5a1ba
08-19-20	ICAPWG/MIWG	Hybrid Storage: Proposed Energy market tariff revisions for Co-located Storage Resources (CSR) https://www.nyiso.com/documents/20142/14617012/02_Hybrid%20Storage%20Energy%20tariff%20ICAPWG%20MIWG%2008.19.20%20draft%20final.pdf/a6b81cb1-fe9a-72cd-2a8f-75befefc4afa
08-19-20	ICAPWG/MIWG	Hybrid Storage: Proposed CRIS and Interconnections tariff revisions for Co-located Storage Resources (CSR) https://www.nyiso.com/documents/20142/14617012/03_Hybrid%20Storage%20Interconnection%20tariff%20ICAPWG%20MIWG%2008.19.20_FINAL.pdf/dbae9003-8314-e5c0-d0c3-55a7d6384cec
08-25-20	ICAPWG/MIWG	Hybrid Storage: Proposed Market design updates and energy market tariff revisions for Co-located Storage Resources (CSR) https://www.nyiso.com/documents/20142/14757023/Hybrid%20Storage_Market%20Design%20Updates%20%20Energy%20tariff%20ICAPWG%20MIWG%2008.25.20%20draft%20final.pdf/ffb01347-c4bd-24a1-6549-91cda42d8cb3
08-25-20	ICAPWG/MIWG	Hybrid Storage: Proposed Tariff Revisions for Co-located Storage Resources (CSR) https://www.nyiso.com/documents/20142/14757023/CSR%20ICAP%20Tariff%20Revisions.pdf/01796e6b-d1d8-ba86-9ab8-12c7bdf1d6f6
09-08-20	ICAPWG/MIWG	Hybrid Storage: Proposed Market design updates and energy market tariff revisions for Co-located Storage Resources (CSR) https://www.nyiso.com/documents/20142/15078529/Hybrid%20Storage_Market%20Design%20Updates%20%20Energy%20tariff%20ICAPWG%20MIWG%2009.08.20%20final.pdf/fcbb65d6-71d1-c1ac-52e9-8ecb6efb20f7

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Previous Presentations on Market Design Proposal and Tariff revisions(cont'd)

Date	Working Group	Discussion Points and Links to Materials
09-22-20	ICAPWG/MIWG	Hybrid Storage: Participation Examples and Energy Market Tariff Revisions for Co-located Storage Resources (CSR) https://www.nyiso.com/documents/20142/15473217/Hybrid%20Storage_CSR%20examples_%20%20Energy%20tariff%20ICAPWG%20MIWG%2009.22.20%20draft%20final.pdf/944fc9aa-edfb-a77a-3d77-b94c82e74b2c
10-02-20	ICAPWG/MIWG	Hybrid Storage: Market Design Updates and Tariff Revisions for Co-located Storage Resources (CSR) https://www.nyiso.com/documents/20142/15773723/4%20Hybrid%20Storage_Energy%20tariff%20ICAPWG%20MIWG%2010.02.20%20final.pdf/856b5bb8-175c-cd27-e972-b72c34e58a19
10-06-20	ICAPWG/MIWG/TPAS	Hybrid Storage Model: Interconnection Tariff Changes https://www.nyiso.com/documents/20142/15824617/2%20Hybrid%20Storage%20Incremental%20Interconnection%20Tariff%20Changes_100620_FINAL.pdf/f5fd38fc-20fb-b669-66ef-6c9a8d0d15ef
10-06-20	ICAPWG/MIWG	Hybrid Storage Model: MST Attachment H Tariff Changes https://www.nyiso.com/documents/20142/15824617/3%20Hybrid%20Storage%20Attachment%20H%20Tariff%20Changes_100620_FINAL.pdf/edea54b2-d8f8-16cb-3aab-31622215a08f
10-16-20	ICAPWG/MIWG	Hybrid Storage Model: MST Energy Market Tariff Changes https://www.nyiso.com/documents/20142/16124862/2%20Hybrid%20Storage_Energy%20tariff%20ICAPWG%20MIWG%20101620.pdf/fcc7cf12-efe1-9c41-a09b-1921da66ebbf
10-27-20	ICAPWG/MIWG	Hybrid Storage Mitigation Tariff Revisions and Model Updates https://www.nyiso.com/documents/20142/16364783/8%20Hybrid%20Storage%20Mitigation%20Tariff%20Revisions%20and%20Model%20Updates_10272020%20MIWG_FINAL.pdf/90b53974-e404-63d6-7f5a-1e9d7a93fb85
10-27-20	ICAPWG/MIWG	Hybrid Storage Model: Comprehensive CSR Market Design Proposal https://www.nyiso.com/documents/20142/16364783/Hybrid%20Storage_CSR%20proposal%20overview%20ICAPWG%20MIWG%2010.27.20%20final.pdf/c48cc0e0-c1da-d89c-7f15-6929e590db63

