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Independent System Operator

Hybrid Aggregated Storage (HSR) Model – Energy and Capacity Market Design Proposal

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New Resource Integration

MIWG/ICAPWG

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Agenda

- HSR Bidding Examples
- HSR Reserve Limit Derate Examples
- HSR Capacity Market Participation Proposal
- HSR ICAP/UCAP Calculations
- HSR Interconnection Rules Proposal

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Previous Discussions (2022)

Date	Working Group	Topic/Links to Materials
July 15th 2022	MIWG/ICAPWG	Hybrid Aggregated Storage (HSR) Model – Energy and Ancillary Services Market Design Proposal Update: https://www.nyiso.com/documents/20142/32238824/HSR%20Energy%20and%20Ancillary%20Services%207-15%20Final.pdf/3c26ce45-242a-ac73-b1cb-61992d085da9
May 11th 2022	MIWG/ICAPWG	NYISO Hybrid Aggregated Storage Resource (HSR) Model Use Case and Proposal Update: https://www.nyiso.com/documents/20142/30555355/HSR%20Use%20Cases%20%20Proposal%20Update%20051122%20MIWG%20(002).pdf/975c4032-05b3-072e-7efb-59e317ec9efa
March 25th 2022	MIWG/ICAPWG	Hybrid Storage Model – Energy and Capacity Market Design Proposal: https://www.nyiso.com/documents/20142/29448212/2%20HSR%20Energy%20and%20Capacity%20Market%20Design%20MIWG.pdf/0015667b-9278-61b5-276f-cbe7d86a7dc4

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Background

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 (no commitment, dispatchable over entire offer curve)
- HSRs cannot be co-located with Load behind a single utility retail meter; the HSR must be directly metered
  - Only station service load is permitted
- 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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HSR Bidding Examples

Scope of Examples and Assumptions

- The following examples covering HSR bidding (slides 9 and 10) and derating the Reserve Limit (slides 15-16, 18-19, 21-22) focus on Reserves and the RL concept
- To simplify the examples below, the HSR submits Regulation Capacity bids of 0 MW
- Forecasted performance is based on the HSR operator's expected IPR output, expected ESR SOC, and expected LBMPs

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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 maximum expected capability to provide energy and ancillary services from 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 timely 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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RT HSR Bidding Example, ESR Charging

- Consider an HSR comprised of one IPR and one ESR with the following characteristics and forecasted performance:

Component	Value
IPR Min/Max Limits	0 MW / 100 MW
ESR Min/Max Limits	-50 MW / +50 MW
ESR Injection and Capacity	50 MW / 50 MWh
POI Min/Max Limits	-50 MW / +130 MW

Forecasted Performance		
	Hour 1	Hour 2
IPR Output	70 MW	50 MW
ESR Output	-20 MW	0 MW
Net POI Output	50 MW	50 MW
ESR SOC, start of the hour	10 MWh	30 MWh

- The bids must be in line with the following parameters:
  - Reserve Limit <= ESR's SOC at the start of the hour
  - Reserve Limit + Regulation Capacity MW + Energy Schedule <= Bid-in UOL
- Based on its forecasts and these parameters, the HSR Operator submits the following bids in RT:

	Hour 1	Hour 2
Reserve Limit	**Up to 10 MW**	**Up to 30 MW**
Regulation Capacity	0 MW	0 MW
Bid-In UOL (for the HSR)	80 MW	80 MW

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RT HSR Bidding Example, ESR Injecting

- Consider an HSR comprised of one IPR and one ESR with the following characteristics and forecasted performance:

Component	Value
IPR Min/Max Limits	0 MW / 100 MW
ESR Min/Max Limits	-50 MW / +50 MW
ESR Injection and Capacity	50 MW / 50 MWh
POI Min/Max Limits	-50 MW / +130 MW

Forecasted Performance		
	Hour 1	Hour 2
IPR Output	50 MW	70 MW
ESR Output	20 MW	0 MW
Net POI Output	70 MW	70 MW
ESR SOC, start of the hour	30 MWh	10 MWh

