New York ISO
Independent System Operator

Capacity Accreditation: Current Rules

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August 5, 2021

Agenda

- Background
- Derating Factors
- Capacity Value Study
- Reliability Council Work

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Background

Acronyms

- IPR – Intermittent Power Resource
- EDL – Energy Duration Limitation
- DAF – Duration Adjustment Factor
- PLW – Peak Load Window
- ESR – Energy Storage Resource
- ECE – Expanding Capacity Eligibility
- TAM – Tailored Availability Metric
- IRM – Installed Reserve Margin
- LCR – Locational Capacity Requirement

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Reference Documents

- NYISO ICAP Manual: https://www.nyiso.com/documents/20142/2923301/icap_mnl.pdf/234db95c-9a91-66fe-7306-2900ef905338
- NYISO ICAP Manual Attachments: https://www.nyiso.com/documents/20142/2923635/app_a_attach_icapmnl.pdf/503354b6-0607-9a12-f2d4-f866c25eac65

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Background

- **The resource mix is evolving and the NYISO's markets need to continue to accurately value resources for the attributes they provide in meeting system reliability**
  - Specifically for the Installed Capacity (ICAP) Market, a review of how reliability contributions are valued in the market is needed
  - Currently, resources receive payment for their UCAP value, which is generally based on their historic availability or performance that is used to approximate the resource's reliability value
  - These resource reliability values are then used to meet system resource adequacy requirements
- **Properly valuing each resource's contribution to reliability is vital to ensuring an efficient and well functioning ICAP Market that supports reliability**
  - As the resource mix evolves to include more intermittent and energy duration limited resources the reliability contribution of all resources can change over time
  - The reliability contribution of specific resources will become more dependent on the characteristics of the overall resource mix

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Background

- **This presentation will review the current capacity accreditation concepts in use by the ICAP Market, such as:**
  - How a resource determines it's Available ICAP, Adjusted ICAP, and UCAP values
  - How resource-specific derating factors are calculated
  - How these concepts work together to maintain a reliable system through the ICAP Market and resource adequacy constructs
- **This presentation is not intended to propose new concepts related to capacity accreditation**

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Background

- **ICAP Suppliers are assigned an Available ICAP value generally calculated as the lesser of their Demonstrated Max Net Capability (DMNC) and Capacity Resource Interconnection Service (CRIS)**
  - Available ICAP = min(DMNC, CRIS)
  - DMNC testing requirements are resource specific
    - Most resources are required to perform a maximum capability test each Capability Season
    - Other resources use their nameplate MW value in lieu of a capability test
  - CRIS is awarded to a resource during the Interconnection process upon entering the market

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Background

- **Duration Adjustment Factors (DAFs) are used to value capacity resources based on the incremental reliability benefit that the resource provides to system resource adequacy**
  - DAFs are used to account for the capacity value of a resource with an Energy Duration Limitation (EDL) as compared to a 24hr capacity supplier
    - Adjusted ICAP = Available ICAP * DAF
    - Resources without an EDL use a DAF of 100%
  - Any resource with a limited run-time that satisfies the EDL requirements may qualify to participate as an Installed Capacity Supplier

	Incremental Penetration of Resources with EDLs	
	Less than 1000 MW	1000 MW and greater
Energy Duration Limitation (hours)	Duration Adjustment Factor (%)	Duration Adjustment Factor (%)
2	45	37.5
4	90	75
6	100	90
8	100	100

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Background

- **For each resource, Adjusted ICAP is then converted to Unforced Capacity (UCAP) each Capability Period**
  - UCAP accounts for the historic availability or performance of the unit, which is reflected in the resource-specific derating factor calculation
  - UCAP = Adjusted ICAP x (1 – derating factor)
  - UCAP is the commodity traded in the ICAP Market auctions and is used to meet system resource adequacy requirements
- **Depending on the resource type, derating factors are a function of one or more of the following:**
  - Forced outages
  - Forced derates
  - Actual performance

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Background

- **Derating factor calculations measure the availability or performance of a specific resource**
  - They do not consider how the reliability contribution of a resource may be affected by other resources
  - As the resource mix changes, the reliability of the system as a whole is an important aspect to consider when evaluating the reliability of a specific resource
- **For resources with Energy Duration Limitations, DAFs are used to account for the technology type's incremental contribution to system reliability**
- **Taken together, the resource-specific derating factor and the DAF account for the capacity accreditation of a resource's Available ICAP**
  - A resource's capacity accreditation is used both for ICAP Market payments as well as towards meeting ICAP Requirements

