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ISO new england

Capacity Auction Reforms: Seasonal/Accreditation (CAR-SA)

Resource Accreditation Modeling- Impact Analysis (IA): preliminary results

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Key Topic Areas for Discussion

- Modeling recap and model overview
- Key input assumptions
- Near-Term Base Case
  - System demand parameters
  - Analysis of core reliability outputs
  - Accreditation values
- Future Base Case
  - System demand parameters
  - Accreditation values
- Additional analysis is provided in appendix

Impact Analysis Results – Caveats and Context

- All values presented today represent preliminary estimates of model outputs and outcomes conditional on the assumptions discussed and design as currently proposed; if they change, the ISO will share updates
- In preparing today's materials, the ISO spent considerable time trying to develop figures and tables that help explain the model results, with a particular focus on the hours/scenarios that have the largest impact on demand and resource MRI values, especially for the Near-Term Base Case
- The ISO plans to continue discussion of the gas constraint MRI curves in April, coincident with when the discussion of the gas design resumes
- Expects to bring more IA material in April, including additional analysis from the Near-Term Base Case and Future Case 1, and core results from Future Cases 2 and 3 and sensitivities

MODELING KEY CONCEPTS

MRI-Based Accreditation Framework and Hours

- Under the CAR-SA design, MRI-based accreditation reflects each resource's expected contribution to resource adequacy during the simulated hours when reliability is at risk, as determined in modeling that meets the NPCC resource adequacy criterion of 0.1 days per year LOLE
  - The ISO has initially proposed to develop seasonal accreditation values using a seasonal LOLE target that evenly divides the annual 0.1 LOLE criterion, combined with a uniform scaling factor applied to the seasonal demand curves to support cost-effective procurements
  - In response to stakeholder feedback, plan to evaluate the impact of an alternate 80/20 summer/winter risk split

- There are three-types of MRI hours:
  1. Hours with load shed
  2. Hours where energy limited resources are dispatched to prevent load shed
  3. Hours where energy storage resources are charging-constrained

Maximum Capability (MCap)

- MCap will account for a resource's size within the Marginal Reliability Impact Capacity (MRIC) calculation
- Values can be established during either declared audit windows, during periods where the regional (23-city average) temperature is above 80°F for summer or below 32°F for winter, or during a participant-submitted hour where the local site temperature was above 80°F or below 32°F
  - For resources with a registered temperature curve, summer and winter values will be normalized to 90° F and 20° F, respectively

Dependable Capability (DCap)

- DCap will account for expected availability during the seasonal peak load hours when resource adequacy risks are likely to occur
- For additional detail, please see:
  - Dependable Capability
  - Resource Deliverability Considerations
  - Alignment of DCap Sampling Hours with Resource Adequacy-Risk and Load Forecast
  - Follow-ups on MCap and DCap

Equivalent Forced Outage Rates on Demand (EFORd)

- EFORd will be calculated seasonally by using submitted GADS values for the months relevant to that season
- Resource EFORd values for each season will be calculated using the last 10 like seasons

Model Overview

- GE Vernova's (GE MARS) Resource Adequacy software is the primary tool used to perform resource adequacy assessments and to support the calculation of various Forward Capacity Market parameters, including the Installed Capacity Requirement (ICR) and related values, and system and capacity zone demand curves

- The ISO has provided a memo on enhancements to the software and three in depth trainings on the software functionality
  - Technical Session 1
  - Technical Session 2
  - Technical Session 3

RESOURCE MODELING OVERVIEWS

Thermal Resource Modeling

- Non-Energy Limited
  - Non-energy limited thermal resources' MRI values will be primarily determined by its size (MCap) and EFORd (outage rate)
  - Large resources may find some correlation with outage risks
- Energy Limited
  - Energy limited thermal resources' MRI values will be primarily determined by their size (MCap), EFORd (outage rate), and daily energy limit
  - Most oil, jet fuel, kerosene, or dual fuel resources will be modeled and accredited as non-energy limited thermal resources, as they are expected to have more than 24 hours of inventoried fuel. Resources with less than 24 hours of inventory will instead be modeled as energy-limited resources with a daily energy limit. The one exception is for the summer season, during which all dual-fuel resources are modeled as non-energy-limited thermal resources regardless of their on-site fuel inventory.
  - For dual-fuel resources that are modeled as energy-limited in the winter, their overall winter accreditation will be determined using the gas-only methodology. The portion of their accredited capacity associated with oil, calculated from the energy-limited model, will be treated as firm, while the remaining portion (the difference between total accredited capacity and accredited oil capacity) will be subject to the gas market constraint
  - Energy limited resources will be dispatched from longest to shortest duration

Energy Storage Resource Modeling

- Energy storage resources' MRI values will be primarily determined by their size (MCap), EFORd (outage rate), maximum stored energy limit, maximum charging capability, and round-trip efficiency
- Energy storage resources will be dispatched from longest to shortest duration and charged from shortest to longest duration
- Some, but not all, simulated hours where energy storage resources are charging constrained can be MRI Hours

Intermittent Power Resources (IPR)

- All IPRs will be modeled using hourly profiles
  - Settlement-only IPR solar and hydro resources will be modeled in aggregate by load zone. Other IPRs will be modeled individually
  - Wind and solar will use simulated profiles, while run of River Hydro and other IPR (landfill gas, certain biogas-fueled resources) will use historical hourly production data for RAA modeling

Hybrid Resources

- Hybrid resources typically are comprised of storage with generation
  - The storage and generator components are modeled separately behind a shared constraint

Demand Response Resources

- Active Demand Capacity Resources (ADCR) accredited capacity values will be determined using hourly profiles that reflect their historical offered availability, historical performance during audit and dispatch, and MCap
- Passive Demand Resources (PDR) accredited capacity values for distributed generation (DG) assets will be determined using profiles from the fleet-wide production data of the same technology type from the latest historic year and their DCap values. PDRs' accredited capacity values for energy efficiency (EE) measures will be determined using the representative industrial profiles of underlying end use, and their respective demand reduction value

Imports

- Imports come from capacity suppliers located outside of New England that sell capacity into the region
- The process by which imports are modeled and accredited is still being assessed and discussed with stakeholders
- For the purpose of these IA results, imports are accredited based on their attributes
- The final IA will incorporate any updates to the modeling imports into its results

INSTALLED CAPACITY REQUIREMENTS (ICR)

ICR

- Net ICR is the minimum MW quantity of capacity required to meet Resource Adequacy criteria
- Net ICR will be determined for each season and used as anchor points for seasonal demand curves
  - Curves will be anchored to satisfy two conditions:
    1. when the system is at criteria in each season, the total annual capacity payments are equal to Net CONE
    2. the curves use a constant scaling factor to assign a constant cost of unserved energy between seasons
- Net ICR will be expressed in both physical (using MCap or DCap) and market terms (using MRIC)

IA PURPOSE & RESULTS INTERPRETATION

Purpose of the IA & Results Interpretation

- The RAM IA aims to use the RAA model outcomes generated based on a set of input assumptions to provide the region with directional information about the CAR design
- These IA results should not be interpreted as ISO predictions or forecasts of future model or market outcomes
- Modeling multiple cases will help stakeholders develop their own expectations about the potential impacts of CAR under a range of potential conditions

Limitations of the IA Modeling

- The IA uses assumptions about the resource mix, key input parameters associated with each resource, and the load forecast that are likely to be different under various and unknown future conditions or actual market behaviors

- The IA results are generally consistent with the design as it is proposed today, but may not reflect the final proposal for numerous reasons, including:
  - The potential for updates to the design based on continued ISO assessment and discussion with stakeholders
  - The translation of the proposal into production software may require further refinement of design elements

- For details of the precise assumptions and model inputs for the cases in this presentation, see Appendix A

- The data and outputs provided are shared in a summarized manner to comply with the information policy

NEAR-TERM BASE CASE: DEMAND OUTPUTS

Recap of Near-Term Base Case Resource Mix, Load, and Other Assumptions

- The near-term base case will use assumptions and inputs that are broadly consistent with potential system conditions that may be in place in the near term
  - CELT 2025 Load has been used, and the resource mix modeled in the RAA case for ARA 1 of CCP 18 with adjustments to exclude known retirements and include resources from 2025 interim qualification
    - Consistent with what ISO proposed in January and February
    - Additional detail can be found in Appendix A

Overview of Key Demand Parameters and Steps

In the following slides, we will walk through the changes to capacity demand in four steps:

1. Calculate NICR under both current rules and CAR in QC and MCap as the capacity measure (these values are established before the RAA model is run)

2. Walk through the key drivers that lead to changes in (summer) NICR when all capacity is measured in QC

3. Derive the capacity MRI curves for the current rules and CAR cases in terms of QC and MCap

4. For CAR case, convert the NICR values and capacity MRI curves to MRIC and explain the underlying logic behind this conversation

Overview of Key Demand Parameters

- As discussed in a February RC presentation, the introduction of capacity seasons and accreditation reforms necessitate changes to capacity demand
- These include changes to reflect that:
  - Capacity demand (as based on capacity's MRI value) will vary between seasons
  - The units in which capacity demand is specified in the auction need to be consistent with those used in accreditation to align the products being bought and sold
- These changes will be reflected in both the Net ICR values and the capacity demand curves (where both will be specified in seasonal MRIC, which is consistent with the accredited value of capacity resources)
- However, the many moving parts make it challenging to make an apples-to-apples comparison between current rules and CAR

Key Differences in Model Assumptions Between Current Rules and CAR

	Current Rules	CAR
1a. Load Modeling: Treatment of PDR	Gross load forecast	Net load forecast (net of PDRs)
1b. Load Modeling: Weather Years	Single load shape from one weather year	Multiple load shapes reflecting many weather years
2a. Resource Modeling: IPRs	IPRs modeled at constant QC value	Use of profiles to model IPRs
2b. Resource Modeling: Energy Limitations	No energy limitations modeled except batteries	Model energy limitations on some oil and storage resources
3. LOLE Target	Annual 0.1 LOLE criterion	Seasonal 0.05 LOLE criteria
4. Tie Benefits	Annual value based on summer conditions	Seasonal values

Additional detail on these differences provided in Appendix A

Step 1: Calculate NICR Under Current Rules and CAR in QC (and MCap)

	CAR-SA (Summer)		CAR-SA (Winter)		Current Rule (Annual)
	in MCap	in QC	in MCap	in QC	in QC
Net ICR (MW)	32,016	28,764	28,620	26,091	31,230
LOLE	0.05 days/season		0.05 days/season		0.1 days/year
LOLH	0.16 hours/season		0.28 hours/season		0.26 hours/year
EUE	147 MWh/season		324 MWh/season		230 MWh/season
50/50 Peak (MW)	25,124		21,101		27,781

Note: The 50/50 annual (summer) peak for the current-rule case is 2,657 MW higher than the CAR-SA case because the current rule treats Passive Demand Resources (PDR) as a supply resource, which is reconstituted back in the load forecast to avoid double-counting. CAR-SA reflects PDR in the net load instead

Key Observations Regarding NICR Values

- Summer load and NICR values are higher than winter values
- MCap values are higher than QC values for summer and winter reflecting, among other things, higher MCap values than QC values for IPRs
- When the system is at criteria, loss of load events tend to be longer and the EUE larger, on average, in the winter
- *Next*: Take a closer look at what is driving the differences in NICR between current rules and CAR (summer)

Step 2: Drivers Behind Net ICR Differences

- CAR-SA net ICR (QC and net-load based) of 28,764 MW is 521 MW higher than the current rule of 28,243 MW (converted to net-load based also in QC using the corresponding required reserve margin)
  - Additional detail provided in Appendix B
- Major drivers and respective directional impacts are summarized in the table below
  - Impacts from different drivers may not be additive

	Net ICR (QC MW)	Approximate Impact (QC MW)
Current Rule	28,243*	
Driver 1a: Load Modeling – Use of net load forecast (net of PDR)		-400
Driver 1b: Load Modeling – Use of multiple load shapes		+100
Driver 2a: Resource Modeling – Use of profiles to model IPRs		+150
Driver 2b: Resource Modeling – Some oil resources modeled using daily energy limited model, and PSH modeled using energy storage model		+150
Driver 3: LOLE Target – Use of 0.05 days/season LOLE		+400
CAR-SA	28,764	

*Current Rule NICR is lower here than on slide 25 to net out PDRs and therefore provide a like-for-like comparison

