Expanding Capacity Eligibility

Zachary T. Smith
Manager, Capacity Market Design

ICAPWG/MIWG

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Agenda

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- SCR Program
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Background

Purpose of the DER Project

- **The objective of the complete DER design is to allow smaller resources into the NYISO markets including load reduction assets into the Energy Market**
- **In addition, the NYISO is proposing rules that value capacity resources based on the reliability benefit that the resource provides to the system**
  - This proposal would allow resources with short durations that currently cannot participate in the Capacity Market to be eligible for the Capacity Market
  - The market rules pertaining to this change will be initially implemented for Capability Year 2021

Purpose of Today's Discussion

- **Review NYISO's proposed design of the capacity market qualifications and participation requirements to allow participation of both a Capacity Supplier that has demonstrated the capability to meet the full duration requirement and Capacity Suppliers with duration limitations that can demonstrate the capability to meet a shorter duration qualification requirement**
  - Proposed design for rules pertaining to Qualifications, DMNC, Bid/Schedule/Notify, Derating Factor, Aggregations, Time Stacking, and CRIS
    - Majority of these concepts have been discussed at the 10/9/2018 ICAPWG

Capacity Supplier Payment Structure

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Purpose of Today's Proposal

- As part of the DER project, the NYISO has been evaluating the capacity value of resources with varying duration limitations
  - GE's Capacity Value Study has provided insight into the capacity value of all resources with duration limitations in the NYISO market
  - This has lead to a holistic reevaluation of capacity market qualifications, participation requirements, and payments for resources with duration limitations, with the goal of aligning payments with the capacity value provided by each resource
- This is a shift from the one-size-fits-all approach currently used today
  - Resources will now be valued based on what the value they provide to the capacity market when considering resource adequacy
  - Capacity payment is directly tied to the capacity value and availability of the resource
- Since the 10/9/2018 ICAPWG, NYISO staff conducted extensive stakeholder outreach to collect detailed feedback on the GE study and the proposed capacity market design
- NYISO is proposing updates the capacity market design concepts presented at the 10/9/2018 ICAPWG, primarily the capacity value of resources with duration limitations, which balances the input received with the system needs over the next several years

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Capacity Supplier Payment Structure

- **The proposed payment structure for Capacity Suppliers is based on the 2000 MW penetration of resources with duration limitations on the "High Wind – High Solar" (i.e., 2000 MW of incremental Wind and 2000 MW of incremental Solar) scenario with 50 MW block size from the GE Capacity Value Study**
  - This scenario represents the near future (~3-5 years) system conditions, and is in line with the New York State goals
  - The Capacity Value Study results for this scenario are closely aligned with the NYISO Operations experience
  - To some extent, this scenario also addresses some of the questions regarding the older 2002, 2006, 2007 load shapes that were used in the IRM analysis and GE Capacity Value Study
  - A scenario with lower penetration would need to be revisited sooner than the anticipated revision of the Capacity Values (more details later in the presentation)

Capacity Value Results from the GE Study

- The capacity values for the 2000 MW penetration case for High Wind – High Solar 50 MW block size from the GE Study are included below
  - (Note: NYISO's proposed capacity payment % are on slide 13)

Penetration (MW)	Duration (hours)	Results from Capacity Value Study
2000	2	52.5%
2000	4	67.9%
2000	6	81.6%
2000	8	93.8%

System Operations Analysis using SCRs

- The NYISO conducted an analysis using actual enrollment and event data to determine the expected duration of SCR calls at different penetration levels (1200 and 2000 MW)
- The NYISO conducted additional analysis to determine the appropriate length of time of SCR calls as to not introduce a double peak throughout the day at different levels of resource penetration
- The analysis uses the reconstituted load profiles for Zones J and NYCA for four SCR calls over the last few years
  - More details on following slide

SCR Analysis (cont.)

Table 1: Actual SCR calls

	Date of SCR call	8.12.2016	7.2.2018	8.28.2018	8.29.2018
NYCA	Average Load Reduction	1216 MW			
	Time of Actual Duration	HB 13-17			
	Actual Duration	5			
Zone J	Average Load Reduction	371 MW	394 MW	461 MW	421 MW
	Time of Actual Duration	HB 13-17	HB 12-16	HB 12-17	HB 12-17
	Actual Duration	5	5	6	6

Table 2: Expected duration of SCR calls

	Date of SCR call	8.12.2016		7.2.2018		8.28.2018		8.29.2018	
NYCA	Resource Penetration	1200 MW	2000 MW	1200 MW	2000 MW	1200 MW	2000 MW	1200 MW	2000 MW
	Time of Expected Duration	HB 13-17	HB 12-17	HB 12-17	HB 11-18	HB 13-18	HB 12-19	HB 12-17	HB 11-18
	Expected Duration	5	6	6	8	6	8	6	8
Zone J	Resource Penetration	384	640	384	640	384	640	384	640
	Time of Expected Duration	HB 13-17	HB 12-17	HB 13-17	HB 12-17	HB 13-17	HB 12-17	HB 12-17	HB 12-17
	Expected Duration	5	6	5	6	5	6	6	6

The values for Zone J were determined as the proportion of (actual SCR ICAP in Zone J/ actual SCR ICAP NYCA) * penetration levels (i.e. 1200 or 2000 MW)

Capacity Supplier Payment Structure

- **In addition to the operational analysis and the GE Capacity Value Study, the NYISO also took into account qualitative factors that influence the proposed capacity values:**
  - Extensive outreach to stakeholders to understand expectations regarding different duration resources
  - Consideration for the current and near future (~3-5 years) expected system conditions and system operational needs
  - Extrapolation of the GE Capacity Values from 50 MW to 5 MW to acknowledge the additional value of granularity in dispatch block

Capacity Supplier Payment Structure

- **The NYISO proposed capacity values are included below**
  - The NYISO contracted GE to conduct a rigorous (Capacity Value) study as well as looked at alternate study results and actual system operations when determining a set of capacity values that the NYISO deems just and reasonable

Penetration (MW)	Duration (hours)	Proposed Capacity Values
2000	2	37.5%
2000	4	75%
2000	6	90%
2000	8	100%

Capacity Supplier Payment Structure

- **The NYISO is proposing a discounted Duration Adjustment Factor for 2 hour resources**
  - The GE Capacity Value Study assumed perfect foresight in scheduling its resources, which is beyond what the NYISO's tools can support to optimally schedule 2 hour resources
    - Not optimally scheduling these short duration resources creates operational challenges and decreases the capacity value of these resources, as demonstrated by the GE results when scheduling the full penetration at the same time
- **Due to these challenges, the market signal should not incent investment of large quantities of 2 hour resources**

	Winter			Summer	
HB	Top 20 (100 Hours)	Top 40 (200 Hours)	HB	Top 20 (100 Hours)	Top 40 (200 Hours)
0	0	0	0	0	0
1	0	0	1	0	0
2	0	0	2	0	0
3	0	0	3	0	0
4	0	0	4	0	0
5	0	0	5	0	0
6	0	0	6	0	0
7	0	0	7	0	0
8	0	0	8	0	0
9	0	3	9	0	0
10	0	3	10	0	0
11	0	4	11	0	4
12	0	3	12	5	11
13	0	2	13	8	23
14	0	0	14	17	28
15	0	1	15	21	38
16	3	7	16	24	38
17	31	53	17	20	33
18	40	65	18	5	20
19	21	41	19	0	5
20	5	17	20	0	0
21	0	1	21	0	0
22	0	0	22	0	0
23	0	0	23	0	0

SCR Program

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SCR Program

- **The NYISO team conducted extensive outreach to the SCR providers and collected input on SCR program**
  - Majority of the SCR providers communicated that their resources cannot support longer than the current 4 hour obligation
  - Majority of the SCR providers also communicated that their resources cannot support shorter notification times
- **The SCR program will remain at a 4 hour duration requirement for participation in the Capacity Market**
  - SCRs will only be eligible to participate as Capacity Suppliers with duration limitations of 4 hours
  - SCRs will receive the payment percent that is applicable to resources that have duration limitations of 4 hours
  - All other SCR program rules, including the current notification times and testing requirements, will remain the same

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Capacity Suppliers

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Capacity Suppliers – Qualifications

- **A resource must not have any hourly limitations to qualify as a Capacity Supplier**
  - Satisfaction of all registration requirements, including an effective Interconnection Agreement with the Connecting Transmission Owner (or with the Connecting Transmission Owner and the NYISO, if the resource is subject to the NYISO's interconnection procedures) that allows wholesale market participation
  - Have a minimum injection capability of 1 MW for all resources

Capacity Suppliers– Qualifications (cont.)

- **What is necessary for a resource to be eligible to be a Capacity Supplier?**
  - Must provide a DMNC test, as applicable to the resource type
    - More details on following slide
  - ICAP for a resource will be based on CRIS and DMNC
    - CRIS is only applicable to Injection capability of resources (not Withdrawal or Load Reduction portion)
    - ICAP = min(CRIS, DMNC of injection)

Capacity Suppliers – DMNC

- **DMNC tests will continue to be determined by the technology type of the resource**
  - Traditional resources (nuclear, fuel-based)
    - Will keep the existing 1 or 4 hour maximum capability test, as applicable to technology type
- **More details on following slide**

Capacity Suppliers – DMNC (cont.)