- The bids must be in line with the following parameters:
  - Reserve Limit <= ESR's expected SOC at the end of the hour
  - Reserve Limit + Regulation Capacity MW + Energy Schedule <= Bid-in UOL
- Based on its forecasts and these parameters, the HSR Operator submits the following bids in RT:

	Hour 1	Hour 2
Reserve Limit	10 MW	10 MW
Regulation Capacity	0 MW	0 MW
Bid-In UOL (for the HSR)	80 MW	80 MW

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HSR Reserve Limit (RL) Derate Examples

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)
    - If the HSR is net withdrawing, it may receive a Reserve schedule that is greater than the Reserve Limit
  - When reserves are scheduled by the NYISO, they are represented as callable energy incremental to the existing energy schedule

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Reserve Limit Derates: Post RT Market Close

- **HSRs will have the ability to update their UOL and Reserve Limit [RL] (enhancement as part of HSR development) after RT market close via new software being developed for DER (GOCP) that will allow electronic submission of derates to the ISO**
  - The HSR operator is expected to submit consistent RL values with its Bids for future hours that have not closed yet
- **An HSR Operator may derate its HSR's RL below its DAM Reserves Schedule and/or RT Reserves offers after RT market close if it is unable to meet its DAM schedule or RT Reserves offer due to:**
  - Reserves are converted to Energy via a Reserve Pickup (RPU) call and/or OOM by the NYISO (or TO OOM), reducing Reserves capability in future market hours. If necessary, a RL update must be submitted when the HSR operator is aware of an issue
  - If an unexpected Equipment Outage reduces/eliminates Reserve Capabilities, then a RL update must be submitted immediately when the outage occurs
  - In all other cases where the HSR will not be able to meet the next hour's DAM Reserves schedules and/or RT Reserves offers, a RL update must be submitted when the HSR operator is aware of an issue
    - Examples
      - Lower IPR output than forecast prevents the HSR from charging its ESR up to levels required to meet the next hour's DAM Reserves Schedule or RT Reserve offers
      - HSR operator provides energy offers indicating that, based on the LBMP at the HSR's location, it prefers to inject energy onto the grid now instead of charging the ESR. This decision results in a reduced SOC and less ability to provide Reserves in later 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 RT Market Close – OOM and/or RPU

- **Derate due to conversion of Reserves to Energy by the ISO via an OOM and/or RPU**
  - Updated limits (with effective start/end times) when the HSR operator is aware of an issue following the OOM and/or RPU
  - 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
    - A UOL derate will only need to accompany a Reserve conversion as a result of an OOM and/or RPU if the HSR will be unable to reach its bid-in UOL in future hours because of the expended Energy

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RL Update Example – OOM and/or RPU

- Consider an HSR comprised of one IPR and one ESR with the following characteristics and forecasted performance:

Component	Value
IPR Min/Max Limits	0 MW / 100 MW
ESR Min/Max Limits	-50 MW / +50 MW
ESR Injection and Capacity	50 MW / 50 MWh
POI Min/Max Limits	-50 MW / +130 MW

Forecasted Performance		
	Hour 1	Hour 2
IPR Output	50 MW	70 MW
ESR Output	0 MW	-20 MW
Net POI Output	50 MW	50 MW
ESR SOC, start of the hour	20 MWh	20 MWh

- Based on this forecasted performance, the HSR submits the following bids in RT:

	Hour 1	Hour 2
Reserve Limit	**20 MW**	**20 MW**
Regulation Capacity	0 MW	0 MW
Bid-In UOL (for the HSR)	70 MW	70 MW

- And the resource receives the following RT schedule:

	Hour 1	Hour 2
Reserve Schedule	20 MW	20 MW
RT Energy Schedule	50 MW	50 MW

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RL Update Example – OOM and/or RPU, cont.