Unpacking These Drivers Further

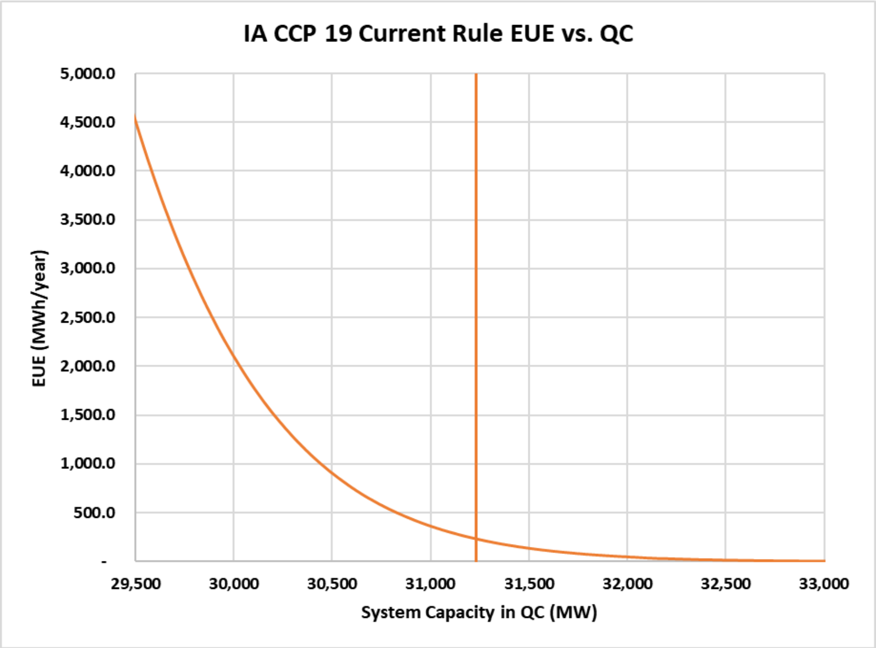
- Collectively, these changes result in a modest increase in the (summer) NICR, when measured on an apples-to-apples basis in QC
- Largely driven by resource modeling changes and the move from a 0.1 to 0.05 LOLE target
  - This means that with this increase in capacity procured, we are getting a more reliable system in the summer
- More generally, the modeling enhancements will allow the model outputs to be a more accurate representation of expected reliability outcomes
  - E.g., the model will determine LOLE and EUE values while accounting for factors such IPR profiles and resource energy limitations

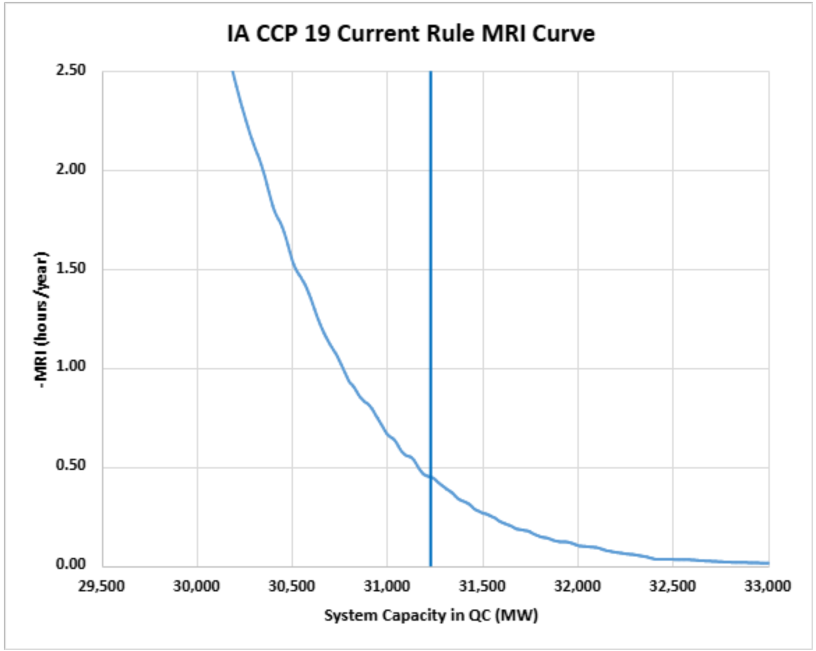
Step 3: Derive MRI-Based Demand Curves in Terms of QC and MCap

- In this step, we derive MRI values for capacity across a range of values
- This is done by calculating the EUE values at various capacity levels and then estimating the MRI value as the extent to which another increment of capacity would reduce EUE
- For the current rules, this is shown annually where capacity is measured in QC
- For CAR, this is shown seasonally where capacity is measured in MCap

Step 3: Derivation of EUE and MRI Values For Current Rules (in QC)

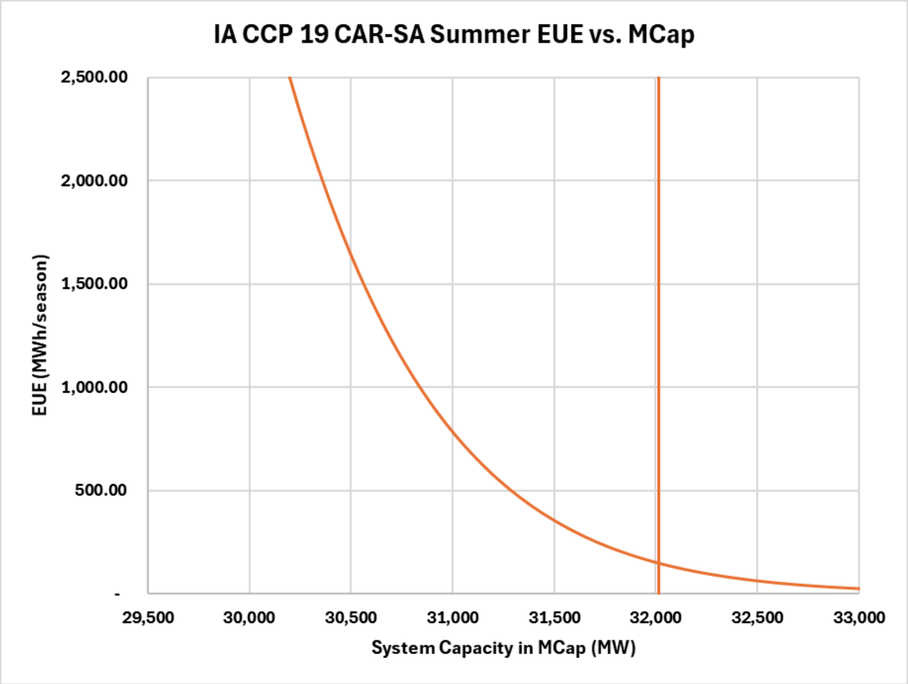
- The MRI at each capacity level is calculated as the reduction in system EUE resulting from adding one additional MW of system capacity. The MRI curve is effectively the derivative of the EUE vs. System Capacity curve

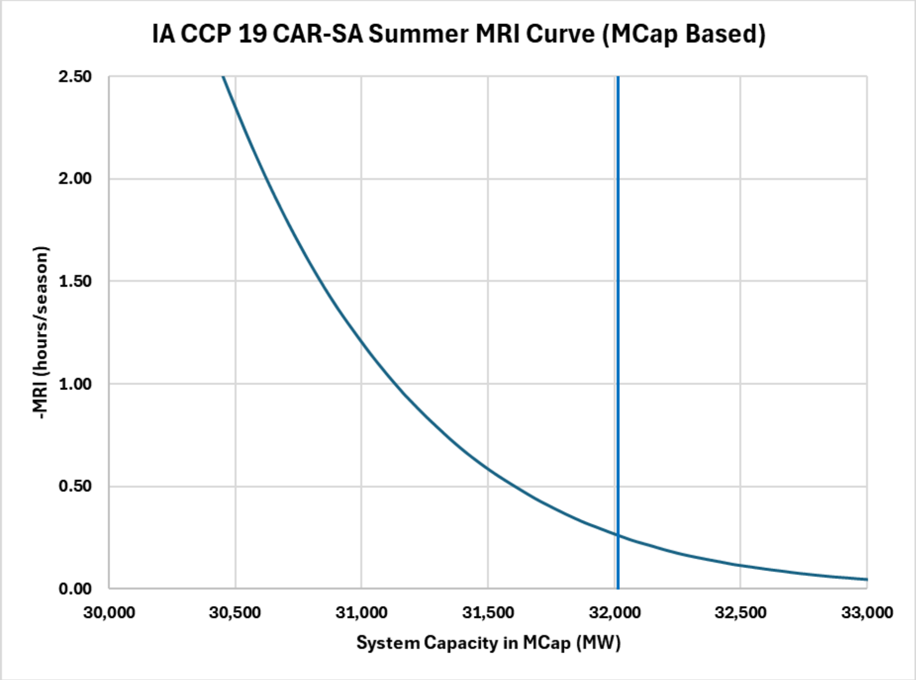




Step 3: Derivation of Summer EUE and MRI Values For CAR-SA (in MCap)

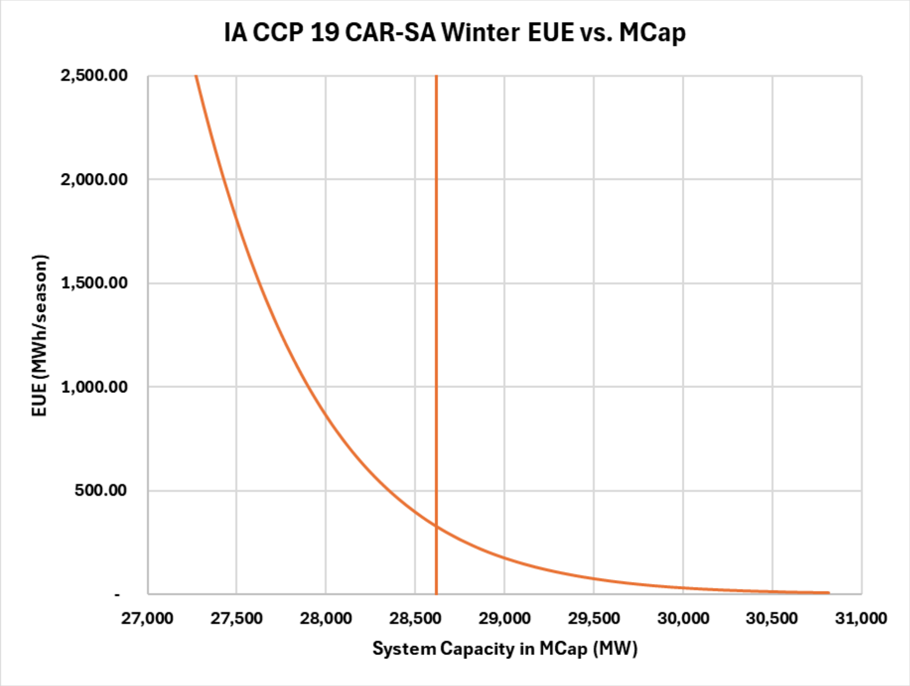
- The MRI curve is the derivative of the EUE vs. System Capacity curve

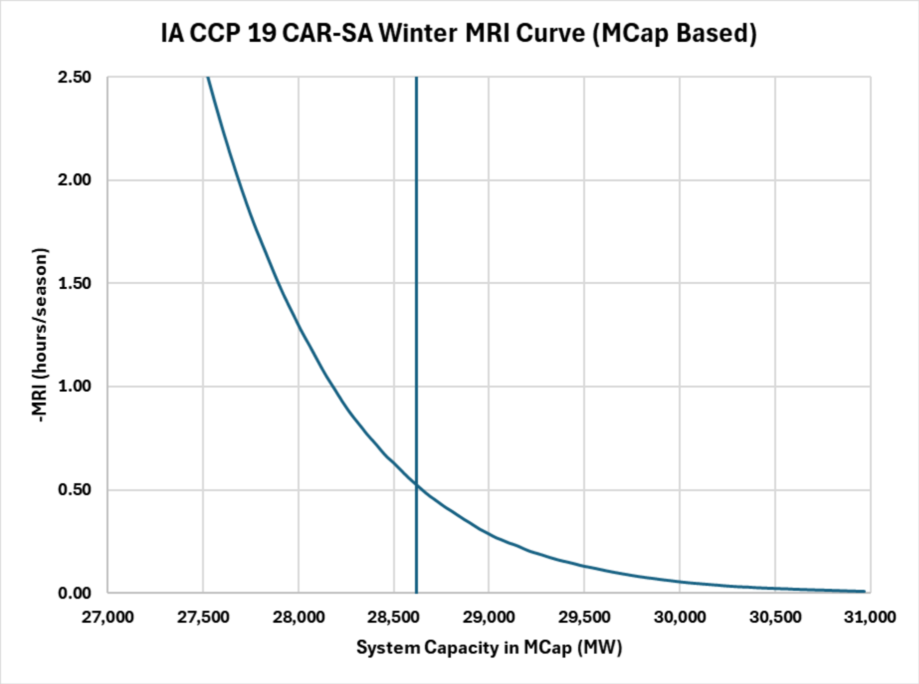




Step 3: Derivation of Winter EUE and MRI Values For CAR-SA (in MCap)

- The MRI curve is the derivative of the EUE vs. System Capacity curve





Step 4: Converting the CAR Demand Parameters to MRIC

- So far, the CAR capacity quantities have been discussed in the context of MCap for two reasons:
  - As a key input into the RAA model replacing QC, MCap also replaces QC's role throughout the processes used to calculate the ICR and related values
  - Represents the maximum capability of the resource mix, which may help to contextualize the numbers
- We will now convert the CAR demand parameters to MRIC
  - This step isn't necessary under the current QC framework, as QC is established before the model is run and also used for accreditation
- In CAR-SA, this step is important because capacity suppliers will offer capacity in MRIC, and we must therefore specify demand in the same units