Appendix – II : Comprehensive Market Design Proposal

CSR Interconnection Rules Proposal

CRIS and Interconnection Rules for CSRs

- For any facility proposing to interconnect as a multi-unit facility behind the same Point of Injection, all units within the multi-unit facility may be included in a single Interconnection Request (IR)
- Each CSR may be studied in the interconnection process as a single facility evaluated at a single CSR ERIS and CRIS value with the ERIS and CRIS allocated to each unit (such that each unit will have its own ERIS and CRIS value)
- **Maximum Permissible Requested ERIS and CRIS**
 - ERIS and CRIS values may not exceed the injection capability of each unit
 - ERIS for the Intermittent Power Resource cannot exceed the CSR Injection Capability plus the full withdrawal capability of the Energy Storage Resource
 - The sum of CRIS among all units may not exceed the injection limit for the total facility
 - While the sum of ERIS among all units may exceed the CSR injection limit, energy injection at the POI may not exceed the CSR injection
 - Units within the CSR may request ERIS below the nameplate for the unit in order to avoid upgrading injection capability, provided proper control technologies are in place

CRIS and Interconnection Rules for CSRs

- Under the proposed rules, new projects seeking to become a CSR may submit a single Interconnection Request
- For projects already in the Interconnection Queue, proposed transition rules enable projects that currently have separate positions in the Interconnection Queue to combine and proceed under a single Interconnection Request as a CSR if:
 - Both projects propose to be behind the same Point of Injection,
 - Both projects are in the queue as of the effective date of the tariff revisions, and
 - A single individual or entity submits a revised Interconnection Request for the combined project
- **The CSR (and any other multi-unit facility evaluated as a single project) will have a single Interconnection Agreement (IA); however projects that propose a configuration or which there are no market rules will require language limiting the facility to operating under current market rules**
 - For example, a proposed combined cycle plus energy storage may proceed under a single IR and single IA, but may not operate in the market as a hybrid resource without market rules allowing for such participation

CSR Resource Registration Proposal

Registration rules for CSR

- **The entity(s) operating the CSR will be responsible to register all parameters pertaining to CSR and its participating Generators.**
- **CSR Registration Parameters:**
 - The following new registration parameters will be added for CSR:
 - CSR Scheduling Limits (MW)
 - CSR injection Scheduling Limit
 - CSR withdrawal Scheduling Limit
 - CSR Generation Capability (MW)
 - CSR Storage Capability (MW)
 - No. and type of units
- **Registration rules and parameter requirements for each Generator in the CSR will depend upon the resource type**
 - The NYISO is not proposing any new registration parameters for the Generators that participate in a CSR at this time

CSR Capacity Market Participation Proposal

ICAP Mitigation Measures

- All existing supply side mitigation measures will apply
- Each unit within a CSR will be a distinct Examined Facility
- CSRs in Mitigated Capacity Zones will be subject to the mitigation evaluations that pertain to ICAP offering behavior
 - Pivotal Supplier “must offer”
- CSRs in Mitigated Capacity Zones will be subject to the mitigation evaluations that pertain to market entrance/exit
 - Physical Withholding
 - Buyer Side Mitigation
 - Renewable units within CSRs will be eligible for the BSM Renewable Exemption
 - The NYISO’s Market Services Tariff defines an “Exempt Renewable Technology,” in all Mitigated Capacity Zones, as “an Intermittent Power Resource solely powered by wind or solar energy”

DMNC Test for CSR

- **Each unit within the CSR will have its own DMNC value**
 - Existing DMNC rules for each resource type will be applicable to units within a CSR
 - ESR units must perform DMNC tests during the Peak Load Window if they have an Energy Duration Limitation (EDL) or provide operating data
 - DMNC is nameplate for Intermittent Power Resources