- DMNC tests for Nameplate resources (e.g., Intermittent Power Resources) will not change
- No other changes will be made to DMNC testing requirements
  - e.g. testing windows, data submission, audit, temperature correction, etc.
  - Operational data can be submitted in place of DMNC test

Capacity Suppliers – Bid/Schedule/Notify

- **Bid/Schedule/Notify obligations for traditional resources will not change for Capacity Suppliers**
  - 24 hour Bid/Schedule/Notify requirement will remain in effect

Capacity Suppliers – Bid/Schedule/Notify (cont.)

- **The NYISO is not proposing any changes to the Bid/Schedule/Notify obligations for performance-based resources**
  - Intermittents (Wind, Solar) have no current obligation to Bid/Schedule/Notify
  - RoR will maintain the 24 hour Bid/Schedule/Notify requirement

Capacity Suppliers – Other Obligations

- **Other rules and obligations for resources that have sold capacity:**
  - Continue to provide 2 year forward outage information
  - Respond to a NYISO SRE
  - Subject to penalties/shortfall charges, e.g. for over sale of capacity, failure to Bid/Schedule/Notify

Capacity Suppliers – Derating Factors

- **UCAP is calculated as ICAP times quantity 1 minus the derating factor**
  - UCAP = ICAP * (1 – derating factor)
- **Derating factor**
  - The derating factor for availability-based Capacity Suppliers will be calculated using GADS data
    - The GADS EFORd calculation will continue to be used for traditional resources
  - The derating factor for performance-based Capacity Suppliers (Wind, Solar, RoR Hydro) will be calculated based on the resource's performance during peak hours
    - The peak hours will expand from 4 hours to 8 hours to match the Peak Load Window used for Capacity Suppliers with duration limitations bidding requirements (see slides later in presentation)

Capacity Suppliers – Derating Factors (cont.)

- **The derating factor calculation for availability-based, GADS/EFORd, resources will remain unchanged**
  - Resources include nuclear, conventional combustion generators large hydro generation, Control Area System Resources (HQ), and UDRs/EDRs
  - Derating factors are calculated based on actual outages over an 18-month rolling average when the resource is scheduled for dispatch

Capacity Suppliers – Derating Factors (cont.)

- **The derating factor calculation for performance-based Capacity Suppliers will scale up with the change in full duration requirement**
  - Wind and Solar resources will be evaluated over an 8-hour Peak Load Window
    - The derating factor calculation will measure over the number of hours that correspond to the duration requirement for these resources
  - The window that RoR Hydro is measured over will scale up
    - See following slide for more detail

Run of River Hydro

- **RoR Hydro units are currently evaluated for performance during the Top 20 NYCA-wide load hours over the previous five like-Capability Periods – a total of 100 hours**
  - The current methodology averages the output of each unit (PTID) over the study period, then divides by the Nameplate MW to arrive at a Performance Factor
  - The Top 20 load hours correspond to peak load periods that consistently fall during peak periods throughout the day
  - The proposal is to expand evaluation from the Top 20 load hours to the Top 40 load hours to better capture performance during the proposed Peak Load Window
- **The NYISO has evaluated several actual, representative units to determine what the impact to their performance factor would be**
  - Four units were selected and evaluated over the previous 5 like-Capability Periods from Winter 2013-2014 to Summer 2018

Run of River Hydro Analysis (cont.)

- **The NYISO also evaluated when each of the top hours occurred in the Top 20 and Top 40 load hours to determine which measurement better lines up with the proposed Peak Load Window**
  - Proposed Winter Peak Load Window: HB 14 to HB 21
  - Proposed Summer Peak Load Window: HB 12 to HB 19
  - In both Capability Periods, more hours of the Peak Load Window are captured using the Top 40 load hours than the Top 20 load hours

	Winter			Summer	
HB	Top 20 (100 Hours)	Top 40 (200 Hours)	HB	Top 20 (100 Hours)	Top 40 (200 Hours)
0	0	0	0	0	0
1	0	0	1	0	0
2	0	0	2	0	0
3	0	0	3	0	0
4	0	0	4	0	0
5	0	0	5	0	0
6	0	0	6	0	0
7	0	0	7	0	0
8	0	0	8	0	0
9	0	3	9	0	0
10	0	3	10	0	0
11	0	4	11	0	4
12	0	3	12	5	11
13	0	2	13	8	23
14	0	0	14	17	28
15	0	1	15	21	38
16	3	7	16	24	38
17	31	53	17	20	33
18	40	65	18	5	20
19	21	41	19	0	5
20	5	17	20	0	0
21	0	1	21	0	0
22	0	0	22	0	0
23	0	0	23	0	0

Capacity Suppliers – Other Rules

- Performance-based generators (Hydro, Solar, RoR) will continue to be Capacity Suppliers if qualified
- Mitigation rules will not change for existing Capacity Suppliers with this current proposal

DER

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DER – Qualifications

- **DER that do not have any hourly limitations can qualify as a Capacity Supplier**
  - DER with hourly limitations can qualify as Capacity Suppliers with duration limitations
  - Satisfaction of all registration requirements, including an effective Interconnection Agreement with the Connecting Transmission Owner (or with the Connecting Transmission Owner and the NYISO, if the resource is subject to the NYISO's interconnection procedures) that allows wholesale market participation
  - Have a the minimum injection capability of 0.1 MW
    - Minimum MW threshold could be met by aggregating with other resources at the same transmission node

DER – Qualifications (cont.)

- **Resources using the DER Participation Model must be electrically located within the NYCA to be a Capacity Supplier**
  - The NYISO has the ability to schedule internal DER whenever they are needed, but not does have the same visibility and/or ability over external DER (including knowing what the DER is comprised of)
  - Load curtailment resources are not able to deliver power to the NYCA so they do not provide a capacity benefit
  - The NYISO cannot depend on external DER to provide capacity when needed
    - Example – the NYISO needs a 4 hour resource starting in HB 16 but the External Control Area scheduled the resource from HB 12-15, the resource would not be available to the NYISO for HB 16

DER – Qualifications (cont.)

- **What is necessary for a DER to be eligible to be a Capacity Supplier?**
  - Must provide a DMNC test
    - More details on following slide
  - ICAP for a resource will be based on CRIS and DMNC
    - CRIS is only applicable to Injection capability of resources (not Withdrawal or Load Reduction portion)
    - For resources using the Dispatchable DER Model:
      - ICAP = min(CRIS, DMNC of injection)+DMNC of load reduction

DER – DMNC

- **DMNC tests for DER**
  - Each Capability Period – 8 hour test at maximum output
  - The NYISO has determined that it is essential for DER to demonstrate its full duration at registration to accurately capture what the resource is capable of providing for its chosen duration
    - Since DER can change on a monthly basis, the NYISO believes it is necessary to test the full duration of the DER each Capability Period to ensure that the DER can continue to meet its duration requirement

DER – Bid/Schedule/Notify

- Bid/Schedule/Notify obligations for Dispatchable DER will be for all 24 hours of the DAM for the ICAP Equivalent of UCAP sold

DER – Other Obligations

- **Other rules and obligations for DER that have sold capacity:**
  - Continue to provide 2 year forward outage information
  - Respond to a NYISO SRE
  - Subject to penalties/shortfall charges, e.g. for over sale of capacity, failure to Bid/Schedule/Notify

DER – Derating Factors

- **UCAP is calculated as ICAP times quantity 1 minus the derating factor**
  - UCAP = ICAP * (1 – derating factor)
- **Derating factor**
  - The derating factor for DER will be calculated using the UOL availability calculation
    - Derating factor = 1 – (Time-Weighted UOL/Time-Weighted ICAP)
      - Based on the availability of the average of 6, 12-month blocks
    - For more details on the UOL Calculation, see Appendix

DER – Other Rules

- **Supply Side Mitigation**
  - Pivotal Supplier must offer – resources using the Dispatchable DER Model are subject to the Pivotal Supplier must offer rule
    - The load reduction portion of the DER must be offered, unless the NYISO has determined that the mitigated UCAP has been attributed to its host load
      - This is conceptually similar to the BTM-NG rule as described in MST 23.4.5.4.1(b)
  - Physical Withholding – resources using the Dispatchable DER Model are subject to the Physical Withholding rules relating to the audit of removals of capacity from Mitigated Capacity Zones
- **Buyer Side Mitigation**
  - The NYISO is not proposing any changes to the existing Buyer Side Mitigation rules, applicable to both Capacity and Capacity Suppliers with duration limitations

Capacity Suppliers with duration limitations

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Capacity Suppliers with duration limitations

- **The NYISO is proposing to allow shorter duration resources to qualify as Capacity Suppliers with duration limitations**
  - Capacity Suppliers with duration limitations can be 2, 4, 6, or 8 hour resources
  - Resources will be allowed to aggregate to meet a certain duration requirement
  - Payments to Capacity Suppliers with duration limitations will depend on the resource's duration

Capacity Suppliers with duration limitations

- **The NYISO is proposing to allow shorter duration resources to qualify as Capacity Suppliers with duration limitations**
  - The duration requirements for Capacity Suppliers with duration limitations are subject to change based on the periodic Capacity Value Study
    - Periodic re-evaluation is required to ensure that the capacity value of resources more accurately reflects the actual system changes over time and sends the right investment signals to the developers
    - The Capacity Value Study will be reoccurring the year starting the Demand Curve Reset process begins (every 4 years) starting in 2023
      - This proposed timeline attempts to balance market certainty (and investment signals) with forecasting capacity values
    - The Peak Load Windows will be evaluated as part of the study
    - The next Capacity Value Study will occur in 2023, with results implemented in 2025

Capacity Suppliers with duration limitations – Qualifications

- **Qualifications for a Capacity Suppliers with duration limitations**
  - Satisfaction of all registration requirements, including an effective Interconnection Agreement with the Connecting Transmission Owner (or with the Connecting Transmission Owner and the NYISO, if the resource is subject to the NYISO's interconnection procedures) that allows wholesale market participation
  - Resources must be electrically located within the NYCA
    - The NYISO has the ability to schedule internal resources (even with duration limitations) whenever they are needed, but not does have the same visibility and/or ability over external resources
    - As such, the NYISO cannot depend on external resources with duration limitations to provide capacity when needed
      - Example – the NYISO needs a 4 hour resource starting in HB 16 but the External Control Area scheduled resource from HB 12-15, the resource would not be available to the NYISO for HB 16

Capacity Suppliers with duration limitations – Qualifications (cont.)