- Consider the following RT performance through Hour 1, during which time the ISO converts the 20 MW of Reserves to Energy in response to RPU (from RTD 10 through RTD 20):

	RTD 00	RTD 05	RTD 10	RTD 15	RTD 20	RTD 25	RTD 30	RTD 35	RTD 40	RTD 45	RTD 50	RTD 55
IPR Output	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW
ESR SOC	20 MWh	20 MWh	18.3 MWh	16.7 MWh	15 MWh	13.3 MWh	13.3 MWh	13.3 MWh	13.3 MWh	13.3 MWh	13.3 MWh	13.3 MWh
Net POI Output	50 MW	50 MW	70 MW	70 MW	70 MW	70 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW

- The HSR Operator will be required to update its Reserve Limit for Hour 2 to reflect the change in the ESR's SOC. Because the Bid-In UOL is equal to the IPR output in Hour 2, the UOL does not need to be updated with the Reserve Limit.

	Hour 1	Hour 2 – Original	Hour 2 – Updated
Reserve Limit	20 MW	20 MW	13.3 MW
Regulation Capacity	0 MW	0 MW	0 MW
Bid-In UOL	70 MW	70 MW	70 MW

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Reserve Limit Derates: Post RT Market Close – Deviation from Forecast

- **Reduction of RL for reasons other than RPU, OOM or equipment outage that causes HSR performance to deviate from the RL that was submitted with the HSR's Bid for a RT hour (the RT Bid could be carried-over from the HSR's DAM schedule)**
  - For example, an inaccurate forecast of IPR output could require the RL to be updated
  - Must be submitted as soon as the HSR operator becomes aware of the issue with an effective start/end time
  - 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

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RL Update Example – Deviation from Forecast

- Consider an HSR comprised of one IPR and one ESR with the following characteristics and forecasted performance:

Component	Value
IPR Min/Max Limits	0 MW / 100 MW
ESR Min/Max Limits	-50 MW / +50 MW
ESR Injection and Capacity	50 MW / 50 MWh
POI Min/Max Limits	-50 MW / +130 MW

Forecasted Performance		
	Hour 1	Hour 2
IPR Output	70 MW	50 MW
ESR Output	-20 MW	0 MW
Net POI Output	50 MW	50 MW
ESR SOC, start of the hour	10 MWh	30 MWh

- Based on this forecasted performance, the HSR submits the following bids in RT:

	Hour 1	Hour 2
Reserve Limit	**10 MW**	**25 MW**
Regulation Capacity	0 MW	0 MW
Bid-In UOL (for the HSR)	80 MW	75 MW

- And the resource receives the following RT schedule:

	Hour 1	Hour 2
Reserve Schedule	10 MW	25 MW
RT Energy Schedule	50 MW	50 MW

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RL Update Example – Deviation from Forecast, cont.

- Consider the following RT performance through Hour 1, during which time the IPR output drops off for a period of time (from RTD 10 through RTD 30). Because the ESR expected to charge from the IPR behind-the-meter, charging was curtailed during the decreased output to meet the RT Energy schedule (50 MW).

	RTD 00	RTD 05	RTD 10	RTD 15	RTD 20	RTD 25	RTD 30	RTD 35	RTD 40	RTD 45	RTD 50	RTD 55
IPR Output	70 MW	70 MW	50 MW	50 MW	50 MW	50 MW	50 MW	70 MW	70 MW	70 MW	70 MW	70 MW
ESR SOC	10 MWh	11.67 MWh	11.67 MWh	11.67 MWh	11.67 MWh	11.67 MWh	11.67 MWh	13.33 MWh	15 MWh	16.67 MWh	18.33 MWh	20 MWh
Net POI Output	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW

- The HSR Operator will be required to update its Reserve Limit, as the actual SOC is less than the forecasted SOC and the RT Reserve Schedule for Hour 2. Subsequently, the HSR Operator will be required to update the bid-in UOL as well.

	Hour 1	Hour 2 – Original	Hour 2 – Updated
Reserve Limit	10 MW	25 MW	15 MW
Regulation Capacity	0 MW	0 MW	0 MW
Bid-In UOL (for the HSR)	80 MW	75 MW	65 MW

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Reserve Limit Derates: Post RT Market Close – Equipment Outage

- **Derate due to an unexpected Equipment Outage that reduces or eliminates Reserve capabilities**
  - Updated limit must be submitted immediately when the outage occurs with an effective start/end time
  - HSR Operator will be required to derate both Reserve Limit and Upper Operating Limit by proportional amounts

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RL Update Example – Equipment Outage