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Background

- The respective 6 and 8-hour Peak Load Windows (PLW) for both the Summer and Winter Capability Periods capture the hours with the highest risk of reliability events
- The appropriate PLWs are applicable to Intermittent Power Resources (IPRs) and resources with Energy Duration Limitations
  - Resources subject to the PLW are evaluated for availability or performance only during those hours

6- hour Peak Load Window	
Summer Capability Period	Winter Capability Period
HB 13 through HB 18	HB 16 through HB 21

8- hour Peak Load Window	
Summer Capability Period	Winter Capability Period
HB 12 through HB 19	HB 14 through HB 21

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Derating Factors

Conventional Generators

- **The current derating factor for most conventional (i.e., thermal) capacity resources uses an Equivalent Demand Forced Outage Rate (EFORd) calculated as an average from two 6-month period EFORds**
  - EFORd evaluates the portion of time a unit is in demand but is unavailable due to forced outages
  - The EFORd is calculated based on submitted GADS
    - Most generators submit their operating data, including failed starts, forced outages, service hours, *etc.*
- **The Average EFORd (AEFORd) of a Resource is calculated based on the average of the two previous like-Capability Period EFORds**
  - For example, the Summer 2020 AEFORd value is calculated by taking the average of the 2019 Summer Capability Period EFORd and the 2018 Summer Capability Period EFORd
  - Refer to Section 4.5 of the ICAP Manual and Section 3.1 of Attachment J for further details

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Conventional Generators

- Available ICAP = Minimum (CRIS, DMNC)
- Adjusted ICAP = Available ICAP * Duration Adjustment Factor
- UCAP = Adjusted ICAP * (1 – AEFORd)
  - Where:
    - The AEFORd is the average of the previous two like-Capability Period EFORds
    - The Duration Adjustment Factor is 100%, as conventional generators can't have a duration limitation

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Energy Storage Resources

- **Similar to conventional generators, the current derating factor for Energy Storage Resources (ESRs) uses an Unavailability Factor calculated as an average of the previous two like-Capability Period Unavailability Factors**
  - ESRs are eligible to elect an Energy Duration Limitation
    - For ESR that elect an EDL, the measurement window for the Unavailability Calculation corresponds to the PLW
    - For ESRs that do not elect an EDL, the measurement window is 24 hours
- **The ESR Unavailability Factor calculation evaluates several different parameters over the measurement period**
  - All ESRs are evaluated for their Upper Operating Limit (UOL), Storage Availability, and Energy Level Availability for all Interval Seconds used in the calculation
  - For ESRs without an EDL, the Lower Operating Limit (LOL) is also evaluated
    - Resources with an EDL must submit bids to charge during hours outside of the PLW
  - Refer to Section 4.5 of the ICAP Manual and Section 3.7 of Attachment J to the ICAP Manual for more details

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Energy Storage Resources

- Available ICAP = Minimum (CRIS, DMNC)
- Adjusted ICAP = Available ICAP * Duration Adjustment Factor
- UCAP= Adjusted ICAP * (1 – Average Unavailability Factor)
  - Where:
    - The Average Unavailability Factor is the average of the two previous like-Capability Period Unavailability Factors
    - The Duration Adjustment Factor is dependent on the Energy Duration Limitation elected
      - If no EDL is elected, the Duration Adjustment Factor is 100%

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Intermittent Power Resources Performance Factors

- **Performance factors for Intermittent Power Resources are based on actual performance over a specified peak period, and are calculated by dividing the output performance by the nameplate capacity of the resource**
  - IPRs include wind, solar, and landfill gas resources
- **Current rules for IPR performance factors weight the hourly production data across the 6 or 8-hour Peak Load Window, and are calculated based off of data from the respective peak months of the previous like-Capability Period**
  - Summer Peak Months: June, July, and August
  - Winter Peak Months: December, January, and February
  - Refer to Section 4.5 of the ICAP Manual and Section 3.4 of Attachment J to the ICAP Manual for further details

	Summer Peak Load Window		Winter Peak Load Window	
HB	6 Hour	8 Hour	6 Hour	8 Hour
12		5.0%		
13	12.5%	10.0%		
14	18.75%	17.5%		5.00%
15	18.75%	17.5%		5.00%
16	18.75%	17.5%	18.75%	17.50%
17	18.75%	17.5%	18.75%	17.50%
18	12.5%	10.0%	18.75%	17.50%
19		5.0%	18.75%	17.50%
20			12.5%	10.0%
21			12.5%	10.0%
Top 4 Hours	75%	70%	75%	70%