CSR ICAP and UCAP Calculations

- **ICAP and UCAP calculation methods for each unit within a CSR will be similar to existing methods based on resource type, with small adjustments to account for the shared Point of Injection (POI)**
 - A POI itself can have a derate (e.g., if the inverter is limited) that does not require the ESR unit to reduce its UOL to match the POI injection capability. Therefore, the NYISO proposes to calculate CSR ESR UCAP using the existing method for calculating UDR
 - While the existing ESR UCAP calculation only measures availability of the ESR itself, the proposed CSR ESR UCAP calculation will multiply the POI availability by the ESR availability
 - Intermittent UCAP will also be limited by the POI injection capability, by taking the minimum of POI injection capability and intermittent output when calculating the Production Factor for CSR intermittent units
 - Additional detail on these calculations is on subsequent slides
- 1. It is to be noted that the DAF is 100% for non-duration limited resources
- 2. Intermittent Power Resources have a DAF of 100% as they are not eligible to be a Duration Limited Resources

Proposed CSR ICAP and UCAP Calculations

■ CSR ESR

- $ICAP = \min(CRIS, DMNC)$
- $Adjusted\ ICAP = ICAP * Duration\ Adjustment\ Factor\ (DAF)^1$
- $UCAP = Adjusted\ ICAP * (1 - Derating\ Factor)$
 - $Derating\ Factor = 1 - Availability\ Factor\ (AF)$
 - $CSR\ ESR\ Availability\ Factor = ESR\ Unit\ Availability\ Factor * CSR\ Injection\ Limit\ Availability\ Factor$

■ CSR Intermittent

- $ICAP = \min(CRIS, DMNC)$
- $Adjusted\ ICAP = ICAP * DAF^2$
- $UCAP = Adjusted\ ICAP * Production\ Factor\ (PF)$
 - $CSR\ Intermittent\ Production\ Factor = average(\min(CSR\ Intermittent\ Output, CSR\ Injection\ Limit) / \min(Unit\ Nameplate, CSR\ Injection\ Limit))$ across performance measurement window

■ Numerical examples of these calculations are on the next slide

*Blue font designates additional calculation components for CSR units.

1. It is to be noted that the DAF is 100% for non-duration limited resources
2. Intermittent Power Resources have a DAF of 100% as they are not eligible to elect an Energy Duration Limitation

CSR ICAP and UCAP Example

Assumptions: Max Facility Injection Limit = 80MW

Intermittent: Nameplate = 100 MW, CRIS = 30 MW, DMNC = 100, DAF = 1

ESR: Nameplate = 50 MW, CRIS = 50 MW, DMNC = 50MW, DAF = 1

Hour	CSR Intermittent Output (MW) (A)	CSR ESR UOL (MW)* (B)	CSR Injection Limit (MW) (C)
1	90	50	80
2	70	50	40
3	60	30	80
4	50	50	80

CSR Intermittent Calculations

ICAP = min (CRIS,DMNC) = 30 MW

Adjusted ICAP = ICAP * DAF = 30 MW * 1 = 30 MW

UCAP = Adjusted ICAP * Production Factor

= 30 MW * (sum(min(A,C))/(min(100, 80)*4 hours))

= 30 MW * ((80+40+60+50)/320 MWh)

= 22 MW

CSR ESR Calculations

ICAP = min (CRIS,DMNC) = 50 MW

Adjusted ICAP = ICAP * DAF = 50 MW * 1 = 50 MW

UCAP = Adjusted ICAP * Availability Factor (AF)

= 50 MW * CSR ESR AF * CSR Injection Limit AF

= 50 MW * (Sum(B)/(50 MW*4 hours)) * (Sum(C)/(80 MW* 4 hours))

= 50 MW * 0.9 * 0.875

= 39 MW

*Note that other elements are included in the existing availability calculation for ESRs, all of which will be applicable for ESRs within CSRs. UOL is used as a proxy for ESR availability for the purposes of this simplified example.