- Consider an HSR comprised of one IPR and one ESR with the following characteristics and forecasted performance:

Component	Value
IPR Min/Max Limits	0 MW / 100 MW
ESR Min/Max Limits	-50 MW / +50 MW
ESR Injection and Capacity	50 MW / 50 MWh
POI Min/Max Limits	-50 MW / +130 MW

Forecasted Performance		
	Hour 1	Hour 2
IPR Output	50 MW	70 MW
ESR Output	0 MW	-20 MW
Net POI Output	50 MW	50 MW
ESR SOC, start of the hour	20 MWh	20 MWh

- Based on this forecasted performance, the HSR submits the following bids in RT:

	Hour 1	Hour 2
Reserve Limit	**15 MW**	**15 MW**
Regulation Capacity	0 MW	0 MW
Bid-In UOL (for the HSR)	65 MW	65 MW

- And the resource receives the following RT schedule:

	Hour 1	Hour 2
Reserve Schedule	15 MW	15 MW
RT Energy Schedule	50 MW	50 MW

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RL Update Example – Equipment Outage, cont.

- Consider the following RT performance through Hour 1, during which time the ESR experiences a partial equipment outage and limits the amount of Energy the HSR can store and Reserves the HSR can provide:

	RTD 00	RTD 05	RTD 10	RTD 15	RTD 20	RTD 25	RTD 30	RTD 35	RTD 40	RTD 45	RTD 50	RTD 55
IPR Output	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW
ESR SOC	20 MWh	20 MWh	10 MWh	10 MWh	10 MWh	10 MWh	10 MWh	10 MWh	10 MWh	10 MWh	10 MWh	10 MWh
Net POI Output	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW	50 MW

- The HSR Operator will be required to update its Reserve Limit in Hour 1 once the equipment outage occurs, and **it will become effective with the corresponding start time**. Corresponding changes will be necessary to the HSR's bid-in UOL for Hour 1 as well as the Reserve Limit and Bid-In UOL for Hour 2.

	Hour 1 – Original	Hour 1 – Updated	Hour 2 – Original	Hour 2 – Updated
Reserve Limit	15 MW	10 MW	15 MW	10 MW
Regulation Capacity	0 MW	0 MW	0 MW	0 MW
Bid-In UOL (for the HSR)	65 MW	60 MW	65 MW	60 MW

HSR Capacity Market Participation Proposal

Capacity Market Participation Proposal

- **NYISO proposes HSRs use largely the same Capacity Market Participation rules as the CSR program**
  - The proposed Capacity participation model simplifies Resource participation, as an MP operating a HSR will be able to convert it to a CSR without learning a new set of Capacity rules.
    - The proposed rules will also make it easier for Resources participating as CSRs to become HSRs.
  - Applying very similar rules to CSRs and HSRs will give the NYISO the insights needed to appropriately model HSRs in long term planning studies
- **HSR Capacity Market rules will reflect work being done as part of Capacity Accreditation**

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DMNC Test for HSR

- **Each component of an HSR will have its own DMNC value and will use DMNC rules applicable to each component's individual resource type**
  - If any individual component of an HSR has an Energy Duration Limitation, all components of the HSR must perform coincident DMNC tests or provide operating data inside of the Peak Load Window
  - DMNC is nameplate for Intermittent Power Resources

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

- **The HSR will be subject to the combined B/S/N obligations of its underlying components that sell UCAP, consistent with the existing rules based on resource type**
  - An ESR within an HSR 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 all hours of the Peak Load Window (PLW)
    - An ESR within a HSR 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 HSR will not be required to B/S/N in the DAM
  - If a unit elects an EDL that is larger than the PLW, they will be required to follow the new rules set forth in the Capacity Accreditation project*

*https://www.nyiso.com/documents/20142/31830389/06-28-22-PLW-and-EDL-Proposal.pdf/a902d27e-3209-3f07-81e9-fdc640eb0bf3

