Expanding Capacity Eligibility

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Agenda

- Periodic Review of Capacity Value Study
- Wind and Solar Analysis
- RoR Hydro Analysis
- LOLE Analysis
- Program Comparisons (ELR, DER, ESR)
- Appendix

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Purpose of Today's Discussion

- **Respond to stakeholder questions and requests**
  - Provide more detail on proposed Capacity Value Study review process
  - Provide the analysis for the wind, solar, and RoR hydro
  - Provide the analysis of the Loss of Load Expectation
  - Comparison of Bid, Schedule, Notify and Derating Factor calculations for ELR, DER, and ESR

Periodic Review of Capacity Value Study

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Periodic Review of Capacity Value Study

- **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 accurately reflects the actual system changes over time and sends the right investment signals to the developers
  - The recurring Capacity Value Study will be conducted the year Demand Curve Reset process begins (e.g., 2023, 2027, 2031, etc.)
    - This proposed timeline attempts to balance market certainty (and investment signals) with forecasting capacity values
  - The next Capacity Value Study will occur in 2023, with results implemented in 2025

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Capacity Value Study Timeline

- **Capacity Value Study Process for 2023 study year:**
  - Q3-Q4 2022: Issue RFP for a consultant to perform Capacity Value Study:
    - Consultant will study the following:
      - re-evaluate the Capacity Value of 2, 4, 6, and 8 hour duration resources
      - re-evaluate the peak load hours that Capacity Suppliers with duration limitations are required to bid for; this evaluation will be taken in conjunction with the input of System Operations to establish the peak load hours
      - evaluate and recommend if the hour durations that resources are classified as should be revised through a future stakeholder process
    - Consultant will use the assumptions, loads, and resources that are available in the IRM that will be effective for 2023
  - 9/1/2022: NYISO posts schedule of Capacity Value Study process
  - 11/15/2022: NYISO signs contract with consultant to perform study

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Capacity Value Study Timeline (cont.)

- **Capacity Value Study Process for 2023 study year:**
  - January - February 2023: Consultant provides stakeholder presentations on Capacity Value study approach, assumptions, and methodology
  - March - April 2023: Consultant provides stakeholder presentations on Capacity Value study result and draft report
  - May 2023: Consultant provides final report on Capacity Value study result and NYISO provides draft report/proposal

Capacity Value Study Timeline (cont.)

- **Capacity Value Study Process for 2023 study year:**
  - June 2023: NYISO provides final report of Capacity Values
  - 9/1/2023: Compliance filing with FERC with updated Capacity Values for 2, 4, 6, and 8 hour durations, and peak load hours
  - 2024: If necessary, stakeholder process to evaluate changes to durations to include other hourly options

Wind and Solar Analysis

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Wind and Solar Performance Factors

- **The NYISO conducted analysis to determine the derating factor impacts of increasing the performance window from 4 to 8 hours for intermittent (e.g. wind and solar) resources**
  - The analysis used performance data from the last 5 Capability Periods to calculate the performance factors for the resource types
  - Performance factors for Summer and Winter Capability Periods were calculated based on the like Capability Periods

Wind Performance Factor

- **The NYISO calculated the performance factor for wind resources the existing 4 hour performance window and proposed 8 hour window for each Capability Period**
  - Summer: 4 hour window (HB 14-17), 8 hour window (HB 12-19)
  - Winter: 4 hour winter (HB 16-19), 8 hour window (HB 14-21)

	Performance Factor (%)		Delta (%)
	4 hour	8 hour	4 to 8 hours
Summer Capability Periods 2013-2017	17.7	17.0	(0.7)
Winter Capability Periods 2013-2017	34.9	35.4	0.5

Solar Performance Factor

- **The NYISO calculated the performance factor for solar resources the existing 4 hour performance window and proposed 8 hour window for each Capability Period**
  - Summer: 4 hour window (HB 14-17), 8 hour window (HB 12-19)
  - Winter: 4 hour winter (HB 16-19), 8 hour window (HB 14-21)
- **Due to the limited number of solar resources, the exact performance factors for 4 and 8 hours could not be included in this presentation**

	Performance Factor Delta (%)
Summer Capability Periods 2012-2016	(6.1)
Winter Capability Periods 2012-2016	5.8

RoR Hydro Analysis

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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 (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

Run of River Hydro (cont.)