- **Qualifications for a Capacity Suppliers with duration limitations**
  - Have a minimum injection capability of 1 MW for all resources, excluding ESR and Dispatchable DER where the minimum injection capability is 0.1 MW
  - Performance-based generators (Wind, Solar, RoR Hydro) will not be eligible for a duration limitation
  - Resources with energy limitations can derate and/or time stack their capacity to reach any duration (more details on Aggregations and Time Stacking later in the presentation)

Capacity Suppliers – DMNC

- **DMNC tests will be determined by the technology type of the resource**
  - Traditional resources (nuclear, fuel-based)
    - Will keep the existing 1 or 4 hour maximum capability test, as applicable to technology type
  - Storage
    - Full duration test at registration
      - This one-time test is required to validate that the resource can perform for the duration
    - Each Capability Period – paper audit with certifications (i.e. information on degradation) with duration test at maximum output (1 hour test for electrochemical storage, 4 hour test for other storage)

Capacity Suppliers – DMNC (cont.)

- **DMNC tests will be determined by the technology type of the resource**
  - DER
    - Each Capability Period – full duration test at maximum output.
      - Since the DER can have frequent changes (e.g., load of the customer changes, participate through time staking, or change their enrollments on a monthly basis) DER will be required to do a full-duration test each Capability Period to demonstrate that the resource can perform for the duration
  - ELR
    - Full duration test at registration
      - This one-time test is required to validate that the resource can perform for the duration
    - Must provide information supporting its ELR status each Capability Year
    - Each Capability Period – paper audit (i.e. information regarding ELR status) with duration test based on technology type (e.g. Pumped Storage is 4 hour test)
- **Duration limited resources must perform their DMNC test during the Peak Load Window**

Capacity Suppliers with duration limitations – Peak Load Window

- **Capacity Suppliers with duration limitations are not expected to be available 24/7 but must be available during a predefined 8 hour Peak Load Window**
  - The Peak Load Window for Winter and Summer Capability Periods are different
    - Summer: 12-8PM (HB12 through HB19); Winter 2-10PM (HB14 through HB21)
      - Note that Winter Peak Load Window has changed since 10/9/2018 ICAPWG, see following slide for more detail
    - The Peak Load Windows are not tied to a resource type or duration limit
- **Peak Load Window was determined using data provided by GE's Capacity Value Study along with operator and control room input**
  - As part of their analysis, GE provided dispatch schedules (MW by hour) for resources with varying energy limitations
  - 2-, 4-, 6-, 8- and 10-hour duration dispatches were used in this analysis

Peak Load Window Analysis

- **Additional analysis has been conducted by the NYISO for the Winter Peak Load Window**
  - This analysis looked at the peak winter day and Cold Snap Periods for the past 6 Winter Capability Periods
  - The analysis showed HB 14 – HB 21 to be the Peak Load Window for Winter

Capability Year	Peak Day		Peak Periods					
	Date	Peak MWh	Cold Snap Period	Total Days	1-9 PM	2-10 PM	3-11 PM	4-12 PM
2012-2013	1/24/2013	2-10 PM	1/17-1/25/2013	9	4	4	1	0
2013-2014	1/7/2014	1-9 PM	1/22-2/28/2014	37	13	21	3	0
2014-2015	1/7/2015	2-10 PM	1/1-2/28/2015	59	17	26	16	0
2015-2016	1/19/2016	1-9 PM	1/15-1/19 & 2/12-2/15/2016	9	4	4	1	0
2016-2017	12/15/2016	2-10 PM	None	0	0	0	0	0
2017-2018	1/5/2018	2-10 PM	12/26-1/7/2018	13	1	12	0	0
Frequency:	**2**	**1-9 PM**	**Cold Snap Freq:**	**127**	**39**	**67**	**21**	**0**
	4	**2-10 PM**	*%*		*30.7%*	*52.8%*	*16.5%*	*0.0%*

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Peak Load Window Analysis (cont.)

- **Additional analysis has been conducted by the NYISO for the Summer Peak Load Window**
  - This analysis looked at the peak summer day and Heat Wave Periods for the past 6 Summer Capability Periods
    - Note: the NYISO activated a Thunderstorm Alert (TSA) for 6 out of the 11 peak periods that fell between 11-7 PM (HB11–HB18). This leads to lower load later in the day as the storm passes through and cools ambient air temperatures, reducing AC load across the state
  - The analysis showed HB 12 – HB 19 to be the Peak Load Window for Summer

Capability Year	Peak Day		Peak Periods					
	Date	Peak MWh	Heat Wave Period	Total Days	11-7 PM	12-8 PM	1-9 PM	2-10 PM
2013-2014	7/19/2013	11-7 PM	7/14-7/20	7	3	3	0	1
2014-2015	9/2/2014	12-8 PM	None	0	0	0	0	0
2015-2016	7/29/2015	12-8 PM	7/20-7/29	10	3	6	1	0
2016-2017	8/11/2016	12-8 PM	7/5-7/7 7/25 8/11-8/12	6	3	2	0	1
2017-2018	7/19/2017	12-8 PM	6/11-6/13 7/19	4	0	2	1	1
2018-2019	8/29/2018	11-7 PM	6/30-7/5 8/6 8/28-8/29 9/2-9/6	14	5	3	4	2
Frequency:	**2**	**11-7 PM**	**Heat Wave Freq:**	**41**	**14**	**16**	**6**	**5**
	4	**12-8 PM**	*%*		*34.1%*	*39.0%*	*14.6%*	*12.2%*

Capacity Suppliers with duration limitations – Bid/Schedule/Notify

- **Capacity Suppliers with duration limitations are required to Bid/Schedule/Notify during the Peak Load Window**
  - ESRs with duration limitations must B/S/N in the DAM for the entirety of Peak Load Window as ISO-Managed
  - DER and ELRs with duration limitations must B/S/N in the DAM for the number of hours that correspond to their duration requirement
  - For ESRs, DER, and ELRs:
    - These hours must be consecutive and within the Peak Load Window
    - NYISO Operations has the right to move the resource's DAM schedule as well as specify the exact hours that resources should bid into on an as needed basis
      - Operations can specify the bidding window up to 4 hours (1 am) before the close of the DAM
        - » This proposed timeline is consistent with the existing DARU timeline
      - Hours do not have to be within the Peak Load Window
      - Responding to hours outside of the Peak Load Window would be on a best effort basis and will not impact the derating factors

Capacity Suppliers with duration limitations – Derating Factor

- **The ICAP to UCAP translation will not change**
  - UCAP = ICAP * (1 - derating factor)
- **Availability-based derating factors will be derived from GADS or the UOL calculation, as applicable to the resource type**
  - The derating factor for traditional resources will continue to be based on the GADS/EFORd methodology
  - The derating factor calculation for resources using the UOL availability calculation (ESRs and DER) will be based on the resource type
    - More detail on the following slide
    - Activity that occurs outside of the required bidding obligation will not affect the derating factor (including failed starts and outages)

Derating Factor – ESRs

- **The derating factor calculation for ESRs that are duration limited is measured over the entire Bid/Schedule/Notify window**
  - ESRs will be measured in real time over the entire Peak Load Window

Derating Factor – DER

- **The derating factor calculation for DER that are duration limited is measured over the hours that the resources is expected to be available for**
  - The resource is expected to be able to operate for the number of hours that correspond to its duration requirement (i.e. 2, 4, 6 or 8)
  - The window that measures the availability of the resource will be adjusted based on the DER's DAM schedule

Capacity Suppliers with duration limitations – ICAP

- **ICAP will still apply to all resources as current practice, but the payment for all resources will be based on an Adjusted ICAP**
  - ICAP = min(CRIS, DMNC)
    - ICAP value used consistent with current practices (i.e. Bid/Schedule/Notify, etc.)
  - Adjusted ICAP = min(CRIS, DMNC) * Duration Adjustment Factor
    - Applies to all Capacity Suppliers where the payment corresponds to the Duration Adjustment Factor for that duration
    - The derating factor is applied to the Adjusted ICAP for the system wide ICAP to UCAP translation
  - UCAP for market = Adjusted ICAP * (1 – derating factor)
- **See Appendix for examples of ICAP payment calculations**

Capacity Suppliers with duration limitations – Other Obligations

- **Other rules and obligations for Capacity Suppliers with duration limitations that have sold capacity:**
  - Continue to provide 2 year forward outage information
  - Additional rules for Energy Storage Resources:
    - Provide Energy Level Telemetry to the NYISO

Capacity Suppliers with duration limitations – Other Obligations (cont.)