HSR ICAP and UCAP Calculations

HSR ICAP and UCAP Calculations

- HSR components that have dedicated inverters will use ICAP and UCAP calculation methods developed as part of Capacity Accreditation, based on resource type
- HSRs with components that share a single inverter can experience a combined derate across components. The ICAP and UCAP calculation methods for each component behind a shared inverter will be dictated by methods developed as part of Capacity Accreditation, based on resource type, with small adjustments to account for the shared inverter derate
  - HSRs operating in this way must provide shared derate information to the NYISO
  - A shared derate may not reduce the UOL of every HSR component
- Intermittent UCAP will be limited by HSR UOL
  - This will be done by taking the minimum of the shared inverter injection capability and intermittent output when calculating the resource specific derating factors for HSR intermittent units
    - The exact calculation that will be employed for IPR UCAP calculation is being developed as part of Capacity Accreditation
- Run of River UCAP calculations are being reworked as part of Capacity Accreditation

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CSR/HSR ICAP and UCAP Calculations

- **HSR Component ICAP/UCAP:**
  - ICAP = min(CRIS, DMNC)
  - Adjusted ICAP = ICAP * CAF
  - UCAP = Adjusted ICAP * (1 – resource specific derating factor)
- **The method for calculating resource specific derating factors will vary between resource types**
  - These calculations will be developed and explained as part of the Capacity Accreditation project.
- **Numerical examples of these calculations are on the next slide**

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HSR ICAP and UCAP Example 1

Assumptions: Max Facility Injection Limit = 80MW with a shared limit

HSR Component	Nameplate (MW)	CRIS (MW)	DMNC	CAF
IPR	100	30	100	1
ESR	50	50	50	1

Hour	HSR Intermittent Output (MW) (A)	HSR ESR UOL (MW)* (B)	HSR shared limit (MW) (C)
1	90	50	80
2	70	50	40
3	90	30	60
4	50	50	80

HSR Intermittent Calculations

ICAP = min (CRIS,DMNC) = 30 MW

Adjusted ICAP = ICAP * CAF = 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

HSR ESR Calculations (Adapted for Capacity Accreditation)

ICAP = min (CRIS,DMNC) = 50 MW

Adjusted ICAP = ICAP * CAF = 50 MW * 1 = 50 MW

UCAP = Adjusted ICAP * (1 – resource specific derating factor)

= 50 MW * HSR ESR AF * HSR shared limit AF

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

= 50 MW * 0.9 * 0.8125

= 36.6 MW

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

#The inclusion of Production Factor as an input to the IPR UCAP calculation reflects present – day UCAP calculations. New IPR resource specific derating factors are being developed as part of Capacity Accreditation that may not utilize Production Factor

HSR ICAP and UCAP Example 2

Assumptions: Max Facility Injection Limit = 80MW with individual limits

HSR Component	Nameplate (MW)	CRIS (MW)	DMNC	CAF
IPR	100	30	100	1
ESR	50	50	50	1

Hour	HSR Intermittent Output (MW) (A)	HSR ESR UOL (MW)* (B)
1	80	50
2	70	50
3	60	30
4	50	50

HSR Intermittent Calculations

ICAP = min (CRIS,DMNC) = 30 MW

Adjusted ICAP = ICAP * CAF = 30 MW * 1 = 30 MW

UCAP = Adjusted ICAP * Production Factor#

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

= 30 MW * ((80+70+60+50)/320 MWh)

= 24.4 MW

HSR ESR Calculations (Adapted for Capacity Accreditation)

ICAP = min (CRIS,DMNC) = 50 MW

Adjusted ICAP = ICAP * CAF = 50 MW * 1 = 50 MW

UCAP = Adjusted ICAP * (1 – resource specific derating factor)

= 50 MW * HSR ESR AF

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

= 50 MW * 0.9

= 45 MW

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

#The inclusion of Production Factor as an input to the IPR UCAP calculation reflects present – day UCAP calculations. New IPR resource specific derating factors are being developed as part of Capacity Accreditation that may not utilize Production Factor

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HSR ICAP and UCAP Example 3

Assumptions: Max Facility Injection Limit = 80MW with a shared limit

HSR Component	Nameplate (MW)	CRIS (MW)	DMNC	CAF
Wind	50	20	50	1
Solar	30	10	30	1
ESR	50	50	50	1