- **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%

LOLE Analysis

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LOLE Analysis

- **The NYISO conducted an analysis to determine which hours of the day have the highest probability of experiencing a Loss of Load Event**
  - The analysis used data from the GE Capacity Value Study for the Summer Capability Period
    - Both the Base Case and High Wind High Solar cases were analyzed

LOLE Analysis

Base Case	
Hour of Day	Expected Number of Occurrences
10	0.3023
11	0.1274
12	2.1612
13	9.2498
14	31.5375
15	79.9591
16	142.1838
17	179.3231
18	179.1465
19	97.2627
20	28.1731
21	7.1231
22	1.7977
23	1.6282
24	0.0606

High Wind High Solar	
Hour of Day	Expected Number of Occurences
10	0.0606
11	0.0668
12	1.4690
13	6.3876
14	24.4235
15	63.9293
16	121.9317
17	174.2329
18	200.0180
19	125.0373
20	44.4244
21	17.6167
22	4.7127
23	1.8926
24	0.1212

- **Please note that the 'Hour of Day', as presented in the GE Capacity Value Study, includes hours 1-24, whereas the NYISO's proposal has been listing hours as 0-23**
  - For example, the analysis shows that for the Base Case hours 13-20 have the highest probability of a LOLE. This is the same window (HB 12-19) as proposed by the NYISO

Program Comparison

Program Comparison

- **The following slide compares the rules for different programs applicable to Capacity Suppliers with duration limitations (i.e. ELR, DER, ESR)**
  - The comparison is specific to the resource's Bid, Schedule, Notify obligation and derating factor implications

Program Comparison (cont.)

	Bid, Schedule, Notify Obligation	Derating Factor measurement	Derating Factor Calculation
ELR	B/S/N to inject in DAM for consecutive number of hours during the Peak Load Window that correspond to duration requirement	Measured over the hours that the resource is expected to operate for (i.e. the number of hours that correspond to duration)	Applicable to technology type (e.g. EFORd for hydro)
DER	B/S/N in DAM for consecutive number of hours during the Peak Load Window that correspond to duration requirement	Measured over the hours that the resource is expected to operate for (i.e. the number of hours that correspond to duration)	UOL availability calculation
ESR	B/S/N in DAM for entire Peak Load Window as ISO-Managed	Measured over the entire Peak Load Window	UOL availability calculation

Next steps:

Future ICAPWG for continued discussions

Feedback/Questions?

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Appendix

SCR 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 intent of this analysis was to make sure that the NYISO targeted the appropriate Capacity Value Study cases
  - This analysis confirms that 8 hour duration is sufficient for a full capacity payment

System Operations Analysis using SCRs

- 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

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

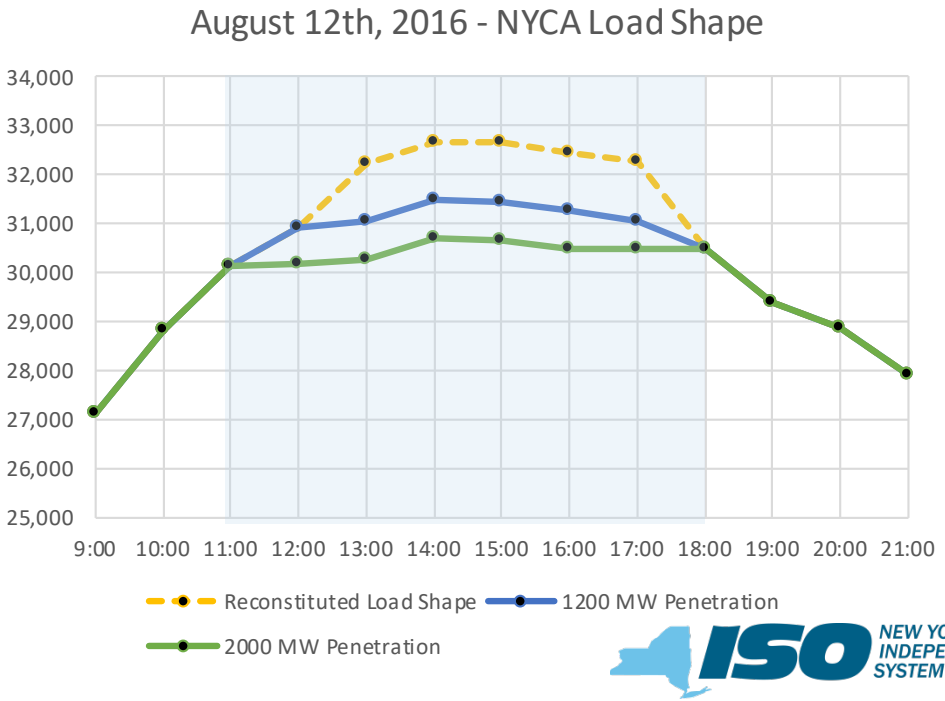
Table 2: Expected duration of SCR calls

	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)

SCR Analysis (cont.)

- 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 (cont.)

- 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

Peak Load Window

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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%*

B/S/N and Derating Factors

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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

Derating Factor – ELR

- **The derating factor calculation for ELRs 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)

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

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 full 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 full 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 requirement:
    - 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 as 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 requirement if the resource is dispatched in real time

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		

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- Planning the power system for the future
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