- **SRE Obligations**
  - Capacity Suppliers with duration limitations must bid during the Peak Load Window for the number of hours corresponding to the duration of the resource, where the NYISO can move the resource's schedule
- **Penalties for failure to Bid/Schedule/Notify**
  - Capacity Suppliers with duration limitations will only be evaluated for Bid/Schedule/Notify Obligation during the Peak Load Window, so the penalty would only be calculated during that window for the appropriate number of hours
    - e.g. a 4 hour Capacity Supplier would be evaluated over the appropriate 4 hour bidding window

Aggregations

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Aggregations – Qualifications

- **DER that are mapped to the same Transmission Node can aggregate to increase their capacity**
  - Each individual DER must be <= 20 MW and separately registered with the NYISO
  - Each DER must be electrically located within the NYCA
  - The minimum size of an Aggregation is 0.1 MW
    - DER <0.1 MW will need to aggregate in order to participate in the NYISO wholesale market
  - Aggregated DER will be managed by a single responsible party and be assigned one PTID. The NYISO will only view aggregated DER as a single resource
    - Aggregations will all be coordinated through the Aggregator, independent of the participation model that the Aggregation is using

Aggregations – Qualifications (cont.)

- **DER that are mapped to the same Transmission Node can aggregate to increase their capacity**
  - Homogenous Aggregations of DER will participate using that resource type's participation model
  - Heterogeneous Aggregations will participate using the DER Participation model
  - Time-stacked Aggregations are discussed later in presentation

Aggregations – DMNC

- **The NYISO will require the DER to perform a DMNC test once every Capability Period for the Aggregation as a whole**
  - Aggregations that obtain a DER new to the market must provide a new DMNC test for the Aggregation as a whole if the Aggregation wants to sell that DER in the Capacity Market
  - The aggregator will provide a resource-specific breakdown of the Aggregation's DMNC
  - An Aggregation can only change its duration at the beginning of the Capability Year
    - The Aggregation must notify the NYISO of this change prior to August 1st of the year preceding the Capability Year
  - Operating data can be submitted in lieu of a DMNC test

Aggregations – DMNC (cont.)

- **DER do not need to perform a new DMNC test again within the same Capability Period if:**
  - The capacity of the Aggregation does not increase
  - The aggregator obtains an existing DER that already performed DMNC (but new to the Aggregation)
  - The aggregator does not intend to sell the increased capacity
  - A DER leaves an Aggregation
    - If a DER leaves an Aggregation and does not join a new Aggregation, it can either participate on its own (if it is >= 0.1 MW) or leave the NYISO markets
      - A DER that leaves the NYISO markets can return at a later date if it meets all of the appropriate qualifications
      - A DER is considered to be a new DER after it has been out of the NYISO markets for 18 months

Aggregations – Bid/Schedule/Notify

- **Bid/Schedule/Notify obligations for a DER will be based on the characteristics of the Aggregation**
  - Homogenous aggregations will have the same obligation as that resource type
    - i.e. an Aggregation of Energy Storage Resources will Bid/Schedule/Notify as ISO-Managed Energy Level in the DAM
    - Exception is that an Aggregation of Load Curtailment resources will participate as part of the Dispatchable DER Model
  - Heterogeneous Aggregations will use the Dispatchable DER Model's Bid/Schedule/Notify obligation

Aggregations – Derating Factor

- **The method for calculating the derating factor for a DER will be based on the characteristics of the DER by treating the DER as a single resource**
  - The derating factor for homogenous Aggregations will be calculated using the method pertaining to that resource type
    - i.e. an Aggregation of all Solar resources (using the Solar Participation Model) will use the derating factor calculation for Solar resources
  - The derating factor for heterogeneous Aggregations will be calculated using the method for the Dispatchable DER Model
- **Derating factors for DER will be measured on the availability or performance of the Aggregation as a whole, as appropriate for that participation model**
  - The NYISO will not have visibility into the availability of the individual DER that comprise an Aggregation (excluding GADS)

Aggregations – Swapping Aggregations

- **Resources that switch Aggregations but remain within the same participation model can switch on a monthly basis**
  - Existing resources will carry their previous DMNC with them
- **Resources that switch between participation models must do so at the beginning of the Capability Year**
  - Existing resources will carry their previous DMNC with them
  - Resources must notify the NYISO of this change prior to August 1st of the year preceding the Capability Year
- **Resources that switch from a retail load modifier to NYISO wholesale market participation must do so at the beginning of the Capability Year**
  - Resources must notify the NYISO of this change prior to August 1st of the year preceding the Capability Year

Aggregations- Swapping Aggregations (cont.)

- **Resources that switch from NYISO wholesale market participation to a retail load modifier**
  - If notified prior to August 1st of the year preceding the Capability Year, then the resource's transition to a retail load modifier will be reflected in the requirements for the Transmission District
  - If not notified prior to August 1st of the year preceding the Capability Year, then the resource's transition to a retail load modifier will not be reflected in the Transmission District Requirements
- **Resources with load reduction at the time of NYCA and Locality Peak will be added back to the actual metered load for determining ICAP Requirements**
  - Similar to the add-back done currently for SCR load reductions
- **New resources entering the market into an existing Aggregation will affect the Aggregation's derating factor going forward**
  - The derating factor for the months prior to the resource entering the market will be based on the NYISO class average of that resource type
- **For resources that swap Aggregations, the resource derating factor will be determined based on the participation models that the resource is moving to/from**
  - Homogeneous Aggregations have derating factors that are resource-type specific, whereas heterogeneous Aggregations are all Aggregations that use the UOL calculation

Time Stacking

Time Stacking - Qualifications

- **Time Stacking - the ability to stack/sequentially align DER to meet minimum duration requirements for capacity payments**
  - Individual DER must be separately registered and must be able to run for a minimum of 1 hour per day to participate in time stacking
    - Individual DER will only be allowed to participate in hour increments and be truncated down to the hour duration before time stacking
  - A time stacked DER will be rated for the amount of power it can sustain over the run time requirement
    - This can be the Capacity Supplier requirement or any Capacity Supplier with duration limitations requirement
  - DER participating in the homogeneous intermittent model cannot time stack
- **Individual DER can time stack to meet the 8 hour duration requirement, and/or can aggregate to increase their capacity if all individual DER are <= 20 MW**
  - The size requirement is only applicable to the injection portion of DER

Time Stacking – DMNC

- **The NYISO will require the time-stacked Aggregation to perform a DMNC test once every Capability Period**
  - The DER will be required to test these DER sequentially during the DMNC window to demonstrate that the DER can be distributed throughout the window
    - Prior to time stacking, each DER will have met all of the qualifications of a Capacity Supplier, excluding the duration requirement
    - The DER are stacked based on their ICAP
  - DMNC of the Aggregation is the minimum sustained output over the duration period
    - Time-stacked Aggregations will only be allowed to switch durations at the beginning of a Capability Year, and consequently perform a new DMNC test
  - Aggregations that obtain a DER new to the market must provide a new DMNC test for the Aggregation as a whole if the Aggregation wants to sell that DER in the Capacity Market

Time Stacking – DMNC (cont.)

- **The NYISO will require the time-stacked Aggregation to perform a DMNC test once every Capability Period**
  - The aggregator will provide a resource-specific breakdown of the time-stacked Aggregation's DMNC
  - Operating data can be submitted in lieu of a DMNC test
- **Aggregators do not need to perform a new DMNC within the same Capability Period if:**
  - The capacity of the Aggregation does not increase
  - The aggregator does not intend to use the new capacity
  - A DER leaves an Aggregation
  - If the duration of a time-stacked Aggregation decreases

Next steps:

Future ICAPWG for continued discussions

Feedback/Questions?

email: ztsmith@nyiso.com

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Appendix

NYISO Analysis

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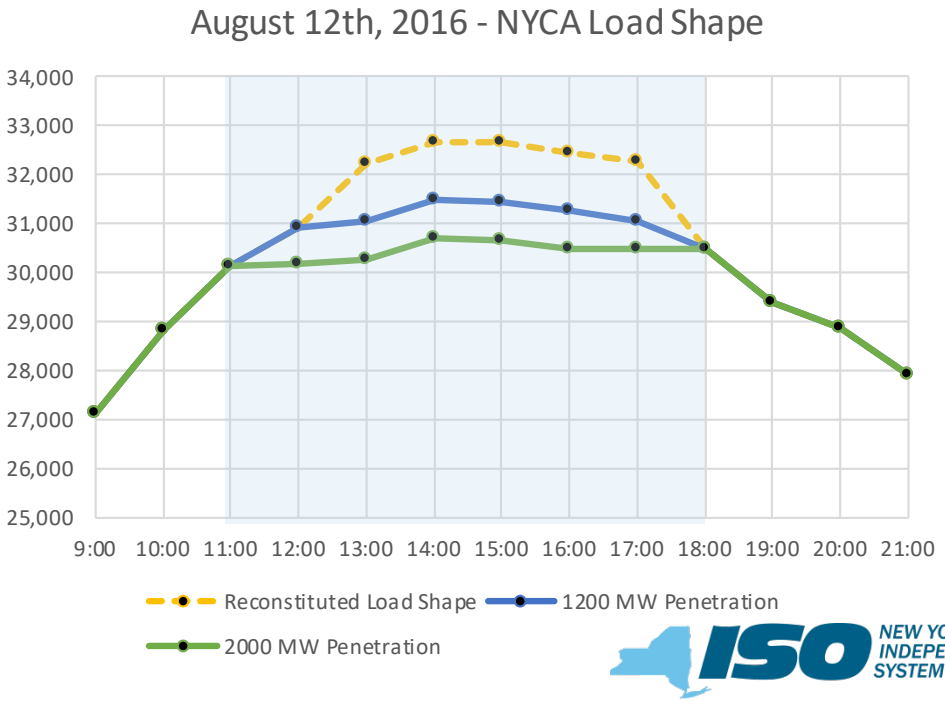
System Operations Analysis using SCRs