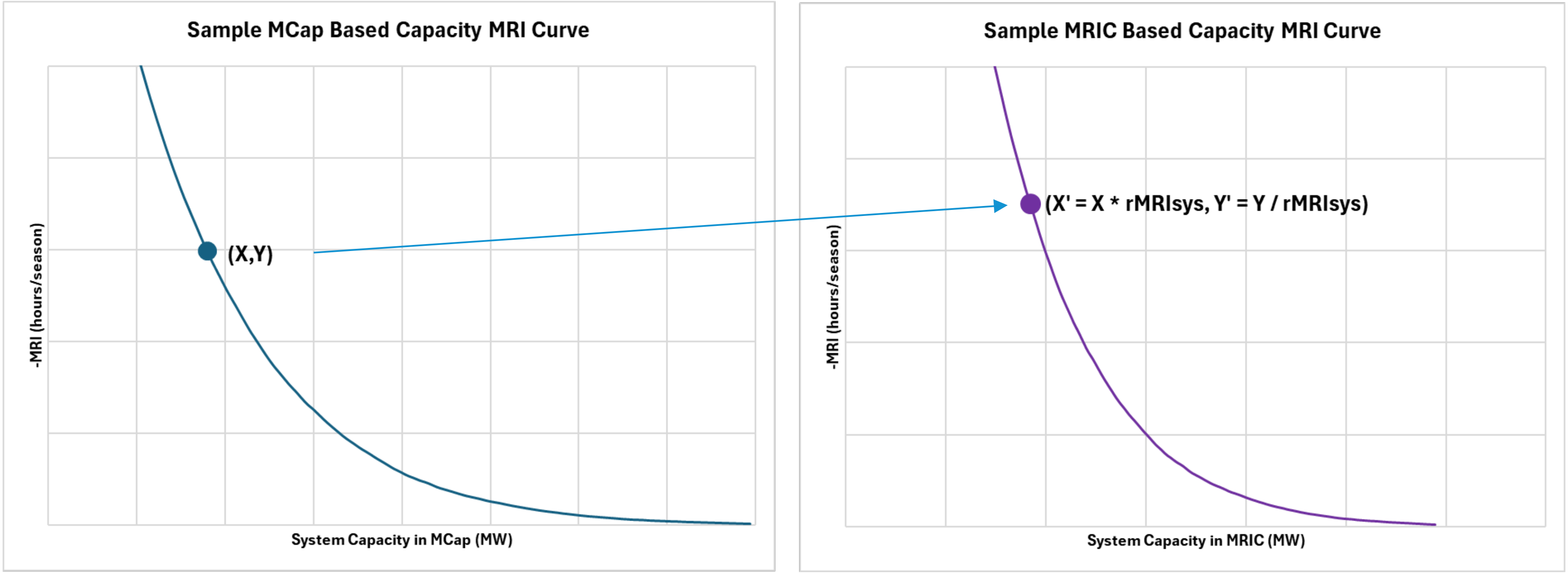
MCap to MRIC-Based NICR and MRI Demand Curve

- At the individual-resource level, MCap represents a resource's maximum supply capability, while MRIC represents its maximum accredited capability, calculated as the product of its MCap and its rMRI value
- Extending this logic to the system level, total system MCap reflects the system's aggregate maximum supply capacity, and total system MRIC reflects the system's total accredited capacity, which can be similarly expressed as total MCap multiplied by the system resource-weighted rMRI
- Intuition: Because MCap represents a resource's maximum supply capability whereas MRIC is a measure of expected performance during MRI hours, the system can achieve the same level of reliability with a lower quantity of MRIC than MCap

MCap to MRIC-Based NICR and MRI Demand Curve (cont.)

- When considering this translation in the context of the MRI demand curves, there is also a shift up in the MRI value to reflect that a MW of MRIC provides more reliability value than a MW of MCap
- This MRI increase is equal to the inverse of the system resource weighted rMRI value
- *Next*: Show how a point on an MCap demand curve shifts to represent a point on an MRIC demand curve

MCap to MRIC-Based NICR and MRI Demand Curve

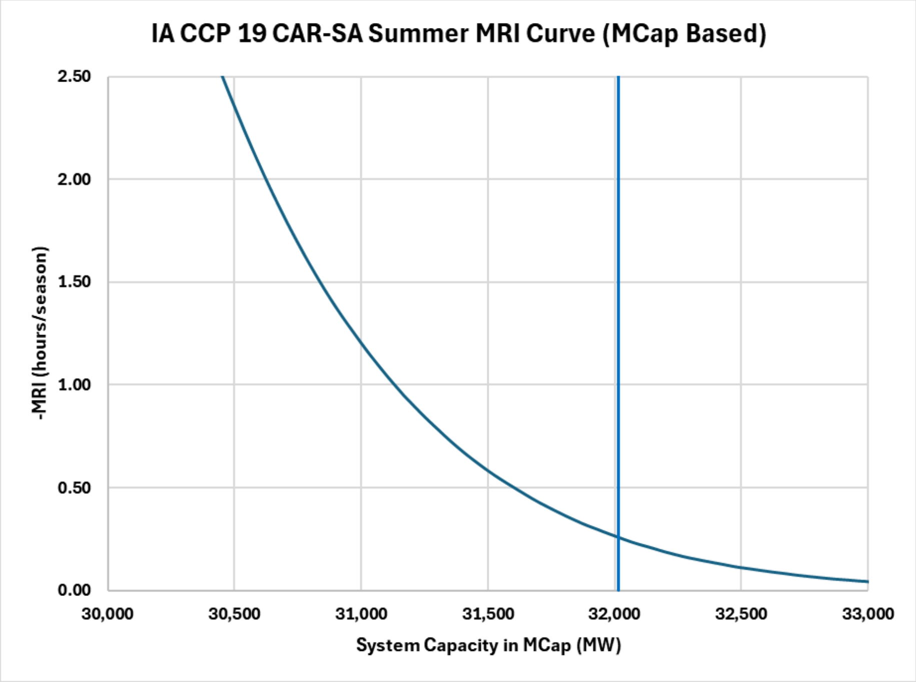


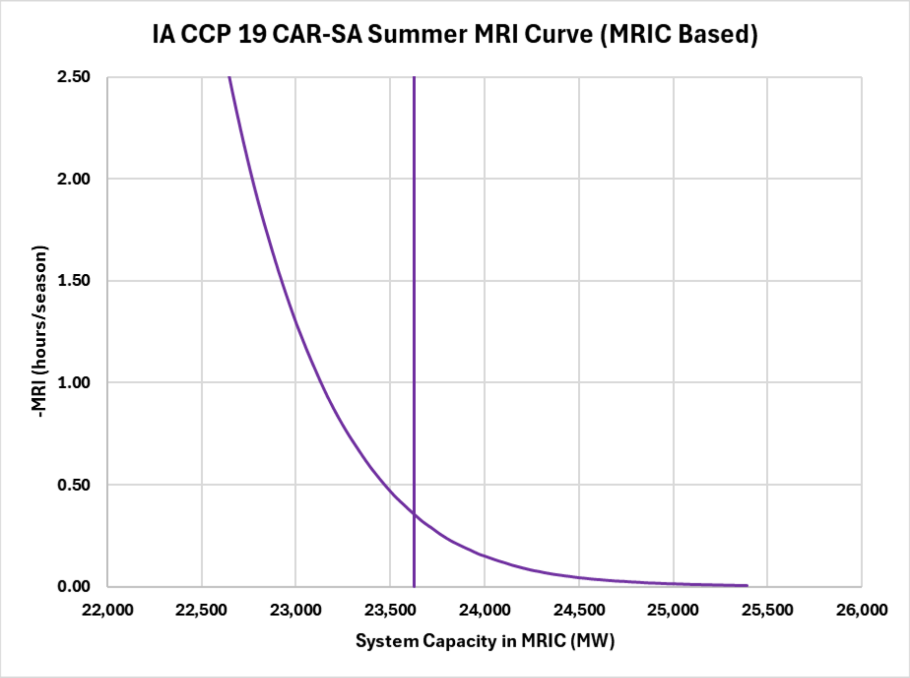
Applying This Translation to the CAR Demand Curves

- We now apply this translation to the NICR and CAR MRI demand curves presented previously to show these parameters in terms of MRIC for the summer and winter
- As the figures show, the NICR decreases to reflect that the system requires less MRIC than MCap to reliably operate the system
- Additionally, the MRI value at the NICR values increases to reflect the fact that when the system is at 0.05 LOLE, another MW of MRIC will provide more reliability value than another MW of MCap

Near-Term System-wide MRIC-based Capacity Demand Curve - CAR-SA (Summer)

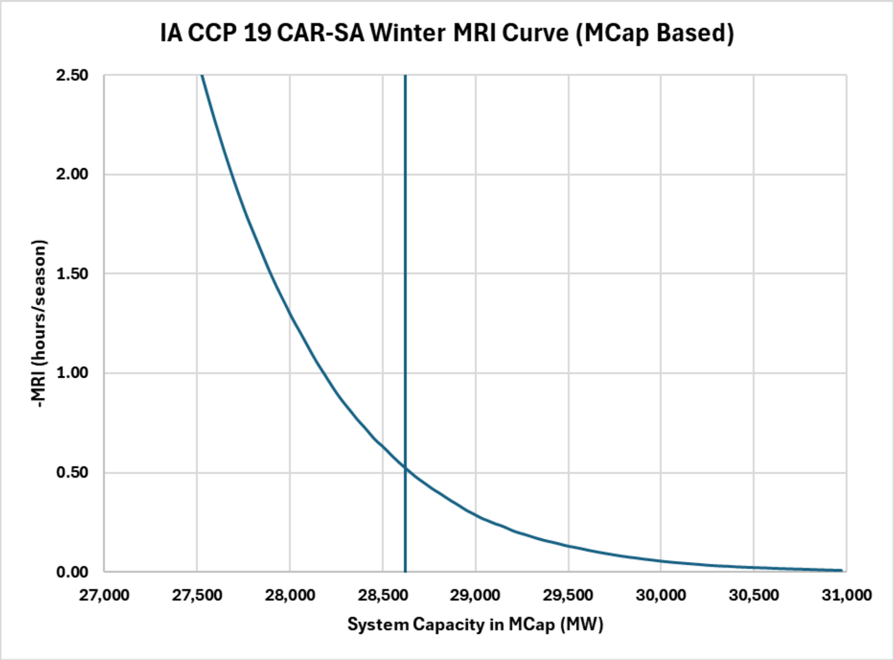
- MCap-based demand curve is transformed to MRIC-based demand curve using summer system resource weighted rMRI

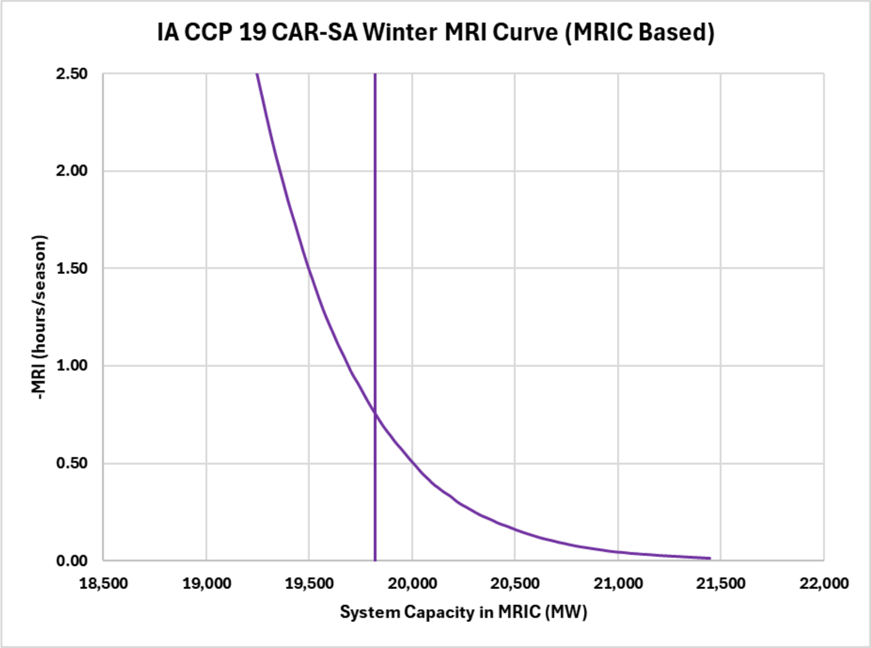




Near-Term System-wide MRIC-Based Capacity Demand Curve - CAR-SA (Winter)

- MCap-based demand curve is transformed to MRIC-based demand curve using winter system resource weighted rMRI



