New York ISO
Independent System Operator

Hybrid Aggregated Storage (HSR) Model – Energy and Ancillary Services Market Design Proposal Update

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New Resource Integration

MIWG/ICAPWG

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Agenda

- HSR Registration Proposal
- HSR Metering and Telemetry Proposal
- HSR Energy and Ancillary Services Bidding Proposal
- HSR Energy and Ancillary Services Scheduling Proposal
- HSR Energy and Ancillary Services: Reserve Capabilities Proposal
- HSR Energy Market Settlements Proposal

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Background

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Review of Scope

- The May 11 MIWG presentation "NYISO Hybrid Aggregated Storage Resources (HSR) Model Use Case and Proposal Update" proposed the current use case for the HSR model
- An HSR consists of at least one Energy Storage Resource (ESR) and at least one Intermittent Power Resource (IPR) and/or Run-of-River (RoR) Hydro
  - This model will support Wind, Solar, Landfill Gas, RoR Hydro, and ESR(s) that aggregate and share a POI operating as a single dispatchable resource
- The Co-located Storage Resource (CSR) model will be updated to allow for:
  - An ESR + a Landfill Gas Generator
  - An ESR + a RoR Hydro Generator
  - An ESR + a Combustion Turbine (CT)

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HSR Definitions

- An HSR consists of at least one Energy Storage Resource (ESR) and at least one Intermittent Power Resource (IPR) [wind, solar and/or landfill gas] and/or Run-of-River (RoR) Hydro that: (a) are all located behind a single Point of Injection; (b) participate in the Energy and Ancillary Services markets as one Resource sharing a single PTID; and (c) have a POI limit greater than 20 MW
- HSRs are dispatch-only
- HSRs cannot be co-located with Load
  - Only station service load is permitted
- HSRs LOL = min (ESR max withdrawal limit or the POI limit), UOL = min (combined generator nameplates or the POI limit)
- Reserve Limit ("RL"): A MW value provided by the HSR operator that represents the upper limit of injection capability of the resource to provide Synchronous Operating Reserves that are sustainable for one hour.

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Scope of Discussion

- The presentation today is focused on the Energy and Ancillary Services Market design for HSR
- A presentation at an upcoming MIWG will discuss designs for the additional use cases

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HSR Registration Proposal

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HSR Registration Rules

- **The entity operating the HSR will be responsible for registering all parameters pertaining to HSR**
- **New registration parameters will be considered for HSR:**
  - Number and type of units within the HSR and information about their capabilities and characteristics
  - Reserve Limit (RL) in MW

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HSR Metering and Telemetry Proposal

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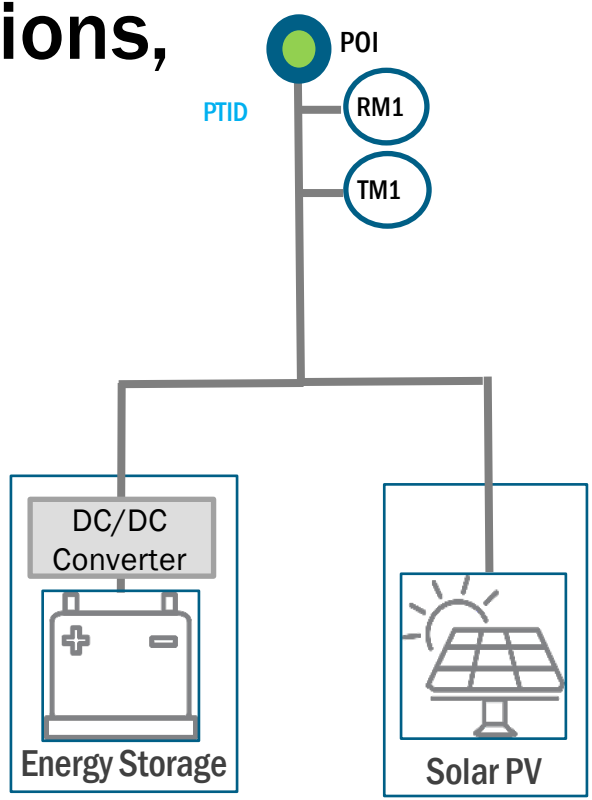
HSR Metering and Telemetry Proposal for Real-time Operations, Energy and Ancillary Services