- The NYISO conducted an analysis using actual enrollment and event data to determine the expected duration of SCR calls at different penetration levels (1200 and 2000 MW)
- The NYISO conducted additional analysis to determine the appropriate length of time of SCR calls as to not introduce a double peak throughout the day at different levels of resource penetration
- The analysis uses the reconstituted load profiles for Zones J and NYCA for four SCR calls over the last few years
  - More details on following slide

SCR Analysis

- As described on slides 10-11, the NYISO conducted an analysis using actual enrollment and event data to determine the expected duration of SCR calls at different penetration levels (1200 and 2000 MW)
- The following figure shows the load shape for one of the days used in the analysis



SCR Analysis

- In 2012, the NYISO with the NYSRC performed an analysis on SCR's contribution to Resource Adequacy
  - http://www.nysrc.org/pdf/MeetingMaterial/ICSMeetingMaterial/ICS_Agenda135/2012%20SCR%20Study%20Report%20for%20ICS%20-final-05-01-12.pdf
- In 2014, the NYISO initiated an effort to increase the duration requirement for the SCR program from 4 to 6 hours
  - https://www.nyiso.com/documents/20142/1403273/SCR%20Performance%20Obligations%20_ICAPWG072114.pdf/c4114ded-c70d-b067-baab-cc536a844664

Run of River Hydro Analysis

- **Performance Factors remained relatively steady when shifting from evaluating performance over the Top 20 load hours to the Top 40**
  - One unit saw an increase of 1% in the Performance Factor during Winter
  - The largest change was a decrease of 2.7% for Units 3 and 4 during Winter

	Winter Capability Period			
Unit	1	2	3	4
Performance Factor Delta from 20 to 40 hours	1.0%	-1.8%	-2.7%	-2.8%

	Summer Capability Period			
Unit	1	2	3	4
Performance Factor Delta from 20 to 40 hours	-0.8%	-2.2%	-1.4%	-0.9%

Derating Factor Examples for duration limited resources

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Derating Factor for duration limited resources

- **The UOL availability calculation captures the real time availability of resources**
- **For ESR, the UOL availability calculation will measure over the entire Peak Load Window**
- **For DER, the UOL availability calculation will measure over the number of hours that correspond to the resource's duration requirement**
  - If a resource receives a DAM schedule for its duration requirement, the UOL availability calculation will measure the resource's availability over the hours that correspond to the resource's DAM schedule
  - If the resource does not receive a schedule in the DAM that corresponds to its duration requirement, the measurement window for the availability calculation will be altered to account for the resource's real time bidding
  - The measurement window will be capped at the end of the Peak Load Window
- **More details on the derating factor implications on the following slides**

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Derating Factor for duration limited DER

- **Availability will be measured as follows:**
  - For resources that receive a schedule in DAM for their full duration:
    - Availability will be measured over the hours in which the resource received a schedule in the DAM
  - For resources that receive a schedule in DAM for a portion of their duration requirement:
    - The measurement window will begin prior to the start of the resource's DAM schedule, such that the total measurement window is the same duration and the resource's duration requirement
    - If the resource receives a schedule in real time prior to its DAM schedule, the resource's availability will be measured starting at the hour when it received a real time schedule and measure over the number of consecutive hours corresponding to the resource's duration requirement
    - If the resource does not receive a real time schedule prior to its DAM schedule, the measurement window will move forward in time, capping at the first hour of the resource's DAM schedule, and measure over the number of consecutive hours corresponding to the resource's duration requirement
  - For resources that do not receive a schedule in DAM:
    - Availability will be measured over all hours in Peak Load Window, and will be capped at the resource's duration if the resource receives a schedule

Derating Factor Examples

- **The following examples will show the timeline that will be used to measure availability of DER**
  - Each of the examples assumes a Capacity Supplier with duration limitations that has a 4 hour capability
  - As previously mentioned, the window in which resources are measured in real time is dependent on their DAM schedule

Derating Factor Example 1

- DER receives a schedule in DAM for its full duration

Example 1	HB							
	12	13	14	15	16	17	18	19
DAM Schedule			x	x	x	x		
Availability measured			x	x	x	x		

Derating Factor Example 2a

- **DER receives a schedule in DAM for a portion of its duration**
  - Resource bids in real time and receives a schedule prior to the start of its DAM schedule

Example 2a	HB							
	12	13	14	15	16	17	18	19
DAM Schedule				x	x			
RT Bidding		x	x	x	x			
RT Schedule		x	x	x	x			
Availability measured		x	x	x	x			

Derating Factor Example 2b

- **DER receives a schedule in DAM for a portion of its duration**
  - Resource bids in real time and receives a schedule prior to the start of its DAM schedule

Example 2b	HB							
	12	13	14	15	16	17	18	19
DAM Schedule				x	x			
RT Bidding		x	x	x	x	x		
RT Schedule			x	x	x	x		
Availability measured		x	x	x	x	x		

Derating Factor Example 3

- **DER receives a schedule in DAM for a portion of its duration**
  - Resource bids in real time and receives a schedule after the start of its DAM schedule

Example 3	HB							
	12	13	14	15	16	17	18	19
DAM Schedule				x	x			
RT Bidding		x	x	x	x	x	x	
RT Schedule				x	x	x	x	
Availability measured		x	x	x	x	x	x	

Derating Factor Example 4a

- DER does not receive a DAM schedule

Example 4a	HB							
	12	13	14	15	16	17	18	19
DAM Schedule								
RT Bidding	x	x	x	x	x	x	x	x
RT Schedule								
Availability measured	x	x	x	x	x	x	x	x

Derating Factor Example 4b

- **DER does not receive a DAM schedule**
  - Window that availability is measured over is capped at the resource's duration requirement

Example 4b	HB							
	12	13	14	15	16	17	18	19
DAM Schedule								
RT Bidding	x	x	x	x	x	x	x	x
RT Schedule			x	x	x			
Availability measured	x	x	x	x	x	x		

The following slides were presented in the Expanding Capacity Eligibility presentation at the 10/9/2018 ICAPWG

Glossary

- **Adjusted ICAP = min(CRIS, DMNC) * Duration Adjustment Factor (%)**
  - Adjusted ICAP determines the portion of payment that the resource will receive
  - The derating factor is applied to the Adjusted ICAP to determine UCAP value for the market
- **Aggregation - a collection of at least two independent assets, managed by a single entity that participate as one larger resource in the NYISO markets**
- **Capacity Supplier - a resource that has registered in the NYISO capacity market, that is capable of injecting to the wholesale grid that not have any hourly limitations**

Glossary (cont.)

- Dispatchable DER Model – the specific rules, requirements and obligations necessary for participation in the NYISO markets for Demand Side Resource assets and Aggregations, as well mixed resource Aggregations
- Capacity Value Study – study to determine the value of resources with different durations
  - Will be recurring every 4 years
- Capacity Supplier with duration limitations- a resource that has registered in the NYISO capacity market, that is capable of injecting into the wholesale grid for 2, 4, 6, or 8 hours

Glossary (cont.)

- **Participation Model – specific rules, requirements and obligations that a class of assets is subject to when participating in the NYISO Markets**
  - i.e. solar resources participate using the Intermittent Resource Participation Model
- **Peak Load Window – the time period in which Capacity Suppliers with duration limitations have obligations to the NYISO**
  - Summer Capability Period = HB 12 - HB 19, Winter Capability Period = HB 14 - HB 21
- **Time Stacking - a specific type of Aggregation that stacks run-time duration as well as MW capability**

ICAP for duration limited resources

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Capacity Suppliers with duration limitations – ICAP

- **The following slides contain information on how to calculate ICAP/UCAP for Capacity and Capacity Suppliers with duration limitations**
  - The method by which UCAP is calculated for Capacity Suppliers with duration limitations is adjusted based on the Duration Adjustment Factor determined from the Capacity Value Study (see later slides)

Capacity and Capacity Suppliers with duration limitations – ICAP/UCAP

- **ICAP will still apply to all resources as current practice, but the payment for all resources will be based on an Adjusted ICAP**
  - ICAP = min(CRIS, DMNC)
    - ICAP value used consistent with current practices (i.e. Bid/Schedule/Notify, ICAP to UCAP translation, ICAP to sell, etc.)
  - Adjusted ICAP = min(CRIS, DMNC) * Duration Adjustment Factor
    - Applies to Capacity Suppliers and Capacity Suppliers with duration limitations where the payment corresponds to the Duration Adjustment Factor for that duration
  - UCAP for market = Adjusted ICAP * (1 – Derating Factor)

Capacity and Capacity Suppliers with duration limitations– ICAP examples

Capacity Supplier Type	CRIS (MW)	DMNC (MW)	ICAP= min(CRIS, DMNC) (MW)	Duration Category (hours)	DMNC Duration Req. (hours)	B/S/N Obligation (MW)	Duration Adjustment Factor (%)	Adjusted ICAP * (MW)	Payment ($)
Capacity	100	80	80	8	8	80	100	80	800
Duration Limited	100	80	80	6	6	80	90	72	720
Duration Limited	100	80	80	4	4	80	75	60	600
Duration Limited	100	80	80	2	2	80	37.5	30	300

Spot Clearing Price = $10

*UCAP is based on the Adjusted ICAP value
The Derating factor is assumed to be = 0