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Intermittent Power Resources

- Available ICAP = Minimum (CRIS, Nameplate Capacity)
- Adjusted ICAP = Available ICAP * Duration Adjustment Factor
- UCAP = Adjusted ICAP * Applicable Production Factor
  - Where:
    - The applicable production factor is the sum of the hourly weighted production data divided by the nameplate capacity (see Attachment J of the ICAP Manual)
    - The Duration Adjustment Factor is 100%, as IPRs can't have a duration limitation

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Special Case Resources

- **The current performance factor for performance-based ICAP Suppliers is based on actual performance over peak periods**
  - The UCAP MW from Special Case Resource (SCR) aggregations is generally based on actual performance of individual SCR facilities within the aggregation during events and tests
    - Performance from the Prior Equivalent Capability Period and the Capability Period preceding the Prior Equivalent Capability Period are used
    - For mandatory events longer than 4 hours, the best 4 consecutive hours are used; mandatory events less than or equal to 4 hours use all hours
    - All resources are required to perform a 1-hour performance test
  - Performance factors are calculated using data from both mandatory events and required performance tests
  - All SCRs are considered to have a 4 hour EDL and use the corresponding DAF to calculate their Adjusted ICAP
  - Refer to Section 4.5 of the ICAP Manual for more details

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Special Case Resources

- Available ICAP = Declared Value * (1 + Transmission Loss Factor)
- Adjusted ICAP = Available ICAP * Duration Adjustment Factor
- UCAP = Adjusted ICAP * Applicable Performance Factor
  - Where:
    - The Duration Adjustment Factor is the applicable percentage for the 4-hour EDL

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Limited Control ROR Hydro

- **The current UCAP calculation for Limited Control ROR Hydro units uses a rolling average of the hourly net energy provided by the resource**
  - Values are calculated separately for both Summer and Winter Capability Periods
  - Data looks at the 20 highest NYCA real-time peak load hours in each of the previous 5 Summer or Winter Capability Periods (for a total of 100 hours)
  - Performance factors are calculated to translate the ICAP of a Limited Control ROR Hydro to the appropriate UCAP value
  - Refer to Section 4.5 of the ICAP Manual for more details

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Limited Control ROR Hydro

- Available ICAP = Minimum (CRIS, Nameplate Capacity)
- Adjusted ICAP = Available ICAP * Duration Adjustment Factor
- UCAP = Rolling average of the net energy provided by the resource during the top load 20 hours of the previous 5 like-Capability Periods
  - Where:
    - The Duration Adjustment Factor is 100%, as Limited Control ROR Hydro can't have a duration limitation

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Energy Limited Resources

- **Energy Limited Resources (ELRs) are capacity resources that, due to environmental restrictions, cyclical requirements, or other non-economic reasons, are unable to operate continuously on a daily basis**
  - These operating restrictions must be justified to the NYISO upon registration
  - ELRs must elect an EDL of at least four hours
  - These resources are not subject to the rules of Energy Storage Resources
- **The derating factor calculation for ELRs is based on actual availability during the PLW for the hours that correspond to its elected EDL**
  - ELR resources use an EFORd calculation
  - Additionally, the calculation uses data from the previous two like-Capability Periods
  - Refer to Section 4.5 of the ICAP Manual for more details

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Energy Limited Resources

- Available ICAP = Minimum (CRIS, DMNC)
- Adjusted ICAP = Available ICAP * Duration Adjustment Factor
- UCAP= Adjusted ICAP * (1 – AEFORd)
  - Where:
    - The AEFORd is the average of the previous two like-Capability Period EFORds over the applicable PLW
    - The Duration Adjustment Factor is dependent on the Energy Duration Limitation elected
      - ELRs must elect a duration of at least 4 hours