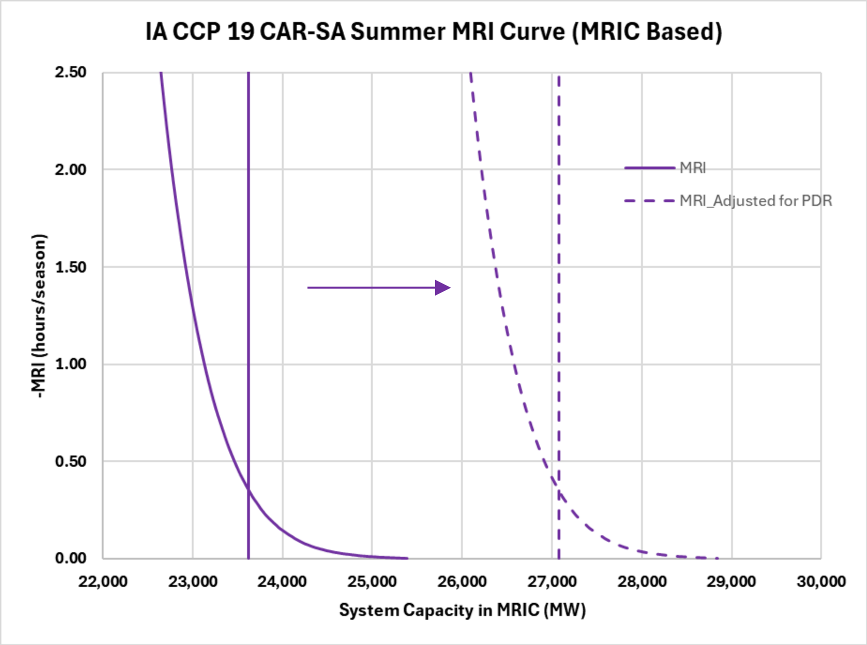


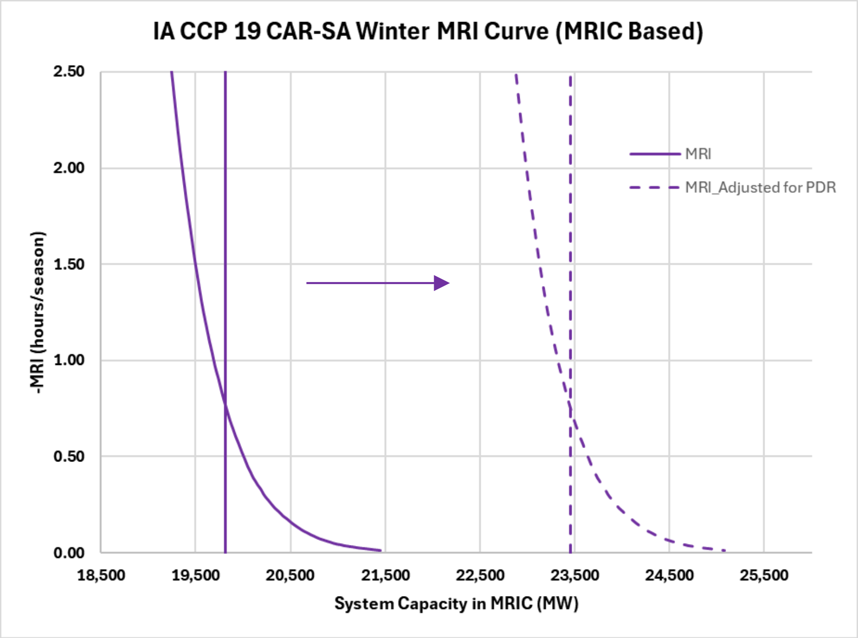
Adjustment to MRIC-based Demand Curves to Account for PDR Impacts

- The CAR MRI-demand curves on the previous slides use a load forecast that incorporates the reduction in energy demand from PDRs
- Because PDRs participate as capacity sellers, the demand curve needs to be shifted to the right by the quantity of PDR MRIC to avoid double-counting their reliability contribution
- *Next*: Show this shift for each season

Adjustment to MRIC-based MRI Curve to Account for PDR Impacts

- The seasonal MRIC-based capacity MRI curve is shifted to the right by the amount of seasonal PDR MRIC





NEAR-TERM BASE CASE

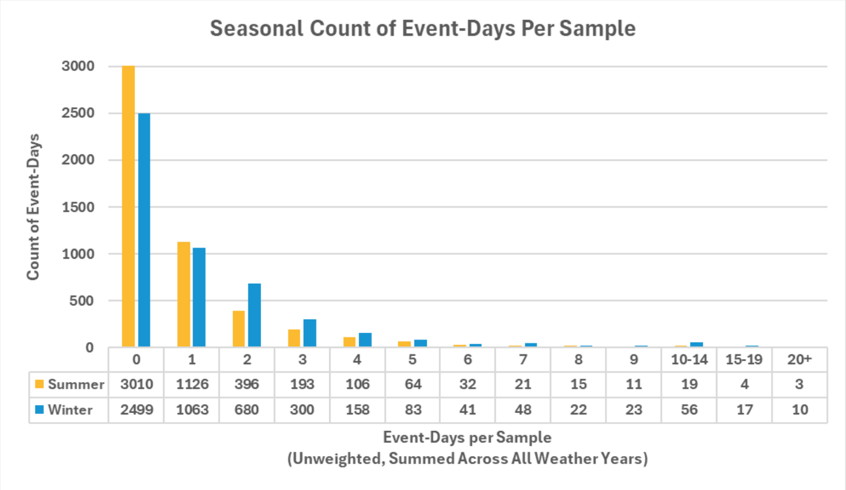
Analysis of Core Reliability Outputs

Additional Information on Reliability Outputs

- While the previous section focused on core model results related to capacity demand for the Near-Term Base Case, we now consider core reliability and model outputs related to the Near-Term Base Case for CAR in the at criteria cases
- While these results are not directly used as inputs to the capacity auction, they provide information that informs many of the key outputs, such as rMRI values
- They may also help provide further information regarding how the RAA model works in practice
- Next: Begin by showing the distribution of EUE events across simulation years

EUE Event-Days Distribution from All Simulated Years

- This chart shows the distribution of simulated samples by the number of event-days observed across all simulated years when the system is at criteria
- For example, in the summer season:
  - 3,010 out of 5,000 samples show zero days with any measured shortfall
  - 1,126 samples show exactly one day of lost load across the simulated load years
- **Important caveat**: These values do not reflect the weights used in the model and therefore cannot be used to sum to the seasonal LOLE targets of 0.05
- Comparable results for LOLH and unserved energy are provided in the appendix



	0	1	2	3	4	5	6	7	8	9	10-14	15-19	20+
Summer	3010	1126	396	193	106	64	32	21	15	11	19	4	3
Winter	2499	1063	680	300	158	83	41	48	22	23	56	17	10

EUE Hours and Duration Heat Maps

- The next batch of slides provide additional information on when EUE occurs in the model
- We first show the distribution of EUE across hours of the day and months of the year
- We then provide additional information that helps visualize not just when the events occur, but also their duration by season and hours of the day

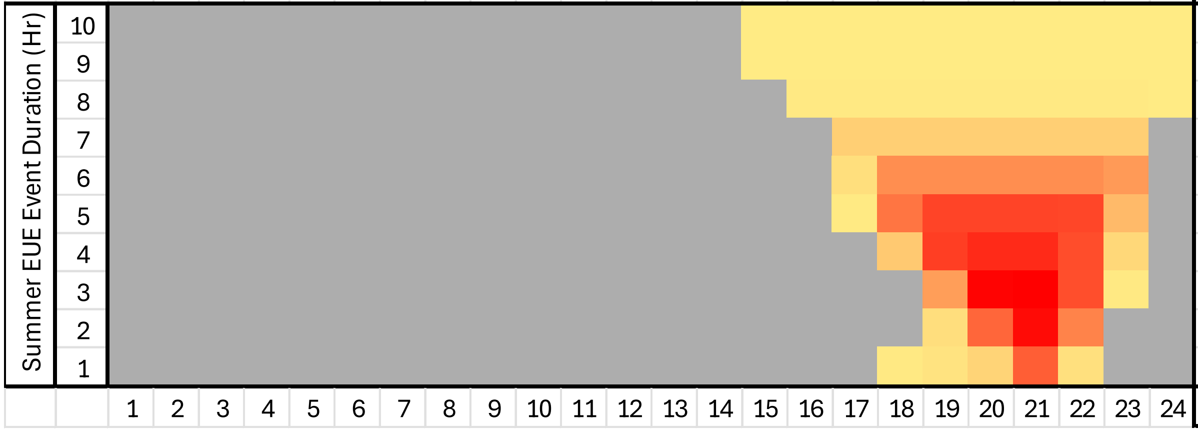
EUE Hours Heatmap

- EUE hours are concentrated in the peak summer (July-Sept) and winter (Dec-Feb) months
- In the summer, events tend to concentrated in the evening (HE 18-22)
- In the winter, the events span a broader set of hours

Hour of Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.000	0.000										
2	0.000											
3	0.000											
4	0.000											
5	0.000	0.000										
6	0.001	0.000										
7	0.002	0.000										
8	0.006	0.001										0.000
9	0.007	0.001										0.000
10	0.007	0.001										0.000
11	0.005	0.001										0.000
12	0.005	0.001										0.000
13	0.004	0.001										0.000
14	0.003	0.000										0.000
15	0.004	0.000					0.000					0.000
16	0.007	0.001					0.000					0.000
17	0.015	0.001					0.002	0.000	0.000			0.000
18	0.027	0.002	0.000			0.000	0.007	0.004	0.001			0.000
19	0.035	0.002	0.000			0.000	0.016	0.008	0.001			0.000
20	0.039	0.003	0.000			0.000	0.024	0.012	0.002			0.000
21	0.040	0.003	0.000			0.000	0.033	0.013	0.002			0.001
22	0.030	0.002	0.000			0.000	0.026	0.005	0.000			0.000
23	0.010	0.001	0.000				0.008	0.000	0.000			0.000
24	0.002	0.000					0.000					0.000

Summer EUE Events Duration Pattern

- Summer EUE events are typically short in duration, with nearly all lasting no more than 10 hours
  - Most events are shorter than 6 hours and occur within a single day
    - 2- and 3-hour events most commonly occur between HE20–22
    - 4-hour events are most likely between HE18–23
    - 5- and 6-hour events most frequently occur between HE17–23



Duration (Hr)	EUE hours	% of total EUE Hours	cumulative%
10	0.000	.1%	100.0%
9	0.000	.1%	99.9%
8	0.001	.6%	99.7%
7	0.009	5.4%	99.1%
6	0.024	14.9%	93.8%
5	0.036	22.1%	78.9%
4	0.034	20.5%	56.8%
3	0.031	18.7%	36.3%
2	0.021	12.6%	17.6%
1	0.008	5.0%	5.0%
	0.16		

- Squares that are more red represent hours within that event duration for which the likelihood of EUE is higher
- Median duration is 3 hours and mean duration is 3.29 hours

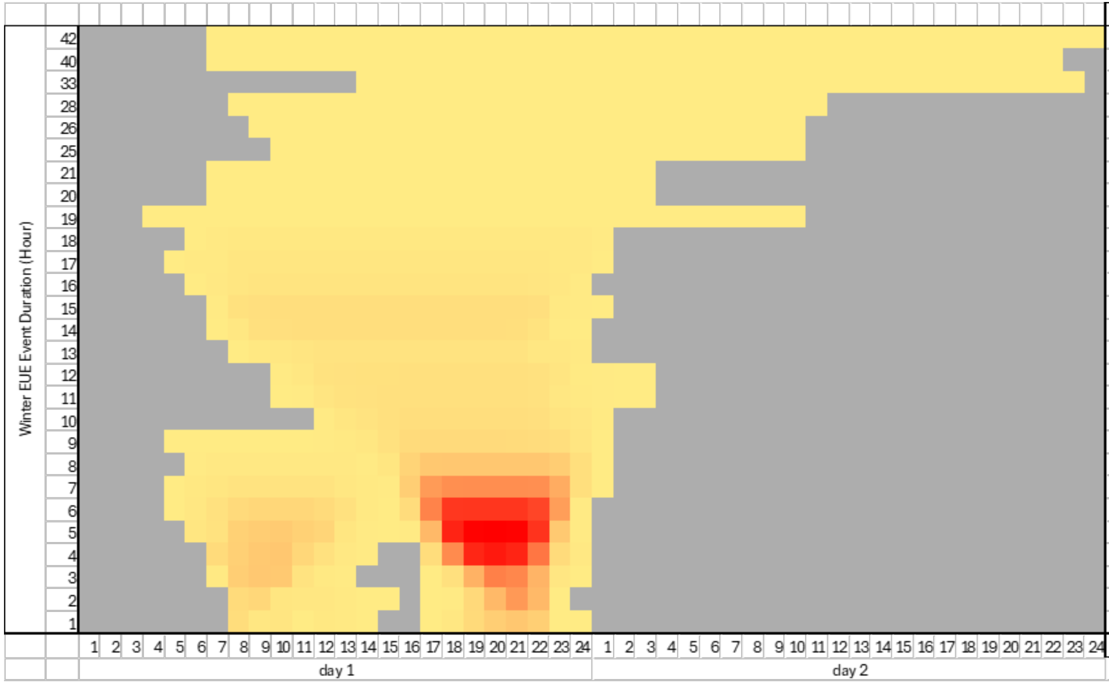
Winter EUE Events Duration Pattern

- Winter EUE events are generally longer than summer events
  - While a few extreme events can span multiple days, these occurrences are rare
  - 99% of EUE hours occur in events lasting fewer than 17 hours, 90% in events under 13 hours, and 80% in events under 8 hours