Capacity and Capacity Suppliers with duration limitations– ICAP/UCAP examples

- The following slides include examples of the ICAP and UCAP calculations for a battery that could derate to meet different duration requirements
  - Example 1 – Deliverability UCAP and CRIS based on duration
- The example shows the UCAP calculations (for the market and deliverability) for a battery with the following parameters: 80 MWh, 40 MW injection capability, and ERIS of 40 MW

Example 1 – ICAP/UCAP calculations

- **ICAP will still apply to all DER as current practice, and the Adjusted ICAP will be used to determine the amount of UCAP for the markets**
  - UCAP for market = Adjusted ICAP * (1 – Derating Factor)
- **DER will be studied for deliverability at their maximum UCAP possible based on their requested CRIS value**
  - UCAP for deliverability = ICAP * (1 – Derating Factor)
  - ICAP = min(CRIS, DMNC)
    - The DER's requested CRIS value is used in the ICAP calculation

ICAP/UCAP for Markets

Capacity Supplier Type	ICAP (MW)	Duration Category (hours)	DMNC Duration Req. (hours)	Duration Adjustment Factor %	Adjusted ICAP for market (MW)	Derating Factor %	UCAP for market (MW)	Payment ($)	Bid/ Schedule/ Notify (MW)
Capacity	10	8	8	100%	10	5%	9.5	95	10
Duration Limited	13.3	6	6	90%	11.9	5%	11.3	113	13.3
Duration Limited	20	4	4	75%	15	5%	14.2	142	20
Duration Limited	20	2	2	37.5%	7.5	5%	7.1	71	20

Spot Clearing Price = $10

Example of battery with the following parameters: 80 MWh, 40 MW injection capability, and ERIS of 40 MW

Example 1 – ICAP/UCAP Deliverability

Example of battery with the following parameters: 80 MWh, 40 MW injection capability, and ERIS of 40 MW

Capacity Supplier Type	Maximum CRIS (MW)	Duration Category (hours)	Derating Factor %	UCAP for Deliverability (MW)	UCAP for market (MW)
Capacity	10	8	5%	9.5	9.5
Duration Limited	13.3	6	5%	12.6	9.4
Duration Limited	20	4	5%	19	9.5
Duration Limited	40	2	5%	38	9.5

Max CRIS request is the expected max output for the developer-selected duration, and UCAP will be that value reduced by derating factor

Time Stacking Examples

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Time Stacking Examples

- **DERs that participate in time stacking must either stack to increase their capacity at the same duration, or stack to increase their duration at the same capacity (MW) level**
  - DER cannot participate as the average MW of the individual DER
- **For example, a 2 MW DER with a 4 hour capability and a 20 MW DER with a 4 hour capability cannot stack to participate as an 11 MW DER with an 8 hour capability**
  - Rather, the 2 MW and 20 MW DER with 4 hour capabilities could either participate as a 22 MW DER with 4 hour capability, or a 2 MW DER with an 8 hour capability, with 20 MW at 4 hour capability of unused capacity

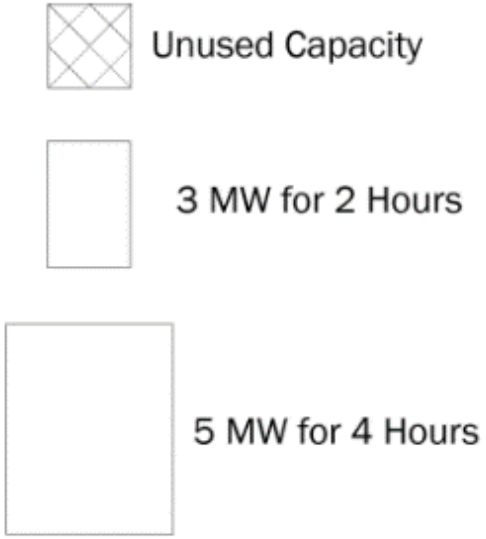
Time Stacking – Non-ESR Example 1

- **On the following slides, we will examine how non-ESR DERs can time stack to meet a duration requirement**
  - These non-ESR DERs cannot derate their capacity to meet the duration requirement
  - A Non-ESR DER cannot separately sell their "left over" capacity because it may not be technically feasible to dispatch both pieces of the DER simultaneously
    - i.e. a Demand Response DER with an 8 hour duration cannot separately sell two 4 hour DER if the DER cannot be dispatched simultaneously

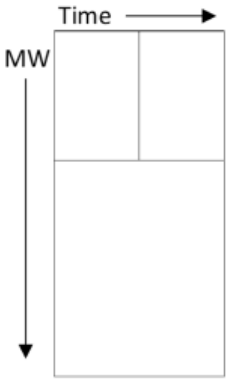
Time Stacking – Non-ESR Example 1 (cont.)

- **Example of three non-ESR DERs that participate in time stacking (cannot derate capacity):**
  - 3 MW DER with 2 hour capability and 3 MW CRIS
  - 3 MW DER with 2 hour capability and 3 MW CRIS
  - 5 MW DER with 4 hour capability and 5 MW CRIS
- **This Aggregation can elect to be either:**
  - An 8 MW DER with a 4 hour capability
    - i.e. stack the 3 MW DER with 2 hour capability to be a 3 MW DER with 4 hour capability, then stack with the 5 MW DER with 4 hour capability to participate as an 8 MW, 4 hour DER
  - An 11 MW DER with a 2 hour capability, with 5 MW and 2 hours left over (tall stack)
    - i.e. stack the 3 MW DER with 2 hour capability to be a 6 MW DER with 2 hour capability, then stack with the 5 MW DER with 4 hour capability to participate as an 11 MW DER with 2 hour capability, with 5 MW and 2 hours left over (cannot be sold separately)
  - A 3 MW DER with an 8 hour capability, with 2 MW for 4 hours remaining (long stack)
    - i.e. stack the 3 MW DER with 2 hour capability to be a 3 MW DER with 4 hour capability, then stack with the 5 MW DER with 4 hour capability to participate as an 3 MW DER with 8 hour capability, with 2 MW and 4 hours left over (cannot be sold separately)

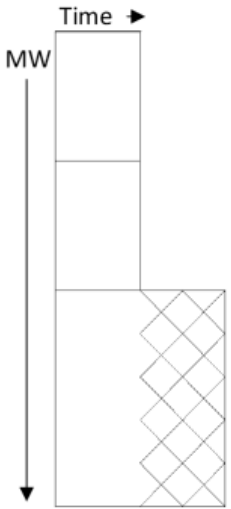
Time Stacking- Non-ESR Example 1 (cont.)



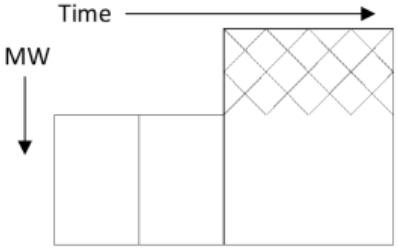
8 MW for 4 Hours



11 MW for 2 Hours

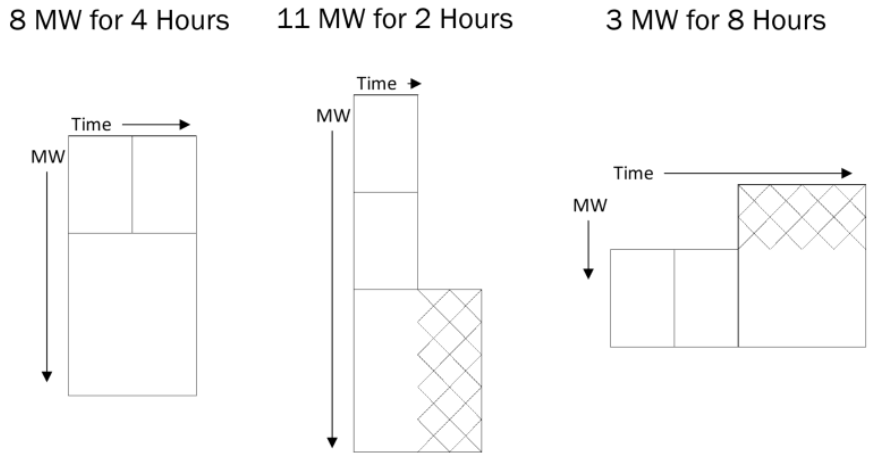


3 MW for 8 Hours



Time Stacking- Non-ESR Example 1 (cont.)

- **In this example, the Aggregations would choose how it wanted to time stack, and then conduct its DMNC test for that duration to show its minimum capability over that time period**
  - The Aggregation would be considered a Capacity Supplier with duration limitations depending on its DMNC test
    - i.e. if the Aggregation chose to time stack as an 8 MW DER for 4 hours, it would be considered a 4 hour Capacity Supplier with duration limitations pending its DMNC test



Time Stacking – Non-ESR Example 2

- **Example of three non-ESR DERs that participate in time stacking (cannot derate capacity):**
  - 3 MW DER with 2 hour capability and 2 MW CRIS
  - 3 MW DER with 2 hour capability and 3 MW CRIS
  - 5 MW DER with 4 hour capability and 5 MW CRIS
- **This Aggregation can elect to be either:**
  - A 7 MW DER with a 4 hour capability, with 1 MW for 2 hours left over
    - i.e. stack the DER with the 2 hour capability to become a 2 MW DER with 4 hour capability, then stack with the 5 MW DER with 4 hour capability to participate as a 7 MW DER with 4 hour capability, with 1 MW for 2 hours left over
  - A 10 MW DER with a 2 hour capability, with 5 MW for 2 hours left over (tall stack)
    - i.e. stack the 2 and 3 MW DER with 2 hour capability to be a 5 MW DER with 2 hour capability, then stack with the 5 MW DER with 4 hour capability to participate as a 10 MW DER with 2 hour capability, with 5 MW for 2 hours left over (cannot be sold separately)
  - A 2 MW DER with an 8 hour capability, with 1 MW for 2 hours and 3 MW for 4 hours remaining (long stack)
    - i.e. stack the 2 and 3 MW DER with 2 hour capability to be a 2 MW DER with 4 hour capability, then stack with the 5 MW DER with 4 hour capability to participate as a 2 MW DER with 8 hour capability, with 1 MW with 2 hour capability and 3 MW with 4 hour capability left over (cannot be sold separately)

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Time Stacking- Non-ESR Example 2 (cont.)