Meter Designation	Meter Requirements	Data flows
RM1	Revenue grade; dual – channel meter; reported by a Member System	Hourly data
TM1	SCADA data	6 second output telemetry from HSR



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HSR Metering and Telemetry Proposal for Real-time operations

- HSR will be required to have dual channel Revenue Grade Meter (RGM) [AC] at the Point of Injection (POI)
  - Meter must be capable of separately recording Energy injections and Energy withdrawals
  - RGM data at the POI will be used for settlement purposes
- HSR shall provide 6-second telemetry at the POI
  - Telemetry data must reflect the actual injections and withdrawals of the HSR
  - 6-second total HSR telemetered data will be used for real-time operations
- HSR component-level performance data may be required for audit/verification purposes
- Additional Telemetry Requirements are expected for Capacity Market Participation (and used for Audit) and will be covered in a future presentation

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HSR Energy and Ancillary Services Market Bidding Proposal

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HSR Energy Market Bidding Proposal

- **HSRs will be able to bid in both Day Ahead and Real Time markets**
- **HSRs may offer via the following bid modes:**
  - Self-Committed Fixed
  - Self-Committed Flex
  - ISO-Committed Flex
- **HSR bids will include the following components that are applicable for other resources:**
  - An 11-point decremental bid curve for Energy scheduling
  - Regulation MW and $/MWh offer component of the Day-Ahead and Real-Time Market bid
  - Sync Reserve $/MWh offer component of the Day-Ahead Market bid

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HSR Energy Market Bidding Proposal, cont.

- HSRs will self-manage their storage levels; there will be no SOC management by the NYISO
- HSRs must be able to offer at least 1 MW to bid for Energy and Ancillary Services
- HSRs may submit bids in increments of 100 kW above 1 MW
- HSR operators will submit a single bid for the entire HSR
  - LOL and UOL measures must be included as part of an HSR's bid and updated as necessary based on changing HSR capabilities and conditions (e.g., wind production decreases sooner than anticipated)
  - RL measures must be included as part of an HSR's bid and updated as necessary based on changing HSR capabilities and conditions (e.g., wind production decreases sooner than anticipated)

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HSR Energy Market Bidding Proposal

- **The HSR can offer in its full expected capabilities, including the non-ESR generator(s) forecasted output for Energy for the market hour**
  - An HSR's UOL represents the sum of expected capabilities to provide energy and ancillary services of all HSR components, and may reflect forecasted HSR output (adjusted by risk tolerance)
- **HSRs qualified for and offering Reserves will be required to provide and update their RL in the DAM and RT offers**
  - The RL must reflect the sync reserves the Resource is capable of sustaining for one hour
  - The RL may be updated in RT after real-time market close to reflect changing conditions (more details in later slides)
  - If the HSR Operator does not update its RL, the NYISO may not have actual reserves available to respond to a system event, putting the NYISO in violation of NPCC* and potentially NERC Disturbance Control# reliability requirements

***NPCC Directory 5 Requirement R6.** A Balancing Authority's **synchronized reserve, ten-minute reserve, and thirty-minute reserve,** if activated, shall be sustainable for at least one hour from the time of activation.