Shorter events (1–6 hours) may occur in the morning (HE6–12) but are more frequently observed later in the day (HE17–23)

Longer events (7+ hours) tend to expand outward from the HE17–22 window, either: 1) starting earlier in the morning; 2) lasting later into the night; or 3) extending in both directions as event duration increases

Median duration is 5 hours and mean duration is 4.89 hours



Winter EUE Event Duration (Hour)	EUE hours	% of total EUE hours	cumulative %
42	0.000	0.1%	100.0%
40	0.000	0.1%	99.9%
33	0.000	0.2%	99.8%
28	0.000	0.1%	99.7%
26	0.000	0.1%	99.6%
25	0.000	0.0%	99.6%
21	0.000	0.0%	99.5%
20	0.000	0.1%	99.5%
19	0.001	0.3%	99.4%
18	0.003	1.0%	99.1%
17	0.004	1.4%	98.1%
16	0.005	1.7%	96.7%
15	0.008	3.0%	94.9%
14	0.007	2.7%	91.9%
13	0.005	1.6%	89.3%
12	0.005	1.9%	87.6%
11	0.005	1.8%	85.7%
10	0.005	1.9%	83.9%
9	0.007	2.4%	81.9%
8	0.013	4.6%	79.5%
7	0.029	10.4%	74.9%
6	0.049	17.7%	64.5%
5	0.054	19.5%	46.8%
4	0.041	14.7%	27.3%
3	0.018	6.6%	12.6%
2	0.010	3.8%	6.0%
1	0.006	2.2%	2.2%
	0.28		

Expanding the Analysis to Consider All Hours that Affect System Reliability

- The previous figures focused on the distribution of EUE hours in the model, where there is load shed
- However, as the ISO has discussed, EUE hours are one of three types of hours where resource performance affects unserved energy, and therefore resource rMRI values
- The following slides will discuss the broader set of MRI hours, and then provide additional figures and tables summarizing the distribution of all MRI hours (by type)

Recall: There are Three Types of MRI Hours

Introduced at December RC Meeting

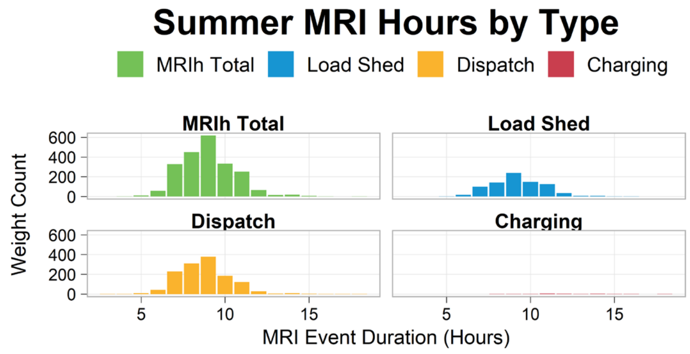
- Hours where additional available capacity would reduce unserved energy in that hour or in a subsequent hour are MRI Hours
- MRI Hours are important because, under the accreditation reforms, resources will be accredited based on their modeled expected performance in the MRI Hours
- There are broadly three types of simulated hours that can be MRI Hours:
  1. **Type 1: Load Shed Hours.** Hours with load shed – these correspond with the EUE hours/events outlined on earlier slides
     - Intuition: an additional MW of available capacity in such hours would directly reduce unserved energy in that hour
  2. **Type 2: Dispatch MRI Hours.** Hours where energy limited (including energy storage) resources are dispatched to prevent load shed
     - Intuition: an additional MW of available capacity in such hours may allow energy limited resources to save energy for a subsequent hour that includes load shed
  3. **Type 3: Charging MRI Hours.** Hours where energy storage resources are charging constrained
     - Intuition: an additional MW of available capacity in such hours would allow energy storage resources to charge additional energy. This additional charged energy could be used to reduce unserved energy in a subsequent hour.

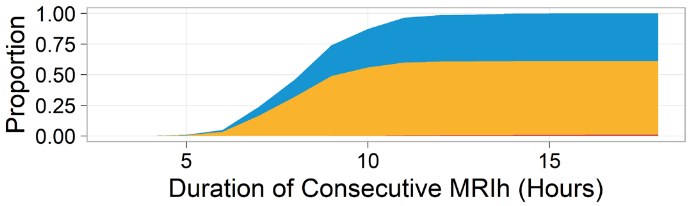
Cumulative Distribution of MRI Hour Event Durations by MRI Hour Type

- The following two slides present the cumulative distribution functions of MRI hours for summer and winter
- These CDFs break down the proportion of continuous events that are less than or equal to a given duration
- Further the distributions are broken down by MRI Hour Type (Load Shed, Dispatch to Avoid Load Shed, and Charging Constrained MRI Hours)

Cumulative Summer MRI Hour Distribution

- While summer EUE events last about 3 hours on average, incorporating the associated dispatch and charging hours shows that total MRI events are considerably longer – averaging roughly 9 hours
- Resource rMRI values will consider performance during the entirety of these MRI hours for each event
- Nearly 60% of summer MRI hours are dispatch hours, with the remaining hours largely corresponding with load shed
  - There are very few charging constrained hours

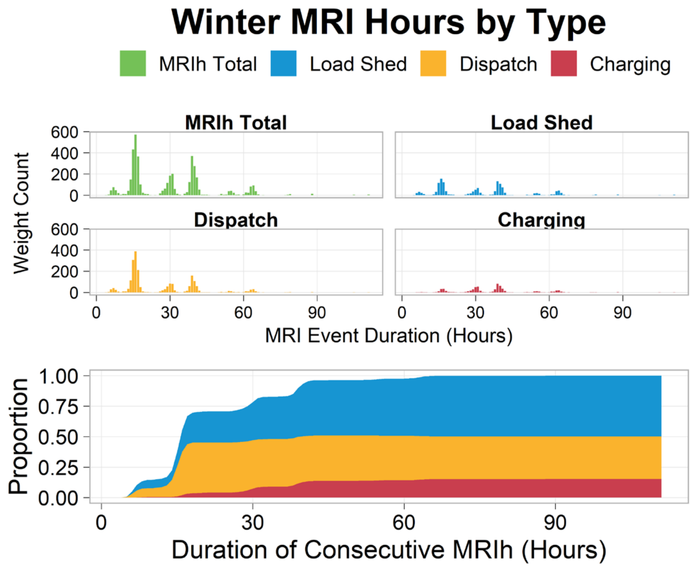




Summer MRIh Consecutive Event Hours					
	5	8	11	14	17
Duration CDF	1%	39%	95%	99%	100%
Cumulative Event Propotion by MRIh Type					
Load Shed MRIh	27%	30%	37%	38%	38%
Dispatch MRIh	73%	69%	62%	61%	61%
Charging MRIh	<1%	<1%	<1%	1%	1%

Cumulative Winter MRI Hour Distribution

- Similar to summer, MRI event duration during winter is also longer than EUE events, with an average of 21 hours
  - On average, these events are also considerably longer than MRI events in the summer
- Implication: These longer events may result in storage and limited energy resources, providing less reliability value and receiving lower rMRI values in the winter
- 50% of winter MRI hours are dispatch hours, with 35% corresponding with load shed and 15% being charging constrained



	Winter MRIh Consecutive Event Hours				
	15	29	43	60	111
Duration CDF	20%	53%	89%	93%	100%
Cumulative Event Propotion by MRIh Type					
Load Shed MRIh	29%	30%	33%	33%	35%
Dispatch MRIh	68%	62%	53%	52%	50%
Charging MRIh	3%	8%	14%	15%	15%

MRI Hour Heat Maps

- Next, we will provide more detailed heat maps that build on the data provided in the previous slides, but break out the distribution of MRI hours by hours of the day
- The colors correspond with the types of MRI hours:
  - Red corresponds to EUE hours
  - Green corresponds with dispatch constrained hours
  - Blue corresponds with charging constrained hours

Summer MRI Hours Duration Pattern

- Consistent with the earlier analysis, the duration of MRI events is considerably longer, on average than that of EUE events
- A typical summer MRI event:
  - Begins with several discharging constrained hours in the afternoon to avoid load shed for as long as possible
  - Transitions in the late evening to EUE hours when there is no longer enough available energy to meet load

Note: Each cell in the overlay shows the magnitude of largest component
Type 1 (EUE hr) = Red; Type 2 (Discharging hr) = Green; Type 3 (Charging hr) = Blue

Summer MRI Event Duration (Hour)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Hours	% of total MRI Hours	Type 1 (%)	Type 2 (%)	Type 3 (%)
18						0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0%	50%	22%	28%
17								0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0%	59%	35%	6%
16									0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0%	56%	33%	10%
15								0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.001	0%	44%	40%	16%
14									0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003	1%	38%	43%	19%
13										0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.003	1%	47%	42%	11%
12											0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.012	3%	52%	43%	4%
11											0.000	0.001	0.004	0.005	0.005	0.005	0.004	0.003	0.004	0.004	0.005	0.005	0.004		0.047	12%	50%	48%	2%
10												0.000	0.004	0.007	0.007	0.007	0.006	0.004	0.004	0.006	0.007	0.007	0.003		0.061	15%	44%	55%	1%
9													0.000	0.013	0.014	0.014	0.014	0.011	0.007	0.011	0.014	0.013	0.000		0.111	29%	38%	61%	0%
8													0.000	0.007	0.011	0.011	0.011	0.010	0.007	0.007	0.011	0.005			0.080	21%	31%	69%	0%
7														0.000	0.009	0.009	0.009	0.009	0.006	0.006	0.009	0.001			0.058	15%	30%	70%	0%
6														0.000	0.001	0.002	0.002	0.002	0.001	0.002	0.001	0.000			0.010	3%	28%	72%	0%
5														0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000				0.002	0%	28%	72%	0%
4															0.000	0.000	0.000	0.000	0.000						0.000	0%	25%	75%	0%
3																	0.000	0.000	0.000						0.000	0%	33%	67%	0%
																									0.431				

Hour Ending

Winter MRI Hours Duration Pattern

- In the winter, a typical MRI event runs longer and may span multiple days
- Consistent with the summer results, discharging hours precede EUE hours to reflect that the model uses any available stored energy before shedding load
- There are now also instances of charging MRI hours, where these often fall between periods of EUE hours

Note: Each cell in the overlay shows the magnitude of largest component
Type 1 (EUE hr) = Red; Type 2 (Discharging hr) = Green; Type 3 (Charging hr) = Blue

Winter MRI Event Duration (Hour) — day 1

Winter MRI Event Duration (Hour)	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
65		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
64		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
55											0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
54											0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
41	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
40	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
39		0.000	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.001	0.000
38		0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.001
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
17	0.000	0.002	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.004	0.003	0.004	0.004	0.004	0.004	0.002	0.000
16	0.000	0.002	0.006	0.007	0.007	0.007	0.007	0.007	0.006	0.006	0.006	0.007	0.006	0.006	0.006	0.007	0.005	0.001	0.000
15	0.000	0.000	0.002	0.006	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.005	0.005	0.004	0.000	0.000
14		0.000	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.001	0.000	
13			0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	
9										0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8									0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	
7										0.000	0.000	0.002	0.002	0.002	0.001	0.002	0.002	0.000	
6										0.000	0.001	0.002	0.002	0.002	0.002	0.001	0.000		

Winter MRI Event Duration (Hour) — day 2

Winter MRI Event Duration (Hour)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	% of total MRI hrs	Type 1 (%)	Type 2 (%)	Type 3 (%)
65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1%	56%	26%	18%
64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2%	47%	31%	22%
63	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2%	46%	31%	23%
55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1%	46%	28%	26%
54	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1%	45%	33%	23%
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1%	44%	30%	25%
41	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000		4%	44%	35%	21%
40	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000		7%	39%	39%	22%
39	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.000	0.000		9%	35%	43%	22%
38	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000		3%	31%	46%	23%
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		1%	41%	34%	25%
31	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000		5%	34%	39%	27%
30	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000			4%	28%	44%	28%
29	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000				3%	29%	48%	23%
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000				2%	26%	48%	26%
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000						1%	31%	45%	24%
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000															2%	38%	50%	12%
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																9%	33%	58%	9%
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																	14%	27%	67%	5%
15																									10%	27%	71%	3%
14																									4%	21%	77%	2%
13																									1%	18%	81%	1%
9																									0%	52%	39%	9%
8																									1%	45%	48%	7%
7																									2%	43%	55%	3%
6																									1%	40%	59%	1%