CSR Bid/Schedule/Notify (B/S/N) Obligations

- **Each unit within a CSR will be subject to B/S/N obligations consistent with existing rules based on resource type**
 - An ESR within a CSR that has an Energy Duration Limitation (EDL) must Bid/Schedule/Notify in the Day-Ahead Market (DAM) for injection of the ICAP Equivalent of UCAP sold (ICE), for each hour of the Peak Load Window (PLW)
 - An ESR within a CSR that has an EDL must also bid the full withdrawal range, i.e. max(negative Installed Capacity Equivalent, Lower Operating Limit), for all hours outside of the Peak Load Window
 - If the ESR does not have an EDL, it must B/S/N ICE injection into the DAM for all hours, consistent with traditional generator requirements
 - Intermittent units within a CSR will not be required to B/S/N in the DAM

CSR Energy Market Bidding Proposal

Energy Market Bidding for CSRs

- **Must submit separate bids for each CSR Generator participating in the NYISO wholesale market**
- **Bidding rules and parameter requirements depends upon the participation model used by the CSR Generators**
 - For the ESR unit, ESR bidding rules and parameter requirements will apply
 - For IPR unit, resource-specific (solar or wind) bidding rules and parameter requirement will apply
- **CSR Injection Limit shall be a biddable parameter**
 - Each CSR Generator shall specify the CSR Scheduling Limits with its Day-Ahead and Real-Time Bids
 - Each of the CSR Scheduling Limits will be a MW submission only. There will not be a price (\$/MW) associated with the CSR Scheduling Limit values
 - NYISO will review submitted limits for possible Energy market physical withholding
- **Desired injection and withdrawal schedules should be achieved through market Bids**

Energy Market Bidding for CSRs

- Similar to other generators, CSR will be able to bid in both Day Ahead and Real Time markets
- Minimum offer size for Energy and Ancillary Services:
 - 1 MW for generation units;
 - 100 kW for ESR unit
- The Bidding process will be same as currently applicable to ESR, solar or wind IPR
 - Must submit CSR Scheduling Limit with each Bid
- Bid types (e.g., fixed, flexible, self-schedule) available to each resource type within CSRs are consistent with existing Generator bidding rules
 - ESR are not permitted to self-commit or self-schedule outside the relevant CSR Scheduling Limit

CSR Energy Market Scheduling Proposal

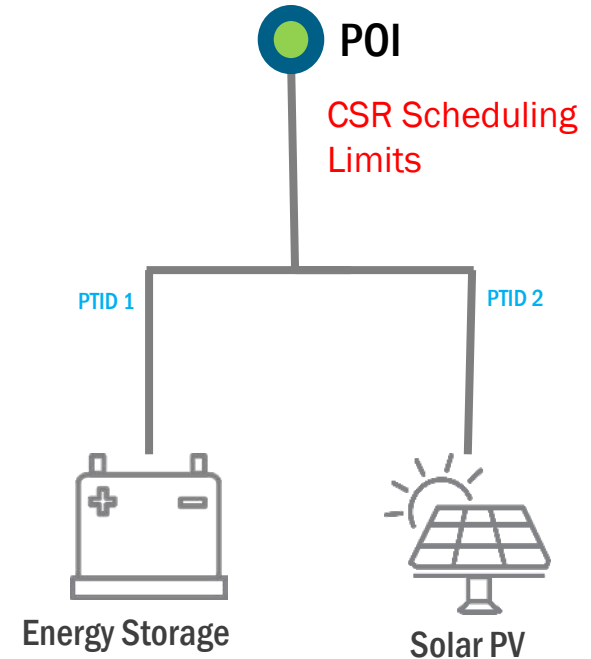
Energy Market Scheduling for CSR

- Basepoints will be sent to individual units
- NYISO will determine energy, reserves and regulation schedule for units within the CSR
 - The NYISO will use CSR scheduling constraints to determine energy and ancillary services schedules for different units within the CSR

$$\sum_{\text{unit}=1}^2 (Energy_{\text{unit}} + Reserves_{\text{unit}}^* + Regulation_{\text{unit}}^*) \leq \text{CSR injection Scheduling Limit}$$

$$\sum_{\text{unit}=1}^2 (|Energy_{\text{unit}}| + Regulation_{\text{unit}}^*) \leq |\text{CSR withdrawal Scheduling Limit}|$$

- Other scheduling constraints applicable to each generation unit shall continue to apply



*Please note that intermittent resources are not eligible to provide reserves and regulation

Energy Market Scheduling for CSR (cont'd)

- **When the total CSR schedules are near the CSR injection Scheduling Limit, the solar or wind IPR unit will be instructed not to exceed its economic basepoint**
- **This instruction will be communicated via a Wind and Solar Output Limit flag**
 - The purpose of this treatment is to ensure that reliability services, such as operating reserves and regulation service, are deliverable by the ESR at times when the schedules of the CSR are near or equal to the CSR injection Scheduling Limit