#**BAL-002-3**, Disturbance Control Performance, Contingency Reserve for Recovery from a Balancing Contingency Event

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HSR Energy Market Scheduling Proposal

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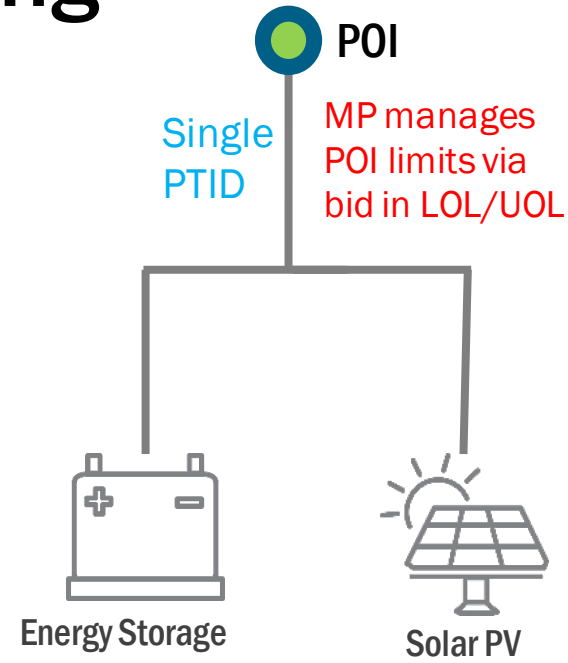
HSR Energy Market Scheduling

- **A single Basepoint/Schedule will be sent to the HSR**
  - Injections and withdrawals will not be scheduled independently
- **NYISO will determine energy, reserves and regulation schedule for the HSR**
  - The NYISO will use HSR net telemetry (TM1), real-time operating limits and ramp rate to determine feasible energy and ancillary service schedules



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

HSR Ancillary Service Eligibilities

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HSR Ancillary Services Eligibility: Voltage Support Service and Black Start Service

- **Voltage Support Service (VSS)**
  - HSRs may qualify to provide VSS, subject to the existing supplier qualification criteria
  - HSRs must conduct a test for VSS eligibility according to "normal operating conditions" of their Resource
    - Multiple HSR components may be required to test together if they will normally be operated in tandem
  - The total compensable MVARs of the HSR shall be the lesser of:
    - The combined HSR component VSS test results, or
    - The injection limit at the POI
  - Metering/telemetry to measure the MVAR flows at the units and POI will be required for an HSR to provide VSS
  - Testing requirements and performance measurement details for HSR will be incorporated into the Ancillary Services Manual, as necessary
- **Black Start Service**
  - HSRs will not be eligible to provide Black Start Service

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HSR Ancillary Services: Reserves and Regulation Eligibilities

- **HSRs may qualify for both Spinning Reserves and Regulation**
  - An HSR's Reserves and Regulation capabilities will be limited to the capabilities of its ESR components
    - The maximum Operating Reserves that an ESR can qualify for will be equivalent to its maximum sustainable output for one hour
  - Non-ESR components of an HSR cannot contribute to the HSR's reserve/regulation qualifications
    - IPRs and ROR Hydro units cannot qualify to provide Reserves or Regulation under present market rules
- **HSRs can bid to simultaneously provide Energy, Reserves, and Regulation**
- **The NYISO will consider removing an HSR's operating reserves qualification should it persistently underperform**
  - All Operating Reserves offered by an HSR must be sustainable for one hour

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HSR: Reserve MW Limit

- **Reserve Limit: A MW value provided by the HSR operator that represents the upper limit of injection capability of the resource to provide Synchronous Operating Reserves that are sustainable for one hour.**
- **The HSR Operator will be required to specify/be able to update a Reserve Limit :**
  - At Time of registration
  - On DAM and RT offers
  - After the RT market close
- **An HSR can submit a Reserve Limit update in RT either before or after Market Close to reflect changing operating conditions that would reflect its Reserves capabilities**
  - The timing of updates will impact how they are assessed by the NYISO; more on slides 26-28
  - An HSR may increase or decrease its UOL without adjusting its RL