NEAR-TERM BASE CASE

Accreditation Values

Accreditation Values

- This section will provide several summary statistics regarding rMRI and MRIC values for the CAR Near-Term Base Case in each season
  - Also includes QC as a point of comparison, where QC MW tends to be higher than MRIC MW for most resources
- These rMRI values are derived for each resource from the RAA model based on the marginal reliability value provided (as measured in EUE reduction from incremental capacity)
- *Recall*: The rMRI value for a resource represents the proportion of its MCap value that it can offer into the capacity market
  - E.g., A resource with a 100 MW MCap and an rMRI value of 0.7 has an MRIC value of 70 MW (=100 MW × 0.7)
- Additional information about the distribution of rMRI values by resource type is included in the appendix
- We walk through the summary results based on how the resource is modeled (thermal, energy limited and storage profile) before summarizing the values across all resource types
- The values that follow are simulated results based on the design as currently proposed and input assumptions regarding the resource mix and load forecast; they are not actual accreditation values

Summary of rMRI for Thermal Modeled Resources

	MCap (MW)		CAR-SA rMRI		CAR-SA MRIC (MW)		Current Rule
	Summer	Winter	Summer	Winter	Summer	Winter	QC (MW)
Gas-only	8,006	8,637	91.9%	91.0%	7,362	7,857	7,873
Oil/Dual-Fuel (Thermal)	10,516	11,287	82.1%	79.3%	8,635	8,956	10,500
Daily/Weekly Hydro	1,067	1,060	95.0%	96.2%	1,013	1,020	1,062
Other Thermal (including Nuclear)	3,947	3,968	86.9%	88.7%	3,430	3,520	3,922
Imports	2,205	1,331	91.5%	88.4%	2,018	1,177	2,205*

- Summer MCap values are closely aligned with summer QC
- MRI-based accreditation values (MRIC) are generally lower than QC because resource accreditation under CAR-SA explicitly accounts for resource performance during MRI hours
  - EFORd and MCap are the primary drivers of thermal resources' performance
- Winter MRIC values are higher than summer for most classes, driven by higher winter MCap
- Recall: For gas-only resources, limitations due to the regional gas infrastructure will be reflected via the gas constraint, rather than through a reduction in accreditation values
- Note: The 2,202 MW of import QC value in Feb MC presentation is incorrect.

Summary of rMRI for Energy Limited and Storage Resources

	MCap (MW)		CAR-SA rMRI		CAR-SA MRIC (MW)		Current Rule
	Summer	Winter	Summer	Winter	Summer	Winter	QC (MW)
Oil/Dual-Fuel (EL3)	840	1,019	90.9%	67.2%	764	685	798
Energy Storage Resources (PSH + Batteries)	3,877	3,875	55.2%	20.9%	2,141	810	3,862
Hybrid (PV/ES + Hydro/ES)	1,053	1,053	50.8%	25.2%	535	264	644

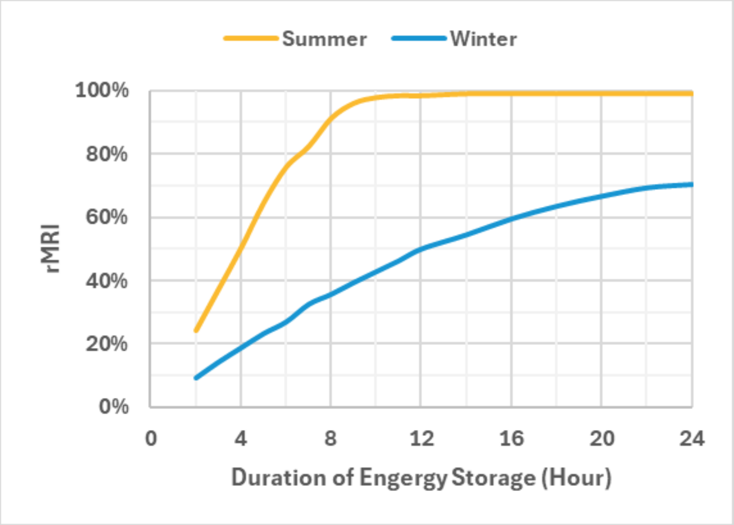
- Across all energy-limited and storage classes, CAR-SA accreditation (MRIC) is below Current Rule QC, reflecting how energy constraints reduce performance during MRI hours
- Winter rMRI values are consistently lower than summer, indicating that winter MRI event conditions are longer and more energy-intensive, resulting in short-duration or limited-energy resources providing less reliability value
- Classes with higher-duration storage capability (e.g., oil/dual-fuel) experience smaller accreditation reductions, while short-duration storage shows a larger decrease, reflecting that they can contribute to resource adequacy for a smaller portion of MRI hours
  - Unpack this relationship further on the following slides
- Hybrid resource accreditation reflects their facility limit as well as the energy limitation of the underlying energy storage component and the generation component, which is mostly solar

rMRI for Proxy Energy Storage Resources

- Estimated seasonal rMRI for proxy energy storage resources with different duration (assumed with 84% RTE and 0% EFORd)

- rMRI values increase with hour duration, reflecting the fact that batteries that can discharge for longer periods provide more reliability benefits during both summer and winter

- Duration of reliability events, as shown earlier in the presentation, are different in summer and winter, thus driving different rMRI outcomes
  - Shorter duration in summer results in higher rMRI and earlier plateau
  - Longer duration in winter results in lower rMRI



Duration (Hour)	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24
rMRI(s)	0.243	0.373	0.503	0.645	0.757	0.822	0.911	0.959	0.976	0.982	0.982	0.988	0.988	0.988	0.988	0.988	0.988
rMRI(w)	0.092	0.142	0.187	0.232	0.269	0.325	0.356	0.393	0.427	0.462	0.499	0.544	0.594	0.633	0.665	0.691	0.702

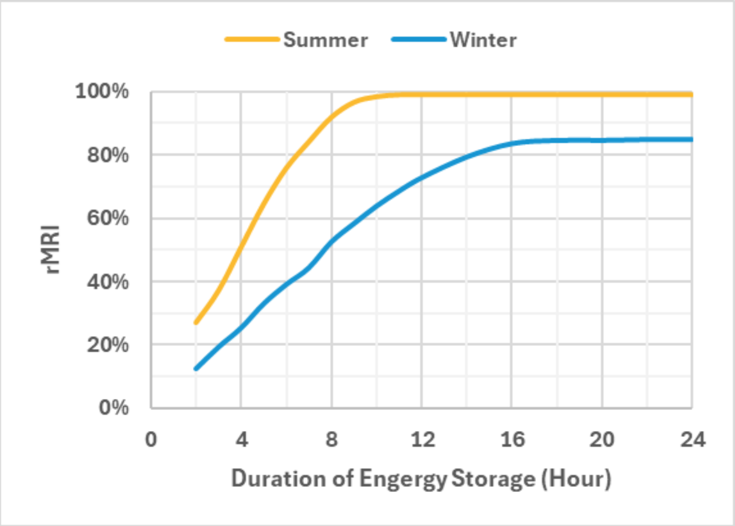
rMRI for Proxy Daily Energy Limited Resources

- Estimated seasonal rMRI for proxy daily energy limited resources with different duration

- Similar to energy storage resources, rMRI values of daily energy limited resource increase with increased usable daily energy available during both summer and winter

- Difference in reliability events duration in summer and winter also drives different rMRI outcomes
  - Shorter duration in summer results higher rMRI and earlier plateau
  - Longer duration in winter results in lower rMRI

- Energy limited resources generally have higher rMRI than energy storage resources with the same duration because their energy can be replenished without being subjected to similar constraints of energy storage resources



Duration (Hour)	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24
rMRI(s)	0.272	0.373	0.509	0.645	0.757	0.840	0.917	0.965	0.982	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988
rMRI(w)	0.124	0.193	0.253	0.330	0.391	0.443	0.525	0.583	0.639	0.686	0.728	0.794	0.836	0.847	0.847	0.850	0.850

Summary of rMRI for Profile Resources

	MCap (MW)		CAR-SA rMRI		CAR-SA MRIC (MW)		Current Rule QC	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
IPR - Wind	2,525	2,525	19.9%	36.1%	503	912	565	1,254
IPR - Solar	1,409	1,409	24.1%	7.1%	339	100	561	0
IPR - Hydro	560	560	40.7%	59.9%	228	336	316	422
IPR - Others	273	273	79.8%	79.2%	218	216	232	244
ADCR	794	674	22.5%	34.3%	179	231	761	
PDR	6,504	6,186	53.1%	58.7%	3,452	3,633	2,658	

- Under the current rule, winter QC is used for IPR for accreditation for the winter

Summary of rMRI for Profile Resources, cont.

- The MRIC values for most profile resources fall below their Current Rule QC values, highlighting that CAR-SA accreditation more directly reflects performance during MRI hours, which are different from the pre-defined Reliability Hours under which QC is calculated
- On average, PDRs have higher MRICs than QCs, because PDR contributes meaningfully during reliability-critical periods outside the limited hours used in the QC calculation
- Notable seasonal pattern for MRIC values of resources that have distinct seasonal output or more alignment with seasonal MRI conditions
  - wind, hydro, and demand-side programs tend to have higher winter output
  - solar output is closely correlated with load in summer
- Off-shore wind generally performs better than on-shore wind in both seasons due to stronger and more consistent wind speeds
- Tracking solar tends to perform better than fixed

Comparison of System Share Between QC and MRIC By Resource Type

- We now consider the portfolio of resources and resource types that comprise the Near-Term Base Case
- Compare each resource type's percent of total QC (how much capacity they can sell under current rules) to their percent of total MRIC (how much capacity they can sell in each season)
- Making this comparison in percent terms is informative because:
  - The total QC today is higher than MRIC
  - Settlements regarding Capacity Scarcity Events are based on a share-of-system obligation

Comparison of Accreditation Share (MRIC vs. QC)

	CAR-SA MRIC (summer)		CAR-SA MRIC (winter)		Current Rule QC	
	MW	System share (%)	MW	System share (%)	MW	System share (%)
Gas-only	7,362	26.9%	7,857*	30.1%	7,873	24.2%
Oil/Dual-Fuel (Thermal)	8,635	31.6%	8,956	34.3%	10,500	32.3%
Daily/Weekly Hydro	1,013	3.7%	1,020	3.9%	1,062	3.3%
Other Thermal (including Nuclear)	3,430	12.5%	3,520	13.5%	3,922	12.1%
Imports	2,018	7.4%	1,177	4.5%	2,205	6.8%
Oil/Dual-Fuel (EL3)	764	2.8%	685	2.6%	798	2.5%
Energy Storage (PSH + Batteries)	2,141	7.8%	810	3.1%	3,862	11.6%
Hybrids	534	2.0%	264	1.0%	644	1.3%
IPR - Wind	503	1.8%	912	3.5%	565	1.4%
IPR-Solar	340	1.2%	100	0.4%	566	0.4%
IPR-Hydro	228	0.8%	336	1.3%	316	1.0%
IPR - Others	218	0.8%	216	0.8%	232	0.7%
ADCR	179	0.7%	231	0.9%	761	2.3%
Total	27,362		26,083		33,305	
System-weighted rMRI		73.8%		69.2%		

- PDRs are excluded in the system rMRI calculation
- Gas-only resources will be subject to the gas market constraint, which does not affect accreditation, but will impact the quantity of gas capacity procured, and the compensation for that capacity

FUTURE CASE 1

Future Case 1: Overview and Differences from Near-Term Base Case

- Future Case 1 includes updates to the supply and demand assumptions relative to the Near-Term Base Case
- These updates are intended to flex a potential system further out in the future and include additional supply from energy storage, offshore wind, and solar resources
- It uses a load forecast corresponding to 2035
- Additional detail was provided in the February RAM IA presentation materials
- Future Cases 2 and 3, which will be presented in April, consider resource mixes with more storage, wind, and solar

Future Case 1: Updated Input Assumptions

- As noted in February MC materials, it was possible that the ISO may need to adjust input assumptions to achieve a reasonable balance between capacity supply and demand for this future case
- Upon setting up the inputs, the ISO found that without adjustments, there would be a supply/demand imbalance in Future Case 1, with not enough supply to reliably serve load in the winter
- To address this imbalance, the ISO has reduced load by 5 percent
- Such an adjustment aligns with stakeholder input about modifying load levels to be responsive to balance supply/demand, and to consider using lower load levels to account for decreased projections in the preliminary 2026 CELT
- To the extent that additional adjustments to the inputs are necessary in other future cases, the ISO plans to employ a similar approach

Future Case 1 Results

- The slides that follow provide information on key outputs and reliability metrics associated with Future Case 1
  - These constitute a subset of the results and analysis provided for the Near-Term Base Case
- Focuses on differences in results from the Near-Term Base Case, and includes a discussion of drivers behind those differences

Future Case 1 Net ICR

	Future Case 1		Near-Term Base Case	
	Summer	Winter	Summer	Winter
Net ICR in MCap (MW)	36,625	38,493	32,016	28,620
LOLE (days/season)	0.05	0.05	0.05	0.05
LOLH (hours/season)	0.16	0.29	0.16	0.28
EUE (MWh/season)	135	552	147	324
50/50 Net Peak (MW)	27,331	25,908*	25,124	21,101

- Net ICR increases in both summer and winter, driven by the higher 2035 load forecast
- Winter NICR experiences a greater increase, reflecting larger projected load growth in that season
- Winter EUE rises substantially, likely due to changes in load characteristics with higher electrification assumptions in the 2035 forecast and resource mix with a higher level of intermittent resources

Note: The 50/50 winter peak for future case 1 (2035) has been scaled down by 5% to balance the supply and demand.