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Externals and UDRs

- **External Installed Capacity Suppliers may participate in the NYISO's ICAP Market, subject to deliverability to the New York Control Area (NYCA) border and availability of Import Rights**
  - At present, IPR, ESR, Limited Control Run-of-River (ROR) Hydro and resources with EDLs are unable to qualify as external capacity suppliers
  - Resources that do qualify as external capacity suppliers will use the derating factor methodology that corresponds to their technology type
- **Alternatively, external capacity suppliers may deliver their capacity using External Unforced Capacity Deliverability Rights (External UDRs)**
  - External UDRs are controllable lines that originate outside of the NYCA and sink into a constrained Locality
  - External UDRs are considered supply resources as the controllable line must be backed by a specific, identified generation resource
  - The derating factor calculation for External UDRs reflects the ICAP of the controllable line, the availability of the resource supplying energy over the External UDR, the outage rate of the External UDR, as well as energy losses over the line
  - Refer to Section 4.5 of the ICAP Manual and Section 3.5 of the ICAP Manual for more details on the UDR derating factor calculation

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Externals and UDRs

- **Available ICAP = Minimum (CRIS, DMNC)**
- **UCAP = (Available ICAP – Line Losses) * (1 – weighted average of EFORds) * (1 – Cable Outage Rate) * Duration Adjustment Factor**
  - Where:
    - The weighted average of EFORds is calculated for the Resources used to supply ICAP over the UDR facility
    - The cable outage rate includes the cable and converter station unavilability

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Capacity Value Study

Expanding Capacity Eligibility

- **Expanding Capacity Eligibility (ECE) was a substantial effort included as part of the Distributed Energy Resources (DER) market design in 2018 that:**
  - Established rules for resources with Energy Duration Limitations to participate as ICAP Suppliers;
  - Established the Peak Load Window;
  - Established the recurring Capacity Value study, to re-examine the reliability contribution of resources with EDLs and the hours of the Peak Load Window

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Capacity Value Study

- **The Capacity Value study, initially performed by GE, analyzed the reliability value of resources with EDLs**
  - The study began at a target reliability level of 0.1 Loss of Load Expectation (LOLE) and ICAP MW at the prescribed level of excess
  - A resource with an EDL was added, and as a result, reliability improves
  - Perfect capacity was then removed from all hours of the study until reliability returns to the target 0.1 LOLE
- **Capacity Value is the ratio of perfect capacity that can be removed to the amount of EDL capacity added once system reliability is returned to the target level of 0.1 LOLE**

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Capacity Value Study

- **The study sought to analyze the incremental reliability value of resources with EDLs under varying conditions**
  - The goal of the study was to understand the capacity value of a resource with an EDL as compared to a 24hr capacity supplier
  - Resources with many different duration limitations and penetration levels were studied under several scenarios and the results were thoroughly vetted by stakeholders
  - As a result, the NYISO adopted the Energy Duration Limitations and Duration Adjustment Factors currently in use today
  - The DAFs used are dependent on the amount of resources with duration limitations participating in the ICAP market
    - When the system reaches 1,000 MW of duration limited resources, the DAFs will shift

	Incremental Penetration of Resources with EDLs	
	Less than 1000 MW	1000 MW and greater
Energy Duration Limitation (hours)	Duration Adjustment Factor (%)	Duration Adjustment Factor (%)
2	45	37.5
4	90	75
6	100	90
8	100	100

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Capacity Value Study

- **The previous Capacity Value study was the NYISO's first attempt at calculating the incremental reliability value of resources with Energy Duration Limitations**
  - This study demonstrated that the reliability contribution of some resources is dependent on the resource mix
  - The study was planned to recur every four years, ending prior to the subsequent ICAP Demand Curve reset

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Peak Load Window

- **The Peak Load Window was initially established as part of ECE to identify a specific period of time when resources with EDLs are required to be available**
  - Because these resources have energy duration limitations, they are not required to be available 24 hours a day
  - The hours of the PLW are established as part of the Capacity Value study, which evaluates which hours have the highest risk of reliability events
  - Resources with EDLs or those that use performance-based derating factors use the PLW to measure their availability or performance
    - This applies to all IPRs along with resources that have EDLs
    - Resources that do not have EDLs are evaluated over 24 hours
  - The duration of the PLW is dependent on resources with duration limitations
    - When the system reaches 1,000 MW of duration limited resources, the window shifts from 6 hours to 8 hours as the addition of resources with EDLs flattens the load profile and pushes the hours with the highest risk of a loss of load to outside of the 6 hour window