Hour	HSR Wind Output (MW) (A)	HSR Solar Output (MW) (B)	HSR ESR UOL (MW)* (C)	HSR Limit (MW) (D)
1	50	30	50	80
2	30	30	50	40
3	50	20	30	60
4	10	10	50	80

HSR Wind Calculations

ICAP = min (CRIS,DMNC) = 20 MW

Adjusted ICAP = ICAP * DAF = 20 MW * 1 = 20 MW

UCAP = Adjusted ICAP * Production Factor#

= 20 MW * (sum(min(A,D))/(min(50, 80)*4 hours))

= 20 MW * ((50+30+50+10)/200 MWh)

= 14 MW

HSR Solar Calculations

ICAP = min (CRIS,DMNC) = 10 MW

Adjusted ICAP = ICAP * DAF = 10 MW * 1 = 10 MW

UCAP = Adjusted ICAP * Production Factor#

= 10 MW * (sum(min(B,D))/(min(30, 80)*4 hours))

= 10 MW * ((30+30+20+10)/120 MWh)

= 7.5 MW

HSR ESR Calculations (Adapted for Capacity Accreditation)

ICAP = min (CRIS,DMNC) = 50 MW

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

UCAP = Adjusted ICAP * (1 – resource specific derating factor)

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

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

= 50 MW * 0.9 * 0.8125

= 36.6 MW

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

#The inclusion of Production Factor as an input to the IPR UCAP calculation reflects present – day UCAP calculations. New IPR resource specific derating factors are being developed as part of Capacity Accreditation that may not utilize Production Factor

HSR Interconnection Rules Proposal

CRIS/ERIS/Interconnection Rules for HSRs, CSRs

- The NYISO introduced a new term to the OATT for interconnection as part of last year's CSR initiative, "Project", which encompasses:
  - A CSR that is comprised of two distinct Generators; OR
  - A multi – unit Generator
- The definition of "Project" will be modified to also encompass Hybrid Aggregated Storage Resources (HSRs) as part of the HSR tariff filing
  - "Project" will continue to encompass 1) a CSR that is comprised of two distinct Generators and 2) a multi – unit Generator, until HSR has been deployed. In other words, the inclusion of "Project" in the OATT does not permit HSRs to submit Interconnection Requests to the NYISO until the HSR tariff language becomes effective.
- In short, this means that CSRs and HSRs will share the same interconnection rules. As such, this presentation discusses interconnection rules generally applicable to all "Projects"
- All Projects will need to specify a chosen Participation Model (CSR, HSR, Generator) on submitted Interconnection Requests

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Interconnecting New Projects

- **New Projects must proceed through the interconnection queue under a single Interconnection Request**
  - This is true regardless of the Project's chosen Participation Model (CSR, HSR, or Generator Model), and regardless of the Project's facility size (Small Generating Facility or Large Generating Facility)
- **New Projects must proceed under a single Interconnection Agreement upon completion of interconnection studies**

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Modifying an Existing Facility/Project

- An existing Facility participating as a standalone Generator may submit a request to reconfigure into either an HSR or a CSR
- An existing Project participating as an HSR or CSR may also submit a request to modify their capabilities
- This can be done through the addition of new technologies to the Facility or Project, such as through the addition of Energy Storage Resources to an existing Solar Resource.
  - One of the existing co-located Participation Models (HSR/CSR) must support the new technology configuration in order for the Facility to be allowed to reconfigure as a co-located resource in the NYISO markets
    - For example, the HSR model will not support the coupling of a CT/GT with an ESR
    - A second example, neither the CSR/HSR model will support the incorporation of a Nuclear Generator
- For a facility to become a co-located resource (i.e. a Project), or for an existing Project to modify its capabilities the following must occur:
  - The Project must propose to interconnect all units within the Project at the same Point of Injection; AND
  - The NYISO must determine that the modification is not material; AND
    - More detail on following slide
  - The Interconnection Agreement(s) must be amended to reflect the creation of the new Project, with appropriate ERIS and CRIS allocations to its composite units
    - More on ERIS/CRIS allocations in later slides

New York ISO

Modifying an Existing Facility/Project cont.