Future Case 1 rMRI
Thermal Modeled Resources

	Future Case 1				Near-Term Base Case				Change in System Parameters			
	MCap (MW)		rMRI		MCap (MW)		rMRI		ΔMCap (MW)		ΔrMRI	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Gas-only	8006	8,637	92.4%	92.4%	8,006	8,637	91.9%	91.0%	0	0	0.5%	1.4%
Oil/Dual-Fuel (Thermal)	10,516	11,287	83.4%	83.1%	10,516	11,287	82.1%	79.3%	0	0	1.3%	3.8%
Daily/Weekly Hydro	1,067	1,060	95.4%	96.4%	1,067	1,060	95.0%	96.2%	0	0	0.4%	0.2%
Other Thermal (including Nuclear)	3,947	3,968	88.0%	91.5%	3,947	3,968	86.9%	88.7%	0	0	1.1%	2.8%
Imports	2,205	1,331	92.4%	89.2%	2,205	1,331	91.5%	88.4%	0	0	0.9%	0.8%

- The rMRI values of these resources under the Future Case 1 are very similar to the near-term CCP 19 Base Case
    - MCap and EFORd values are the same for these two cases

Future Case 1 rMRI
Energy Limited and Storage Resources

	Future Case 1				Near-Term Base Case				Change in System Parameters			
	MCap (MW)		rMRI		MCap (MW)		rMRI		ΔMCap (MW)		ΔrMRI	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Oil/Dual-Fuel (EL3)	840	1,019	92.5%	71.9%	840	1019	90.9%	67.2%	0	0	1.6%	4.7%
Energy Storage Resources*	4,077	4,075	62.6%	21.9%	3,877	3,875	55.2%	20.9%	200	200	7.4%	0.9%
Hybrid (PV/ES + Hydro/ES)	1,053	1,048	47.9%	25.6%	1,053	1,048	50.8%	25.2%	0	0	-3.0%	0.4%

- Energy storage resources include both Pumped Storage Hydro and stand-alone batteries
  - Future case 1 includes an additional 200 MW of 2-hr batteries

Future Case 1 rMRI Profiled Resources

	Future Case 1				Near-Term Base Case				Change in System Parameters			
	MCap (MW)		rMRI		MCap (MW)		rMRI		ΔMCap (MW)		ΔrMRI	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
IPR - Wind	4,525	4,525	11.3%	28.8%	2,525	2,525	19.9%	36.1%	2000	2,000	-8.6%	-7.3%
IPR - Solar	1,609	1,609	12.3%	5.8%	1409	1409	24.1%	7.1%	200	200	-11.7%	-1.3%
IPR - Hydro	560	560	42.6%	62.3%	560	560	40.7%	59.9%	0	0	1.9%	2.4%
IPR - Others	273	273	80.7%	79.6%	273	273	79.8%	79.2%	0	0	0.9%	0.4%
ADCR	794	674	21.5%	33.1%	794	674	22.5%	34.3%	0	0	-1.0%	-1.2%
PDR	6,504	6,186	50.9%	58.3%	6,504	6,186	53.1%	58.7%	0	0	-2.2%	-0.4%

- Future Case 1 includes 2,000 MW of new offshore wind and 200 MW of new solar additions
- The decline in wind rMRI values is driven by the increased concentration of offshore wind located near existing facilities, which increases the correlated impact on loss of load events
- The reduction in summer solar rMRI values is due to additional BTM PV in the 2035 load forecast, which shifts the net peak further into the evening hours when solar output further diminishes

Next Steps

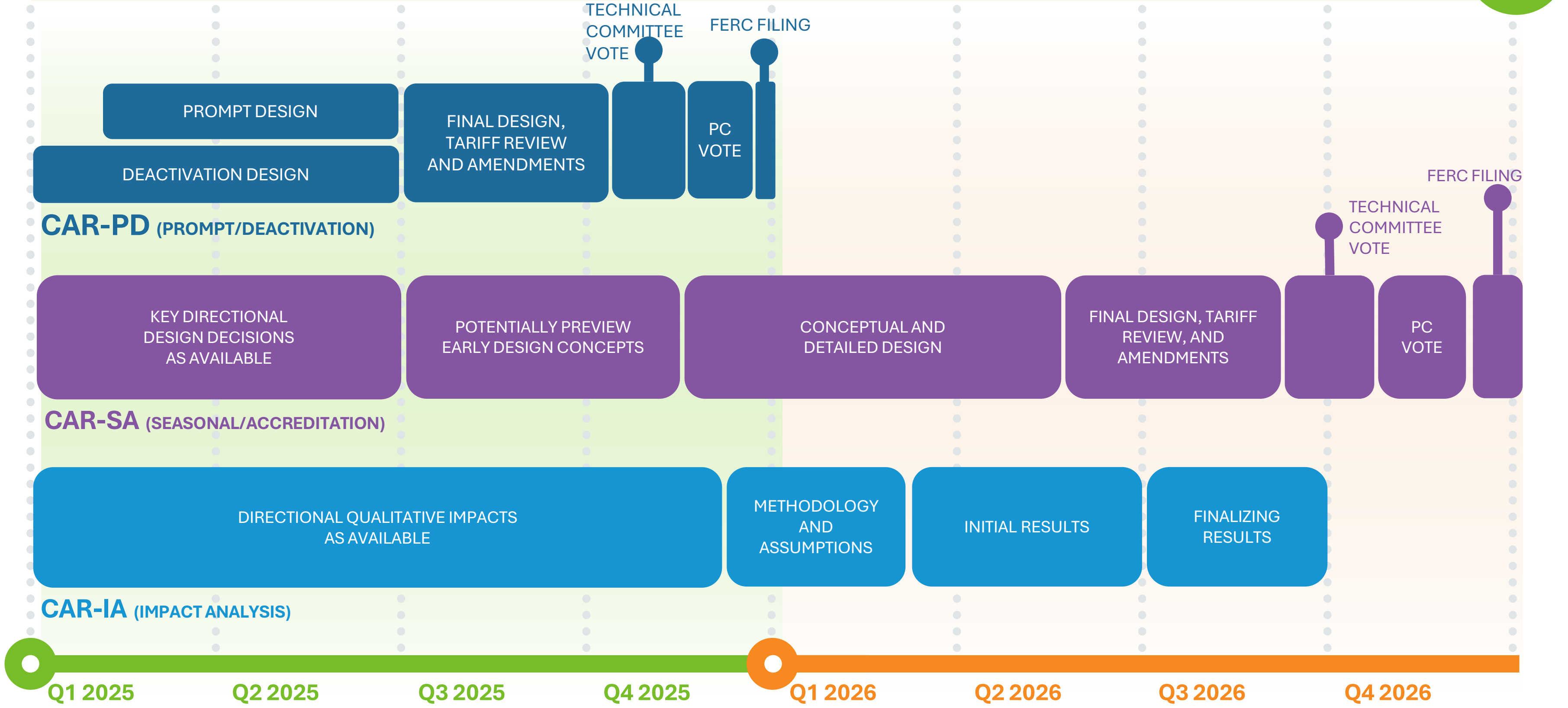
The ISO plans to continue discussing the Impact Analysis in the coming months, with the following targets for when materials will be presented:

- April - May: Continued discussion of RAM IA, including Future Cases 2 and 3, gas constraint, additional analysis and sensitivities
- May - June: Share Market Clearing IA results
- Q3: Present final IA results reflecting any updates to the proposal informed by ISO analysis and/or stakeholder discussion

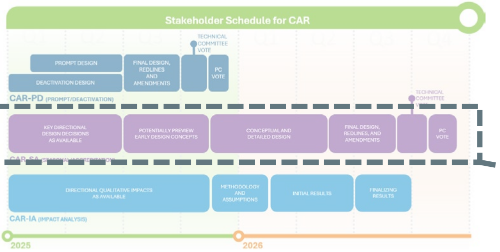
Questions

STAKEHOLDER SCHEDULE

Stakeholder Schedule for CAR



CAR-SA



Stakeholder Schedule for CAR-SA

CAR-SA (SEASONAL/ACCREDITATION)

- CORE MODELING AND ACCREDITATION CONCEPTS
- SEASONAL/ACCREDITATION MODELING AND MARKET DESIGN
- CONFORMING DESIGN DETAILS
- FINAL DESIGN, TARIFF REVIEW AND AMENDMENTS
- TECHNICAL COMMITTEE VOTE
- PC VOTE
- FERC FILING

Stakeholder Activity

- PROVIDE QUESTIONS AND FEEDBACK ON DESIGN
- CONCEPTUAL AMENDMENTS
- PRESENT AMENDMENTS

ISO Activity

- PRESENT DESIGN & RESPOND TO FEEDBACK
- PROVIDE QUESTIONS AND FEEDBACK ON AMENDMENTS

Q4 2025 | Q1 2026 | Q2 2026 | Q3 2026 | Q4 2026

CAR-SA Schedule Projection

- **March**
  - Intermittent Power Resource Modeling and Accreditation, Continued Discussion (MC timeframe)
  - Hybrid Resource Modeling and Accreditation, Continued Discussion (MC timeframe)
  - Resource Accreditation Modeling Impact Analysis: Initial Base Case Results (MC timeframe)
  - Market Clearing Impact Analysis, Continued Discussion (MC timeframe)
  - Import Resource Modeling and Accreditation (MC timeframe)
  - Principles of Competitive Offer Construction, Self-Supply and Seasonal Definition Impacts (MC timeframe)
  - Capacity Market Cost Allocation (MC timeframe)
  - Modeling Deliverability: Summary of All Resource Types (RC timeframe)

All NEPOOL members are invited to attend meetings where CAR topics are discussed

CAR-SA Schedule Projection (Continued)

- **April**
  - Resource Accreditation Modeling: Impact Analysis, Continued Discussion (MC timeframe)
  - Market Clearing Impact Analysis, Continued Discussion (MC timeframe)
  - Gas-Only Resource Contract Requirements (MC timeframe)
  - Gas Demand Curve, follow-ups and continued detailed design discussion (MC timeframe)
  - Import Resource Modeling and Accreditation, continued discussion (MC timeframe)
  - Competitive Offer Construction and Mitigation (MC timeframe)
  - Qualification Process (MC timeframe)
  - Preliminary Activity Schedule (MC timeframe)
  - Self-Supply, continued discussion (MC timeframe)
  - Installed Capacity Requirement, continued discussion (RC timeframe)
  - Deactivation Conforming Changes (TC timeframe)
  - Quarterly Follow-up Medley (TBD timeframe)

CAR-SA Preliminary Topic Schedule (Continued)

- The list below provides a draft projection of committee discussions:

Topics	Projected Committee Discussions
Transition Year Topics	May – June
Technical Details	June – August

APPENDIX A: MAJOR ASSUMPTIONS AND MODEL INPUTS

Overview of Resource Modeling Inputs and Assumptions

- The tables presented on the next six slides seek to provide additional details about the major assumptions and inputs used in the RAM IA modeling process

Proposed Seasonal Auction Structure

Summer Season	Winter Season
May 1 – October 31	November 1 – April 30

- The ISO explained the rationale behind this structure at the March 2025 MC

Resource Modeling (CAR-SA vs. Current Rule)

Resource Type		CAR-SA		Current Rule
		MARS resource model	Key Input Parameters	
Non-IPR Gen	Gas-only Nuclear Daily/Weekly Hydro Non-IPR others (LFG, MSW, WDS, Fuel Cell)	**Thermal:** modeled individually	Seasonal MCap Seasonal EFORd Seasonal Transition Number	Thermal: modeled individually - Summer QC - Annual EFORd - Annual Transition Number
	Oil-only	**Thermal:** if qualified inventory >=24 hrs.; modeled individually **EL3 (daily energy limited):** if qualified inventory <24 hrs.; aggregate for resources with shared tank, otherwise modeled individually	Thermal: MCap/Seasonal EFORd/Seasonal Transition Number EL3: MCap/Seasonal EFORd/Seasonal Transition Number/daily energy limit	
	Gas/Oil Dual Fuel	**Thermal**: summer; winter if qualified inventory >=24 hrs.; modeled individually **EL3:** in winter if qualified inventory <24 hrs.; aggregate for resources with shared tank, otherwise modeled individually	Thermal: MCap/Seasonal EFORd/Seasonal Transition Number EL3: MCap/Seasonal EFORd/Seasonal Transition Number/daily energy limit	
	Pumped Storage Hydro	**ES (energy storage):** Aggregate for resources with shared pondage, otherwise modeled individually	Discharging rate: seasonal MCap Charging rate: seasonal MCap for battery Storage capability Round Trip Efficiency Seasonal EFORd Seasonal Transition Number	
	Stand-alone Battery	**ES:** modeled individually		ES: modeled individually Similar parameters for ES
	Hybrid	**Base model: Storage component**: aggregate ES for of all hybrids **Generation component**: consistent with respective generation type **Accreditation model (for perturbation)**: ES and generation components of each hybrid resource modeled explicitly behind an export-zone with export limit representing facility limit	**Storage component:** same input parameters for stand-alone batteries **Generation component:** same parameters for respective generation type Facility Limit	- Separate battery modeled as ES - Separate generation modeled as thermal using QC - Single resource modeled as thermal without EFORd using QC