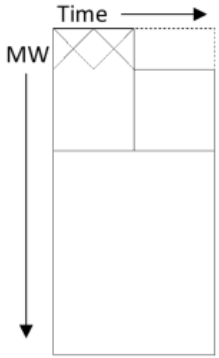
Unused Capacity

3 MW for 2 Hours
3MW CRIS

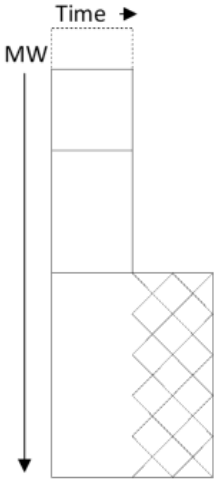
3 MW for 2 Hours
2MW CRIS

5 MW for 4 Hours

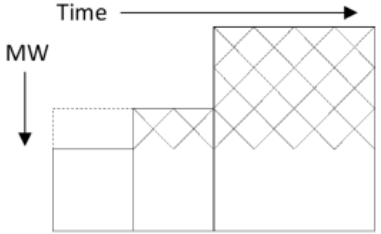
7MW for 4 Hours



10MW for 2 Hours



3MW for 8 Hours



Time Stacking – Non-ESR Example 1 Payment Scenarios

	8MW for 4 hours		11 MW for 2 hours		3MW for 8 hours	
Linear Step Model	75%	$60	37.5%	$41	100%	$30

*Auction Clearing Price = $10

Time Stacking – Calculating the Derating Factor for Aggregations that Swap Resources

- **For time stacked DER, the derating factor blending will be MWh-weighted**
  - Example of DER that participate in time stacking taking DER availability factor into account
    - 5 MW DER A with 4 hour capability, 100% availability factor
    - 3 MW DER B with 2 hour capability, 100% availability factor
    - 3 MW DER C with 2 hour capability, 50% availability factor
      - DER C previously participated in other Aggregations over the last 18 months, which is why its derating factor is different than the first two DER

The availability factor for this Aggregation would be = Total Available MWh / Total Nameplate MWh = 90.6%

Availability Factor	Hours	MW	Total Available MWh	Total Nameplate MWh
100%	4	5	20	20
100%	2	3	6	6
50%	2	3	3	6
		Total	29	32

Derating Factor Examples

NEW YORK INDEPENDENT SYSTEM OPERATOR

Derating Factors for DER/ESR

- **How will derating factors for Energy Storage Resources and Distributed Energy Resources be calculated?**
  - Derating factors for DER/ESR will be calculated based upon a time-weighted UOL availability evaluated against the ICAP sold
    - For each RTD interval that the UOL is adjusted down due to a NYISO or a TO reliability need, the NYISO will replace the UOL with the bid UOL
    - The Normal UOL will have a floor of 0 and be capped against the ICAP Sold, and the number of seconds will be calculated for that interval
    - For the intervals where the unit was on a planned or scheduled outage approved by NYISO operations, the seconds will be set to 0, removing it from the calculation

Derating Factors for DER/ESR (cont.)

- **How will derating factors for DER/ESR be calculated?**
  - Derating factors for DER/ESR will be calculated based upon a time-weighted UOL availability evaluated against the ICAP sold
    - For each month, 4 values will be calculated
      - Total Seconds – Sum of seconds in the month that the unit was not on an approved outage
      - Total Available Capacity – Sum of (Normal UOL for interval * seconds in interval) for the month
      - Total Expected Capacity – ICAP sold * Total Seconds
      - Monthly Availability – Total Available Capacity / Total Expected Capacity

Derating Factors for DER/ESR (cont.)

- **How will derating factors for DER/ESR be calculated?**
  - 12-month blocks will be calculated, summing the Total Available Capacity, the Total Expected Capacity, and the availability calculation for the 12-month block
  - The derating factor for DER/ESR will be the average of 6 of the 12-month blocks
    - These will be the same 12-month blocks used in the existing EFORd calculation
      - Derating factor to determine Summer UCAP uses a 12 month period ending in July, August, September, October, November, and December from the prior year
      - Derating factor to determine Winter UCAP uses a 12 month period ending in January, February, March, April, May, and June from the current year
      - Derating Factor = 1 – Availability Factor

Derating Factors for DER/ESR (cont.)

- **What will be the default derating factors for DER/ESR who are just entering the market?**
  - Once 3 or more assets have entered the market and have data available to calculate derating factors, the NYISO will use the NYISO class average for that participation model
  - Until there are 3 or more assets:
    - The NYISO will use the NERC reported EFORd for Pumped Storage for ESR (currently 3.53%)
    - The NYISO is still evaluating the default derating factor for resources using the Dispatchable DER Model
  - Resources that have availability data some of the required timeframe but not all of the timeframe will use the default values for the timeframes that are missing

UOL Calculation Examples

- **Go through an example of the proposed derating factor calculation for ESRs for an individual resource**
  - Look at derating factor calculation over a 12-month period and hourly period
  - Look at how derating factor changes for an ESR that is ISO-Managed vs Self-Managed in real time

UOL Calculation Example 1

Month	ICAP Sold for DAM	Total Seconds	Total Available ICAP	Total Expected ICAP	Monthly Availability
1	30	2678400	79220050	80352000	98.6%
2	30	2419200	70044000	72576000	96.5%
3	30	2678400	79100100	80352000	98.4%
4	30	2592000	76300630	77760000	98.1%
5	30	2678400	77021000	80352000	95.9%
6	32	2592000	78476000	82944000	94.6%
7	32	2678400	81324000	85708800	94.9%
8	32	2678400	80456000	85708800	93.9%
9	30	2592000	74500700	77760000	95.8%
10	30	2678400	79000000	80352000	98.3%
11	30	2592000	76000100	77760000	97.7%
12	30	2678400	79242420	80352000	98.6%
Average availability factor			930685000	961977600	96.7%
Average derating factor					3.3%

- **Example of calculation over 12-month period**
  - Total Seconds – Sum of seconds in the month that the unit was not on an approved outage
  - Total Available ICAP – Sum of (Normal UOL for interval * seconds in interval) for the month
  - Total Expected ICAP – ICAP Sold * Total Seconds
  - Monthly Availability – Total Available ICAP / Total Expected ICAP

UOL Calculation Example 2

Interval Begin	UOL	Delta between intervals	ICAP Sold for Month	Provided Impact	Available ICAP	Expected ICAP	Hourly Availability
12:00	30	300	30	30	9000	9000	100%
12:05	30	300	30	30	9000	9000	100%
12:10	30	300	30	30	9000	9000	100%
12:15	30	300	30	30	9000	9000	100%
12:20	30	300	30	30	9000	9000	100%
12:25	30	300	30	30	9000	9000	100%
12:30	30	180	30	30	5400	5400	100%
12:33	30	120	30	30	3600	3600	100%
12:35	28	300	30	28	8400	9000	93.3%
12:40	28	300	30	28	8400	9000	93.3%
12:45	28	360	30	28	10080	10800	93.3%
12:51	28	240	30	28	6720	7200	93.3%
12:55	28	300	30	28	8400	9000	93.3%
Average availability factor					105000	108000	97.2%
Average derating factor							2.8%

- **Example to break down the actual real time calculation**
  - Provided Impact = min(UOL, ICAP Sold for Month)
  - Total Available ICAP – Sum of (Normal UOL for interval * seconds in interval) for the month
  - Total Expected ICAP – ICAP Sold * Total Seconds
  - Hourly Availability – Available ICAP / Expected ICAP

UOL Calculation Examples (cont.)