Tailored Availability Metric

- **As a part of the TAM project, the NYISO built on the PLW concept first established as part of ECE**
  - The PLW identified in the Capacity Value study is now also used as the measurement window to calculate the performance factors of IPRs
- **TAM resulted in hourly weightings across the Peak Load Window that were representative of the risk of reliability events**
  - The weightings were applied to the respective hourly production data in order to calculate the appropriate performance factor
- **In future years, weightings will be re-evaluated as part of the Capacity Value study**
  - Each study could reset the hours within the Peak Load Window and percentages based on the percentages for the Capacity Value study

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Capacity Value and Tailored Availability Metric Study

- **As required by MST Section 5.12.14.3, beginning in 2022 and occurring every four years, the ISO must hire an independent consultant to perform a review of the Capacity Values. This periodic review shall:**
  - Re-evaluate the reliability benefit of resources with Energy Duration Limitations in meeting resource adequacy criteria for the four year period coinciding with the four Capability Years covered by the next Demand Curve Reset (2025-2029 DCR)
  - Identify the methodologies and data used to determine the Duration Adjustment Factors
  - Evaluate the appropriate Energy Duration Limitations
  - Re-evaluate the Duration Adjustment Factors for Resources with Energy Duration Limitations
  - Re-evaluate the Peak Load Window associated with the bidding requirement for Resources with Energy Duration Limitations, and
  - Re-evaluate the hourly weighting factors percentages during the Peak Load Window for Intermittent Power Resources

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Reliability Council Work

Resource Adequacy Studies

- **The NYISO and the New York State Reliability Council (NYSRC) share responsibility for maintaining reliability**
  - The NYSRC establishes the Installed Reserve Margin (IRM) for the NYCA
  - The NYISO performs Planning functions and establishes Locational Minimum Installed Capacity Requirements (LCRs) and ICAP Import Rights
- **The NYSRC Policy 5 provides the methods and assumptions used in the IRM study**
  - The IRM study process is open to the public via the NYSRC's Installed Capacity Subcommittee (ICS)
  - The NYSRC evaluates enhancements to the IRM study process each year via proposals to the ICS
  - The IRM study is conducted annually
- **Upon approval of the IRM in December, the NYISO conducts the LCR study**
  - The LCR study uses the IRM established by the NYSRC, the IRM database, and an economic optimization algorithm to establish LCRs
  - The LCR study is approved in January or February of the following calendar year
  - The IRM and LCRs are then used to administer the Capability Year that runs from May 1 through April 30 following the LCR approval

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The IRM and LCR models

- **The IRM and LCR databases currently represent intermittent resources, limited control run-of-river hydro resources, SCRs, resources with energy duration limits, other existing capacity suppliers (e.g., dispatchable resources), and firm imports (e.g., UDRs, External CRIS)**
- **Resources are modeled at their Available ICAP value, and their performance is determined as follows:**
  - Intermittent and RoR resources are modeled using historical production shapes from the most recent 5 years
  - SCRs are modeled consistent with their performance in the NYISO wholesale markets, a baseline adjustment factor, and limited to 5 calls per month
  - Resources with energy duration limits are modeled consistent with their operational capabilities (e.g., a 10 MWh battery is modeled as having 10 MWh of discharge capability and is dispatched to avoid loss of load events) and historical performance (EFORd) over the past 5 years
  - Dispatchable suppliers without energy duration limits are modeled based on historical performance (i.e., EFORd) over the past 5 years
  - Firm imports are modeled based on the historical performance of the resource backing the firm import
    - Firm imports from Quebec are treated as system backed resources with full performance
- **The NYSRC is exploring methods to model DERs, hybrid resources, and other emerging resource configurations as they begin to enter the market**

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Ongoing Enhancements to the IRM Setting Process

- **Enhanced modeling of energy duration limited resources in resource adequacy studies**
  - Operating limits create complex challenges in scheduling
- **Update load shape and load forecast uncertainty values**
  - Load forecast uncertainty update was approved in Q2 2021
  - NYISO is coordinating a review of the current load shapes to determine if a proposal to update the shapes is appropriate
- **Enhanced modeling of extreme weather events in scenarios and sensitivity analyses**

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Future Enhancements to the IRM Setting Process

- **2022-2023 Capacity Value study**
  - The Capacity Value study is separate from the IRM setting process but requires a significant amount of NYISO and stakeholder input and impacts future IRM models
- **Winter-only resources**
  - Determine a method of accounting for winter-only operation of peakers in the IRM, LCR, and Import Rights studies
- **CSR/Hybrid resources**
  - Build on energy duration limited resource modeling framework to accurately model reliability value of combined storage and generation resources

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

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

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Questions?