- A facility participating as a Generator that wishes to become an HSR/CSR and an existing Project seeking to modify their capabilities must first submit a material modification request to the NYISO detailing how the facility will change, using the way it was initially studied and described in its Interconnection Agreement as a benchmark
  - This includes any proposed changes to ERIS and CRIS
- If the incremental changes are deemed to be non-material, then said changes may proceed under an amended IA, without the need for a new Interconnection Request
- If the incremental changes are deemed to be material, then the said changes must proceed through the Interconnection Queue under a new Interconnection Request to identify any required system upgrades

New York ISO

Modifying a Pending Interconnection Request

- **A Project in the Interconnection Queue can add a new technology and proceed under the Project's existing queue position if:**
  - The Project is in the Interconnection Queue as of the effective date of the HSR tariff revisions and has not completed the interconnection study process; AND
  - Both Interconnection Requests propose to connect at the same Point of Injection; AND
  - A single individual or entity submits a revised Interconnection Request for the combined project
  - The NYISO deems the proposed change to be non-material
- **A Project proposing such a modification must submit a modification request form of the Interconnection Request by submitting the form of Appx. 3 of Attachment X to the NYISO OATT**

New York ISO

Transition Rule for Combining Facilities in the Interconnection Queue

- **The NYISO plans to introduce a transition rule that will allow separate facilities with separate queue positions, and proceeding through the Interconnection Queue under individual Interconnection Requests to combine to become an HSR (Project) and proceed under a single Interconnection Request as a Project if:**
  - Both facilities will be located behind the same Point of Injection; AND
  - Both facilities are in the queue as of the effective date of the HSR tariff revisions and neither has completed the interconnection study process (I.e., has not completed the interconnection process and finalized its Interconnection Agreement); AND
  - A single individual or entity submits a revised Interconnection Request for the combined Project; AND
  - Demonstrate the manner in which such Developer of record retains Site Control for the combined Project
- **The NYISO also plans to reopen the CSR transition rule window to allow facilities in the Interconnection Queue to combine as CSRs, as above**

New York ISO

Transition Rule cont.

- **The NYISO will introduce two separate transition rules with two separate effective periods:**
  - The first pertaining to CSRs; such transition window to become effective prior to the HSR transition rule (e.g. 90 days after FERC acceptance of CSR tariff revisions)
  - The second pertaining to HSRs, coinciding with the deployment of the HSR Participation Model

New York ISO

CRIS/ERIS Rules for Projects

- **Each Project will be studied in the interconnection process under a single Interconnection Request, evaluated at a single total ERIS and CRIS value, with the total ERIS and CRIS allocated to each of the units within said Project (such that each unit will have its own ERIS and CRIS value)**
- **Maximum Permissible Requested ERIS and CRIS:**
  - Unit ERIS and CRIS values may not exceed the injection capability of the unit in question
  - ERIS for non-Energy Storage units cannot exceed the Project's POI Limit, plus the full withdrawal capability of all Energy Storage units within the Project
    - An example: An HSR with a POI Limit (UOL) of 100 MW, a 130 MW Solar unit, and a +30/-30 MW ESR unit could allocate its Solar unit up to 130 MW of ERIS [Max ERIS = POI Limit + abs(ESR LOL)] -> Max ERIS = 100 MW +abs(-30)=130 MW
  - The sum of CRIS among all units within a project may not exceed the Project's POI Limit
    - Example: An HSR with a POI Limit (UOL) of 100 MW will be awarded a maximum of 100 MW of CRIS, which can be allocated to the individual units within said HSR.
  - While the sum of ERIS among all units within a Project may exceed the Project's POI limit, actual energy injections at the POI may not exceed the Project's POI Limit
    - Example: Our HSR with a 100 MW POI Limit (UOL) and a 130 MW solar unit can never inject more than 100 MW of Energy onto the grid, through the POI
  - Units within a Project may request ERIS below the nameplate of said unit, in order to avoid upgrading injection capability, provided proper control technologies are in place

New York ISO

Next Steps

- HSR Energy/Capacity Mitigation
- CSR Participation Model Updates

New York ISO

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

New York ISO

Questions?