- **Comparison of an ESR that is ISO-Managed one day and Self-Managed another day**
  - The resource is assumed to be “drained” for the same periods of time between the two days

UOL Calculation Example 3a

- **Example of derating factor calculation by hour for a single day for an ISO-Managed ESR**
  - An ESR that is ISO-Managed and flexible in real time is still considered to have its full UOL even if it is drained of its energy
    - The resource is drained from HB 12-23

Hour	ICAP Sold for DAM	UOL	State of Charge	Total Seconds	Total Available ICAP	Total Expected ICAP	Hourly Availability
0	10	10	40	3600	36000	36000	100%
1	10	10	40	3600	36000	36000	100%
2	10	10	40	3600	36000	36000	100%
3	10	10	40	3600	36000	36000	100%
4	10	10	40	3600	36000	36000	100%
5	10	10	40	3600	36000	36000	100%
6	10	10	40	3600	36000	36000	100%
7	10	10	40	3600	36000	36000	100%
8	10	10	40	3600	36000	36000	100%
9	10	10	30	3600	36000	36000	100%
10	10	10	20	3600	36000	36000	100%
11	10	10	10	3600	36000	36000	100%
12	10	10	0	3600	36000	36000	100%
13	10	10	0	3600	36000	36000	100%
14	10	10	0	3600	36000	36000	100%
15	10	10	0	3600	36000	36000	100%
16	10	10	0	3600	36000	36000	100%
17	10	10	0	3600	36000	36000	100%
18	10	10	0	3600	36000	36000	100%
19	10	10	0	3600	36000	36000	100%
20	10	10	0	3600	36000	36000	100%
21	10	10	0	3600	36000	36000	100%
22	10	10	0	3600	36000	36000	100%
23	10	10	0	3600	36000	36000	100%
Average availability factor					864000	864000	100%
Average derating factor							0%

UOL Calculation Example 3b

- **Example of derating factor calculation by hour for a single day for a Self-Managed ESR**
  - An ESR that is Self-Managed in real time is considered to have its UOL = 0 for the times when the resource is drained of its energy
    - The resource is drained from HB 12-23

Hour	ICAP Sold for DAM	UOL	State of Charge	Total Seconds	Total Available ICAP	Total Expected ICAP	Hourly Availability
0	10	10	40	3600	36000	36000	100%
1	10	10	40	3600	36000	36000	100%
2	10	10	40	3600	36000	36000	100%
3	10	10	40	3600	36000	36000	100%
4	10	10	40	3600	36000	36000	100%
5	10	10	40	3600	36000	36000	100%
6	10	10	40	3600	36000	36000	100%
7	10	10	40	3600	36000	36000	100%
8	10	10	40	3600	36000	36000	100%
9	10	10	30	3600	36000	36000	100%
10	10	10	20	3600	36000	36000	100%
11	10	10	10	3600	36000	36000	100%
12	10	0	0	3600	0	36000	0%
13	10	0	0	3600	0	36000	0%
14	10	0	0	3600	0	36000	0%
15	10	0	0	3600	0	36000	0%
16	10	0	0	3600	0	36000	0%
17	10	0	0	3600	0	36000	0%
18	10	0	0	3600	0	36000	0%
19	10	0	0	3600	0	36000	0%
20	10	0	0	3600	0	36000	0%
21	10	0	0	3600	0	36000	0%
22	10	0	0	3600	0	36000	0%
23	10	0	0	3600	0	36000	0%
Average availability factor					432000	864000	50%
Average derating factor							50%

DER specific examples

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Derating factor for a DER that runs out of energy- Example 1

- For DER that do not make themselves less available in real time, the DER will not take a derate

* 4 hour DER with 40 MW capability

Hour	ICAP Sold for DAM	DAM Bid MW	DAM Schedule	RT Bid MW	RT Schedule/Output	UOL	Total Seconds	Total Available ICAP	Total Expected ICAP	Hourly Availability
0	10	10	0	10	0	10	3600	36000	36000	100%
1	10	10	0	10	0	10	3600	36000	36000	100%
2	10	10	0	10	0	10	3600	36000	36000	100%
3	10	10	0	10	0	10	3600	36000	36000	100%
4	10	10	0	10	0	10	3600	36000	36000	100%
5	10	10	0	10	0	10	3600	36000	36000	100%
6	10	10	0	10	0	10	3600	36000	36000	100%
7	10	10	0	10	0	10	3600	36000	36000	100%
8	10	10	0	10	0	10	3600	36000	36000	100%
9	10	10	0	10	0	10	3600	36000	36000	100%
10	10	10	0	10	0	10	3600	36000	36000	100%
11	10	10	0	10	0	10	3600	36000	36000	100%
12	10	10	0	10	0	10	3600	36000	36000	100%
13	10	10	10	10	10	10	3600	36000	36000	100%
14	10	10	10	10	10	10	3600	36000	36000	100%
15	10	10	10	10	10	10	3600	36000	36000	100%
16	10	10	10	10	10	10	3600	36000	36000	100%
17	10	10	0	10	0	10	3600	36000	36000	100%
18	10	10	0	10	0	10	3600	36000	36000	100%
19	10	10	0	10	0	10	3600	36000	36000	100%
20	10	10	0	10	0	10	3600	36000	36000	100%
21	10	10	0	10	0	10	3600	36000	36000	100%
22	10	10	0	10	0	10	3600	36000	36000	100%
23	10	10	0	10	0	10	3600	36000	36000	100%
Average availability factor								864000	864000	100%
Average derating factor										0%

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Derating factor for a DER that runs out of energy- Example 2a

- For DER that do make themselves less available in real time, the DER will take a derate

Hour	ICAP Sold for DAM	DAM Bid MW	DAM Schedule	RT Bid MW	RT Schedule/Output	UOL	Total Seconds	Total Available ICAP	Total Expected ICAP	Hourly Availability
0	10	10	0	10	0	10	3600	36000	36000	100%
1	10	10	0	10	0	10	3600	36000	36000	100%
2	10	10	0	10	0	10	3600	36000	36000	100%
3	10	10	0	10	0	10	3600	36000	36000	100%
4	10	10	0	10	0	10	3600	36000	36000	100%
5	10	10	0	10	0	10	3600	36000	36000	100%
6	10	10	0	10	0	10	3600	36000	36000	100%
7	10	10	0	10	0	10	3600	36000	36000	100%
8	10	10	0	10	0	10	3600	36000	36000	100%
9	10	10	0	10	0	10	3600	36000	36000	100%
10	10	10	0	10	0	10	3600	36000	36000	100%
11	10	10	0	10	0	10	3600	36000	36000	100%
12	10	10	0	10	0	10	3600	36000	36000	100%
13	10	10	10	10	10	10	3600	36000	36000	100%
14	10	10	10	10	10	10	3600	36000	36000	100%
15	10	10	10	10	10	10	3600	36000	36000	100%
16	10	10	10	10	10	10	3600	36000	36000	100%
17	10	10	0	0	0	0	3600	0	36000	0%
18	10	10	0	0	0	0	3600	0	36000	0%
19	10	10	0	0	0	0	3600	0	36000	0%
20	10	10	0	0	0	0	3600	0	36000	0%
21	10	10	0	0	0	0	3600	0	36000	0%
22	10	10	0	0	0	0	3600	0	36000	0%
23	10	10	0	0	0	0	3600	0	36000	0%
Average availabilty factor								612000	864000	71%
Average derating factor										29%

* 4 hour DER with 40 MW capability

Aggregation Examples

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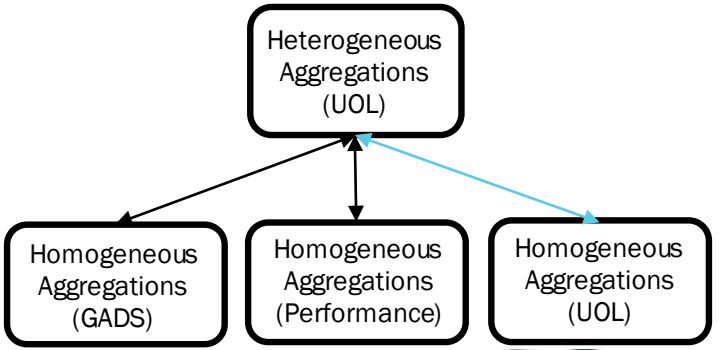
Aggregations – Calculating the Derating Factor for non-GADS Aggregations that Swap Resources

12-Month Average Availability, Month Ending:	Aggregation A Derating Factor	Aggregation B Derating Factor
July	83%	92%
August	80%	96%
September	83%	96%
October	83%	96%
November	73%	96%
December	83%	80%
Summer Capability Period	**81%**	**93%**
January	83%	80%
February	83%	96%
March	80%	98%
April	83%	96%
May	83%	96%
June	83%	96%
Winter Capability Period	**83%**	**94%**

- **The following example describes the process for a DER that is switching Aggregations:**
  - Between two like participation models that use either the UOL calculation or a performance metric to measure their derating factor, excluding SCR Aggregations
  - Between a heterogeneous DER Aggregation and a homogeneous UOL participation model



Aggregations – Calculating the Derating Factor for non-GADS Aggregations that Swap Resources

- For example, a 10 MW DER swapped from Aggregation A to Aggregation B
  - The availability of both Aggregations is immediately affected by the DER switch
    - Aggregation A's total UCAP will decrease by the amount of UCAP held by that DER; Aggregation A's derating factor will be measured on this new UCAP
    - Aggregation B does not know the monthly derating factors that make up the DER's derating factor; Aggregation B will only know how much UCAP the new DER can sell

Aggregations – Calculating the Derating Factor for non-GADS Aggregations that Swap Resources

	Aggregation A	Aggregation B						
		Agg. B prior to New Asset		New Asset		Total Agg. B with New Asset		
12-Month Average Availability, Month Ending:	Availability Factor	ICAP	UCAP	ICAP	UCAP	ICAP	UCAP	Availability Factor
July	83%	50	46	10	8.3	60	54.3	91%
August	80%	50	48	10	8.0	60	56.0	93%
September	83%	50	48	10	8.3	60	56.3	94%
October	83%	50	48	10	8.3	60	56.3	94%
November	73%	50	48	10	7.3	60	55.3	92%
December	83%	50	40	10	8.3	60	48.3	81%
Summer Capability Period	**81%**					**60**	**54.4**	**91%**
January	83%	50	40	10	8.3	60	48.3	81%
February	83%	50	48	10	8.3	60	56.3	94%
March	80%	50	48	10	8.0	60	56.0	93%
April	83%	50	48	10	8.3	60	56.3	94%
May	83%	50	48	10	8.3	60	56.3	94%
June	83%	50	48	10	8.3	60	56.3	94%
Winter Capability Period	**83%**					**60**	**54.9**	**92%**

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- 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

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