Energy Market Scheduling for CSR (cont'd)

- Settlement rules that will apply when Wind and Solar Output Limit is in effect are consistent with current provisions for wind generators:
 - IPR unit will not be eligible for compensation for generation greater than Real-Time Scheduled Energy Injection (beyond 3% tolerance)
 - IPR unit will be eligible for over-generation charges, when such output limit is in effect
- “Wind and Solar Output Limit” on the intermittent unit will be set if certain conditions are met¹
 - Condition 1: ESR unit either has a non-zero ancillary services award or a positive energy schedule; and
 - Condition 2: The sum of the CSR Generators Energy + Operating Reserves + Regulation Service schedules is greater than or equal to a threshold (X %) times the CSR Injection Limit
 - The NYISO has proposed an initial value of 90% for this threshold. The NYISO will monitor this value as it gains operational experience with Co-located storage resources

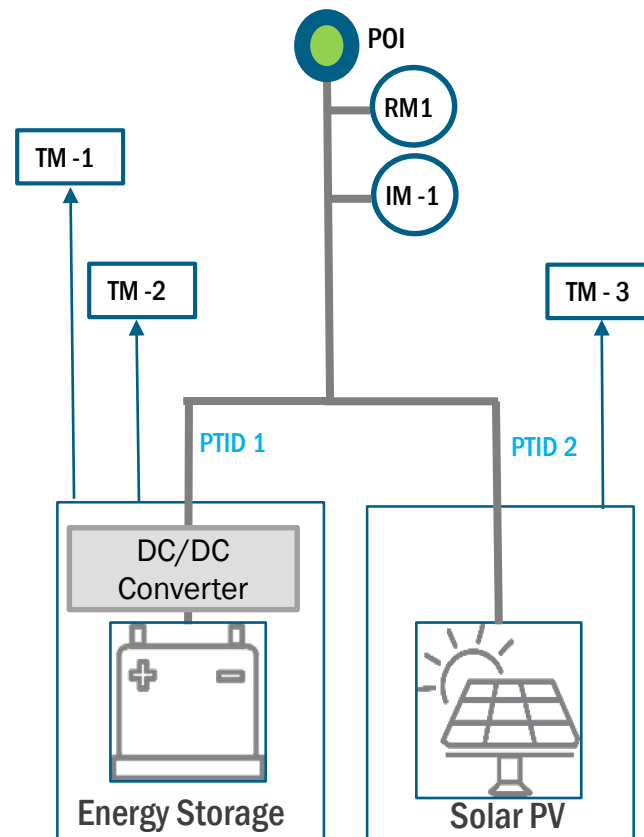
1. For more details, please refer to 08/25/2020 ICAPWG/MIWG presentation located at:

https://www.nyiso.com/documents/20142/14757023/Hybrid%20Storage_Market%20Design%20Updates%20%20Energy%20tariff%20ICAPWG%20MIWG%2008.25.20%20draft%20final.pdf/ffb01347-c4bd-24a1-6549-91cda42d8cb3

CSR Metering Proposal

CSR Metering Proposal

Meter Designation	Meter Requirements	Data flows
RM1	Revenue grade; dual – channel meter; reported by a Meter Authority	Hourly data
IM -1	Instantaneous meter	6 second aggregated output telemetry from CSR
TM - 1	SCADA data	ESR State of Charge (SOC) telemetry
TM -2	SCADA data	6-second aggregated output telemetry from ESR (telemetry should be compensated to the equivalent AC output at the POI)
TM -3	SCADA data	6 second aggregated output telemetry from Solar PV (telemetry should be compensated to the AC equivalent output at the POI)



CSR Metering Proposal (cont'd)

- **CSR will be required to have a dual channel Revenue Grade Meter (AC) at the Point of Injection (POI)**
 - Meter must be capable of separately recording Energy injections and Energy withdrawals
- **CSR shall provide 6 second telemetry at the POI**
 - Telemetry data must reflect the total Energy injections and Energy withdrawals of the CSR
- **Each unit shall provide 6 second telemetry for output and control signals. The telemetry should be compensated to the equivalent AC output at the POI**
 - For the ESR unit, 6 second Energy Level (state of charge) telemetry data will be required
 - For the IPR, wind or solar forecast information will be required
 - Forecast information shall include all the meteorological data as well as outage information
- **6-Second telemetered data from the units will be used for real-time operations**
- **Revenue Grade Meter data at the POI will be used for settlement purposes**