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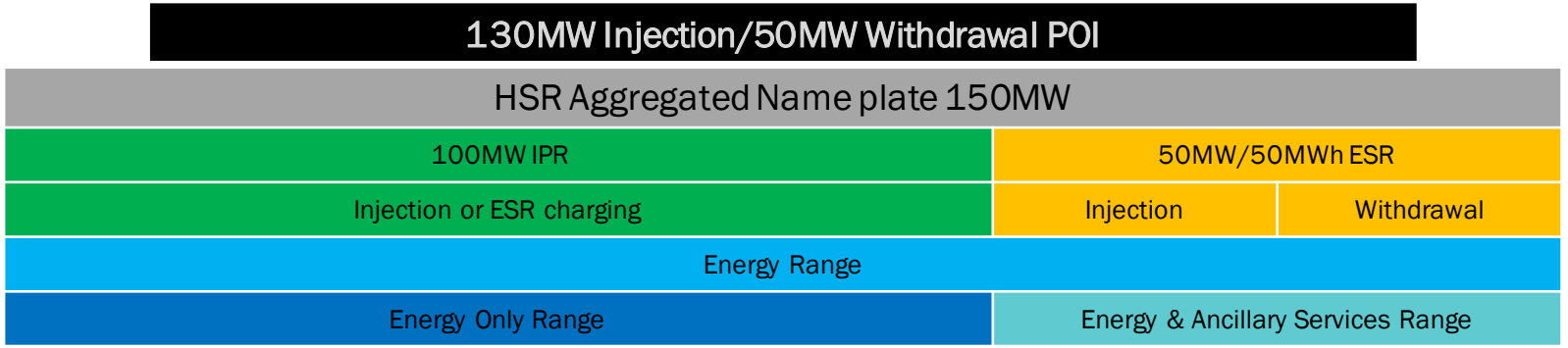
Example HSR Energy & Ancillary Services Capabilities



Limit	Value
IPR LOL / UOL	0 MW / 100 MW
ESR LOL / UOL	-50 MW / +50 MW
ESR Injection and Capacity	50 MW / 50 MWh
POI LOL / UOL	-50 MW / +130 MW

Limit	Value
Max Possible HSR RL	50 MW
Max Energy Award	130 MW
Max Possible Reserve Award	50 MW
Max Possible Regulation Award	50 MW

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HSR Operating Reserves: Scheduling Determinants

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HSR Operating Reserves Scheduling

- **The Reserve Limit is only one of several parameters that are considered by the NYISO when determining an HSR's maximum Reserve schedule**
- **NYISO determines an HSR's maximum Reserves Schedule using the following formula:**
  - Max Reserves Schedule = min(scheduled withdrawal MW + Reserve Limit, ramp rate, UOL)
  - When reserves are scheduled by the NYISO, they are represented as callable energy incremental to the existing energy schedule

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HSR Operating Reserves: Reserve Limit Derates

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Reserve Limit Updates/Derates: Pre–Market Close

- **An HSR Operator may adjust its HSR's Reserve Limit on its RT Offers prior to market close, down to the HSR's DAM Reserves Schedule without submitting a derate**
  - Adjusting the Reserve Limit below the HSR's DAM Reserves Schedule would *require* a tandem, proportional RL/UOL derate
- **Example:**
  - An HSR is awarded a DAM Reserves schedule of 20 MW for the 3 PM hour, with a 3 PM Reserve Limit of 30 MW. The HSR Operator may adjust the 3 PM Reserve Limit down to 20 MW to reflect changing operating conditions, so long as the change is made before 1:45 PM, as part of its timely-submitted real-time offer.

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Reserve Limit Derates: Post – Market Close

- HSRs will have the ability to update their UOL and Reserve Limit (enhancement as part of HSR development) after market close via new software being developed for DER (GOCP) that will allow electronic submission of derates to the ISO
- An HSR Operator may derate its HSR's RL below its DAM Reserves Schedule after market close if it is unable to meet its DAM schedule due to:
  - Unexpected operating conditions cause HSR performance to deviate from what was forecast
  - An unexpected Equipment Outage reduces/eliminates Reserve Capabilities
  - Reserves are converted to Energy by the NYISO, reducing Reserves capability in future market hours
- HSRs that are not able to meet their Day-Ahead Energy or Operating Reserve schedules in real-time will be subject to balancing settlement between DAM and RT markets

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Reserve Limit Derates: Post – Market Close

- **Derate due to unexpected change in operating conditions that causes HSR performance to deviate from what was forecast**
  - Updated limit will become effective at top of next operating hour
    - E.G. A derate to reflect changing operating conditions submitted at 1:25 PM will not become effective until 2 PM
  - Must be submitted at least 15 – minutes prior to the next operating hour
    - E.G. A derate submitted to reflect changing operating conditions must be submitted before 1:45 in order to be considered for 2 PM
  - HSR Operator will be required to derate both Reserve Limit and Upper Operating Limit by proportional amounts
    - Derating the RL down by 10 MW requires a proportional 10 MW derate be administered to the UOL
- **Derate due to unexpected equipment outage**
  - Updated limit will become effective on the next market run after submission
  - May be submitted at any point in time there is an equipment outage
  - HSR Operator will be required to derate both Reserve Limit and Upper Operating Limit by proportional amounts

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Reserve Limit Derates: Post – Market Close, cont.

- **Derate due to economic conversion of Reserves to Energy by the ISO**
  - Updated limit will become effective at top of next operating hour
    - E.G. A derate to reflect changing operating conditions submitted at 1:25 PM will not become effective until 2 PM
  - Must be submitted at least 15 – minutes prior to the next operating hour (e.g. 1:45, 2:45, etc.)
    - E.G. A derate submitted to reflect changing operating conditions must be submitted before 1:45 in order to be considered for 2 PM
  - HSR Operator will be required to derate its HSR's Reserve Limit when Reserve conversion means that it will no longer be able to meet its DAM schedule/RT offer for Reserves in the next hour
    - E.G. NYISO economically converts 10 MW of an HSR's 40 MW of Reserves to Energy over the course of the 12 PM Operating Hour, reducing the ESR component's storage capacity from 40 MWh down to 30 MWh. If this reduction results in an infeasible Reserve Limit value for the 1 PM hour (for example, if the Reserve Limit at 1 PM was 40 MW), then the HSR Operator must derate the HSR's Reserve Limit, and gauge whether or not a UOL derate would also be appropriate.
    - A UOL derate will only needs to accompany a Reserve conversion if the HSR will be unable to reach it's bid–in UOL in future hours because of the expended stored Energy

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HSR Energy Market Settlements Proposal

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HSR Energy Market Settlements

- **HSR components will be settled in aggregate**
  - Individual HSR components, i.e. individual ESRs, IPRs, and/or ROR Hydro units within an HSR, will not be settled separately
- **HSRs would be considered "withdrawal–eligible generators" if the HSR POI allows for grid–based withdrawals**
  - A withdrawal – eligible HSR will be settled for both injections and withdrawals
- **HSRs will not receive Intermittent Power Resource settlement treatment and will not be eligible for special IPR exceptions**
  - By extension, HSRs will not be required to pay IPR forecasting fees to the NYISO
- **The NYISO operators will be able to issue an Out-of-Merit (OOM) to change the HSR Operating Limits UOL, RL, LOL in Real-Time for ISO or TO (local) reliability**

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TSC/NTAC Charges

- **Withdrawal–eligible HSRs will be subject to TSC/NTAC charges when they are net–withdrawing through the POI and not providing a FERC-authorized service**
- **A net–withdrawing HSR is considered to be providing a "service" when it:**
  - Receives a Real-Time Market schedule for Operating Reserves; or
  - Receives a Real-Time Market schedule for Regulation Service; or
  - Is a qualified Supplier of Voltage Support Service to the ISO in accordance with Section 15.2 of the ISO Services Tariff; or
  - Is dispatched by the ISO as Out-of-Merit to meet NYCA or local system reliability in the same hour

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Persistent Overwithdrawal/Undergeneration