CSR Metering Proposal (cont'd)

- **Proposal for allocation of Energy injections and Energy withdrawals to ESR and intermittent renewable units¹**
 - Hourly injection (MWh) and withdrawal (MWh) will be determined from the revenue grade meter at the POI
 - Each Generator's individual telemetered output will be used to determine the injections and withdrawals (MWh) allocated to the ESR and to the wind or solar IPR
- **All energy withdrawals will be allocated to the ESR**

1. For more details on allocation methodology and examples , please refer to 09/22/2020 ICAPWG/MIWG presentation located at: https://www.nyiso.com/documents/20142/15473217/Hybrid%20Storage_CSR%20examples_%20%20Energy%20tariff%20ICAPWG%20MIWG%2009.22.20%20draft%20final.pdf/944fc9aa-edfb-a77a-3d77-b94c82e74b2c

CSR Energy Market Settlements Proposal

CSR Energy Market Settlements

- Settlement will occur at the unit level
- The settlement rules for Generators that participate in a CSR are proposed to be same as those applicable to standalone ESRs and IPRs
 - Some specific settlement provisions that were discussed during ICAPWG/MIWG, are included on subsequent slides
- The NYISO operators will be able to issue an Out-of-Merit (OOM) to change the CSR Scheduling Limits in Real-Time for ISO/TO reliability or at the Market Participant's request
 - When the ISO uses Out-of-Merit to reduce the CSR Scheduling Limit for NYCA or local reliability, the Out-of-Merit for NYCA or local reliability designation will apply to each of the Generators that is subject to the affected CSR Scheduling Limit

DAMAP for ESR Participating in a CSR

- When the ISO uses Out-of-Merit to reduce the CSR Scheduling Limit for NYCA or local reliability, the Out-of-Merit for NYCA or local reliability designation shall apply to each of the Generators that is subject to the affected CSR Scheduling Limit
- The ESR will be eligible for DAMAP when the CSR Scheduling Limit is OOM for reliability or the ESR unit is OOM for reliability¹

1. For more discussion on DAMAP eligibility for ESRs, please refer to the presentation on “ESR Participation Model: Energy Market Design”.
<https://www.nyiso.com/documents/20142/2686166/ESR%20Market%20Design%20MIWG%2009212018.pdf/ce0dccc8-f903-35b0-fbf9-74e8311a202e>

TSC and NTAC charges

- TSC (Transmission Service Charges) and NTAC (NYPA Transmission Adjustment Charge) are assessed to an ESR based on the ESR's actual energy withdrawals when it is not providing a FERC-approved "service"
- The ESR unit that participates in a CSR will not pay TSC and NTAC when it receives charging energy from its co-located Intermittent Power Resource behind the shared POI/POW. The ESR will still be required to pay TSC and NTAC for the net energy withdrawals from the grid by the combined CSR Generators at the POI/POW if the ESR is not providing a FERC-approved "service"
 - E.g., Intermittent unit injecting 20 MW; ESR withdrawing 30 MW. Net withdrawal for CSR is 10 MW (30 – 20 MW), so ESR unit will pay TSC and NTAC on 10 MW withdrawals if it is not providing a FERC-approved "service"

Market Participation Charges for CSR Generators

- **ISO annual budget charges and annual FERC fees will be assessed on the total MWh injections and withdrawals by each Generator that participates in a CSR**
 - For the purposes of these charges/fees, withdrawals by the ESR are negative injections and treated as Injection Billing Units¹
 - This treatment is consistent with the proposal that the two Generators participating a CSR participate as distinct resources in the wholesale market
 - These fees are intended to recover the cost of administering the market. Even though the CSR Generators are physically located behind a common POI, they submit two independent sets of bids into the market, with each resource being scheduled and settled independently. CSR introduce a new operating constraint that must be enforced (the CSR Scheduling Limit) and requires new metering and meter data profiling processes.

1. Please refer to OATT 6.1 Rate Schedule 1 for more details on these charges/fees

CSR Energy Market Mitigation

Energy Market Mitigation for CSR

- **CSR Scheduling Limit will be subject to existing Energy market physical withholding rules**
- **Units within the CSRs shall be subjected to the existing mitigation rules**