- HSRs will be subject to Persistent Undergeneration Settlement treatment(s) when net – injecting
- HSRs will be subject to Persistent Overwithdrawal/Underwithdrawal Settlement treatment(s) when net – withdrawing
  - Consistent with rules developed for ESRs:
    - Persistent Underwithdrawal is treated in the same way as Persistent Overgenetation
    - Persistent Overwithdrawal is treated in the same way as Persistent Undergeneration
- HSRs will be subject to the existing +/-3% threshold when determining Persistent Overgeneration/Undergeneration and Persistent Overwithdrawal/Underwithdrawal treatment

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Day–Ahead Margin Assurance Payments

- **DAMAP protects Day-Ahead Margins that are lost as a result of Real-Time dispatch instructions provided by the NYISO.**
  - Protecting Generators' Day-Ahead Margins incentivizes them to respond to NYISO instructions in RT.
  - Generators that offer as ISO-Committed Flexible or Self-Committed Flexible for the same hours in the DAM and RTM are eligible for DAMAP (among certain other categories of Suppliers)
  - DAMAP is generally reduced or eliminated when Generators decrease their availability in RT.

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DAMAP for HSRs

- **Narrow DAMAP eligibility for HSRs**
  - HSRs face the same intertemporal scheduling constraints as standalone ESRs and DER Aggregations
    - Decisions to inject or withdraw in one hour may affect the Resource's opportunity costs in a future hour, resulting in dynamic margins that DAMAP is not designed to accommodate
    - NYISO determined that extending the existing DAMAP construct to ESRs was inappropriate, as it might dis–incentivize them to respond flexibly to changing conditions in RT
      - This same concern applies to HSRs
      - HSRs will only be eligible for DAMAP when committed OOM for Reliability

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Day–Ahead BPCG

- **Day-Ahead Bid Production Cost Guarantee (BPCG) payments are paid if a Supplier's total as-bid costs are greater than its revenues for the DA market.**
- **DA BPCG is a daily settlement that is calculated on an hourly basis.**
- **Eligibility Criteria:**
  - A supplier must be committed by the ISO and bid using ISO-Committed Fixed or ISO Committed Flexible to be eligible for DA BPCG payments.
  - A supplier is not eligible to receive a DA BPCG payment if it is committed for any other hour as a result of a Self-Committed Fixed or Self-Committed Flexible bid.

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Day–Ahead BPCG for HSRs

- **HSRs will be eligible for DA BPCG consideration if:**
  - The HSR bids into the DAM using the ISO–Committed Flexible bid mode
- **HSRs will be ineligible for DA BPCG consideration if:**
  - The HSR bids into the DAM using the Self–Committed Fixed/Flexible bid modes

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Real-Time BPCG

- Real Time BPCG payments are paid if a qualifying Supplier's total as-bid (or mitigated) costs are greater than its revenues for commitment in RT above its DA schedule.
- RT BPCG is a daily settlement that is calculated at the 5-minute level using RTD schedules.

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Real – Time BPCG for HSRs

- **HSRs will be eligible for RT BPCG consideration if:**
  - The HSR bids using the ISO – Committed Flexible bid mode in the RTM
  - The HSR bids using the Self – Committed Flexible bid mode in the RTM, The HSR is SRE'd or committed OOM by the ISO for reliability
- **HSRs will be ineligible for RT BPCG consideration if:**
  - The HSR switches between ISO – Committed and Self – Committed bid modes in any hour of the operating day, SRE/OOM notwithstanding

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Regulation Service

- **An HSR will be compensated under the existing rules in Rate Schedule 3 of the Services Tariff when it is providing Regulation Service**
  - These same rules apply to all other eligible Resources (including ESRs)

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Next Steps

- HSR Energy/Capacity Mitigation
- HSR Capacity Market Participation
- HSR Interconnection Rules
- Updates to CSR Model
  - Incorporation of CTs, Landfill Gas, and Limited Control Run of River Hydro into CSR model

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Our Mission & Vision

Mission

Ensure power system reliability and competitive markets for New York in a clean energy future

Vision

Working together with stakeholders to build the cleanest, most reliable electric system in the nation

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Questions?

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