CAR-SA vs. Current Rule Modeling

Resource Type		CAR-SA		Current Rule
		MARS resource model	Key Input Parameters	
IPR	Solar/Wind/Hydro/Misc	**Profile model:** - Settlement only solar and hydro modeled as aggregate resource by load zone - Others modeled individually - Solar correlated to load during summer - All other uncorrelated to load	Hourly normalized profiles Size: max of (seasonal Mcap)	**Thermal:** seasonal QC assumed no EFORd
Demand Resources	ADCR	**Profile model**: modeled individually	Hourly normalized profiles Size: seasonal Mcap	**Thermal:** load zone aggregate EFORd: based on historical performance
	PDR	**Base model:** reflected in load **Accreditation:** proxy profiles	Hourly normalized profiles by technology type Size: DG: Mcap EE: imputed Mcap	**Thermal:** seasonal QC assumed no EFORd
Import		**Thermal:** assumed for IA; ISO plans to discuss its proposed CAR-SA design for import in March	Same input parameters for thermal model	**Thermal:** summer QC and EFORd
Other system resources	Tie Benefits	**Thermal:** by individual tie	Mcap: seasonal tie benefits by interfaces EFORd: tie line unavailability factor	**Thermal**: annual tie benefits with tie line unavailability factor
	Voltage reduction	1% of seasonal 90/10 net peak		
	Minimum reserve requirement	700 MW firm load		

CAR-SA vs. Current Rule Load Modeling

CAR-SA	Current Rule

- BTM PV is explicitly modeled and correlated with load during the summer
- Base load includes EV and heat-pump load and is net of PDR
- Multiple load shapes are used
  - 2007 to 2023 for summer
  - 2000/2001 to 2022/23
- Each load shape is assigned a weight through an optimization process designed to emulate load variability across the full 70-year period
	- BTM PV is explicitly modeled and correlated with load
	- EV load is explicitly modeled
	- Base load includes heat-pump load but is grossed up to reflect PDR
	- Single load shape (2002) is used
	- Load is scaled to different levels to represent weather uncertainty with associated probabilities
	- Scaling factors and probabilities are developed to emulate 70-year load variability

Major Assumptions - Resources

Assumptions		CAR-SA	Current Rule
MCap		- Commercial: audit-based - Noncommercial: Non-IPR based on QC; IPR based on NRC - Hybrid: sum of ES and generation component	- FCA 18 QC
Unavailability Factor	Non-IPR generating resources	- 10-yr seasonal average based on GADS - Battery: assumed 5%	- 10-yr annual average based on GADS - Battery: 5%
	IPR	- 5% derate applied to individual solar/wind DNV profiles - Other embedded in RQM based profile	- 0%
	ADCR	- Reflected in profiles	- Based on 5-yr average performance by load zone
	Import	- Pool backed: based on tie line EFORd - Resource backed: NERC class average 2020-2024 and tie line EFORd	- Pool backed: based on tie line EFORd - Resource backed: NERC 30+ hydro class average and tie line EFORd
Profiles	IPR Solar	- Individual: DNV simulated profiles (2007-2023) - Aggregate: adjusted BTM PV profiles (2007-2023)	- N/A
	IPR Wind	- DNV simulated profiles (2000-2023)	- N/A
	IPR Hydro and Misc	- Last 5-yr RQM based profiles	- N/A
	ADCR	- Based on offered Maximum Reduction values from last 3 like seasons adjusted for historical performance	- N/A
	PDR	- EE: NREL end use profiles - DG: Last calendar year RQM based profiles	- N/A
ES/EL3 Dispatch Logic		- Discharging: longest to shortest duration using dispatch group - Charging: shortest to longest duration using priority order	- MARS default logic: dynamic longest to shortest
Tie Benefits		- Summer: 1,795 MW; Winter: 550 MW	- Annual 1,795 MW

Major Assumptions - Load

	CCP 19 CAR-SA	CCP 19 Current Rule	Future Case 1 (2035)
Base Forecast	- 2025 CELT for 2028/29	- 2025 CELT for 2028/29	- 2025 CELT for 2035/26 - Winter scaled down by 5% to balance supply and demand
PDR Treatment	- Net of PDR	- PRD reconstituted in load	- Net of PDR

APPENDIX B: ADDITIONAL INFORMATION ON MODEL DEMAND RESULTS FOR NEAR-TERM BASE CASE

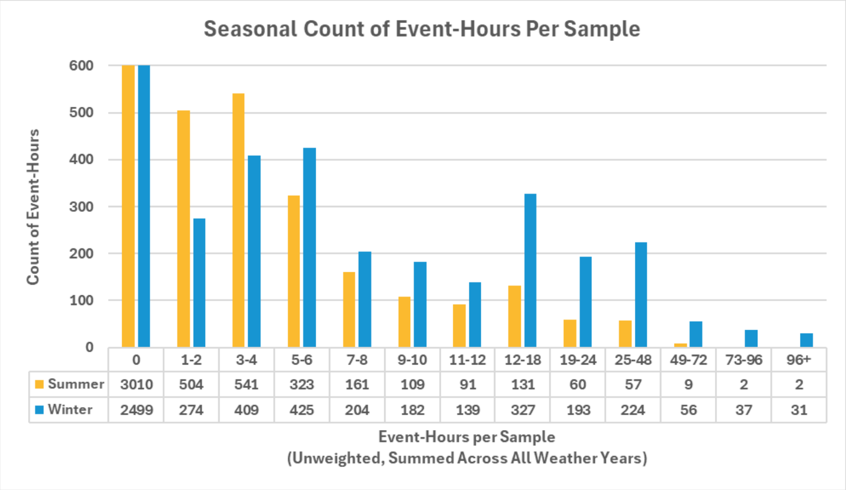
How to Compare Net ICR Changes

- The comparison between CAR-SA and the current-rule focuses on design and modeling differences, excluding updates to underlying data assumptions. To make a true apple-to-apple comparison, several adjustments are required:
  - Use QC-based CAR-SA net ICR to align with current rule net ICR
    - CAR-SA Net ICR is calculated on an MCap basis, whereas the current-rule uses QC
    - For most non-IPR resources, MCap and QC are closely aligned
    - For IPR resources, MCap is generally much higher than QC
  - Seasonal vs. annual comparison
    - CAR-SA evaluates summer and winter separately
    - Under the current rule, reliability risk is primarily observed in the summer, so the summer season is the appropriate basis for comparison
  - Consistent load basis
    - A fair comparison requires using the same net 50/50 peak load
    - The current-rule gross-load net ICR is converted to the net-load basis by applying the same required reserve margin
      - (31,230/27,781)*25,124 = 28,243 MW

APPENDIX C: ADDITIONAL RELIABILITY OUTPUTS FOR NEAR-TERM BASE CASE

EUE Event-Hours Distribution from All Simulated Years

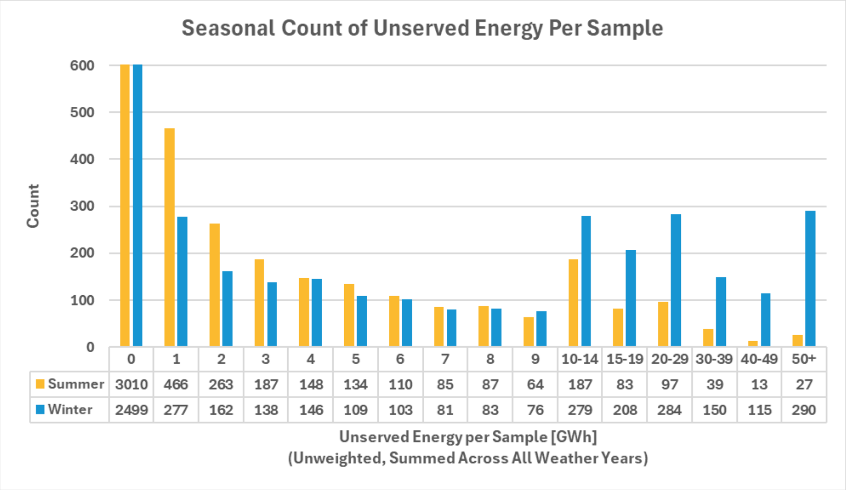
- This chart shows the distribution of simulated samples by the number of event-hours observed across all simulated years
- For example, in the summer season:
  - 3,010 out of 5,000 samples show zero hours with any measured shortfall
  - 504 samples have exactly 1 or 2 hours of lost load across the simulated load years



NOTE: This data, as presented, can not be used to recalculate the LOLH

Unserved Energy Distribution from All Simulated Years

- This chart shows the distribution of simulated samples by total observed unserved energy across all simulated years
- For example, in the summer season:
  - 3,010 out of 5,000 samples show zero days with any measured shortfall
  - 466 samples experienced under 1000 MWh of lost load across all event-hours



NOTE: This data, as presented, can not be used to recalculate the EUE

LOLE Monthly Distribution by Load Year (Summer)

- In the summer season, load years between 2007 and 2023 are used to evaluate the system risk
- LOLE risk is concentrated in a small number of weather years. For example,
  - Weather year 2010 accounts for roughly half of all summer LOLE
  - Remaining risk spread across many years
  - This highlights that adequacy risks are driven by tail-end events, under extreme-weather conditions
- Summer risk is focused in June to September, aligning with periods of highest load
- For each sample, all load years are evaluated and then weighted to arrive at an expected result. In the table to the right
  - The monthly data by load year is unweighted
  - The “Total” row/columns are weighted

Load Year	Weight	CCP 19 Summer						
		May	Jun	Jul	Aug	Sep	Oct	Total
2007	6.0%	-	0.000	-	0.002	-	-	0.000
2008	4.7%	-	0.000	-	-	-	-	0.000
2009	4.6%	-	-	-	0.000	-	-	0.000
2010	6.0%	-	-	0.283	0.148	-	-	0.026
2011	5.9%	-	-	0.113	-	-	-	0.007
2012	10.8%	-	0.000	0.006	-	-	-	0.001
2013	5.9%	-	-	0.086	-	-	-	0.005
2014	4.6%	-	-	-	-	-	-	-
2015	4.7%	-	-	0.001	-	0.015	-	0.001
2016	17.2%	-	-	0.001	0.009	-	-	0.002
2017	4.7%	-	0.000	0.001	-	-	-	0.000
2018	5.9%	-	-	0.018	0.052	-	-	0.004
2019	3.6%	-	-	0.006	0.008	-	-	0.001
2020	5.9%	-	-	0.029	0.001	-	-	0.002
2021	0.0%	-	-	-	-	-	-	-
2022	3.7%	-	-	0.016	0.004	-	-	0.001
2023	5.9%	-	-	0.007	-	0.023	-	0.002
Total	100.0%	-	0.000	0.033	0.014	0.002	-	0.050

LOLE Monthly Distribution by Load Year (Winter)

- In the winter season, load years between 2002 and 2023 are used to evaluate the system risk
- LOLE risk is concentrated in a small number of weather years. For example,
  - Winter 2002/03 and 2003/04 together contribute more than 50% of the total winter LOLE
  - Remaining risk spread across many years
  - This highlights that adequacy risks are driven by tail-end events, under extreme-weather conditions
- Winter risk clusters in December to February, aligning with periods of highest load
- For each sample, all load years are evaluated and then weighted to arrive at an expected result. In the table to the right
  - The monthly data by load year is unweighted
  - The "Total" row/columns are weighted

Load Year	Weight	CCP 19 Winter						
		Nov	Dec	Jan	Feb	Mar	Apr	Total
2002/03	12.3%	-	-	0.094	0.005	-	-	0.012
2003/04	2.7%	-	-	0.720	0.001	-	-	0.020
2004/05	4.3%	-	0.002	0.074	-	-	-	0.003
2005/06	0.0%	-	-	-	-	-	-	-
2006/07	4.9%	-	-	0.018	0.006	0.000	-	0.001
2007/08	4.0%	-	-	0.001	0.000	-	-	0.000
2008/09	6.2%	-	-	0.009	0.001	-	-	0.001
2009/10	0.0%	-	-	-	-	-	-	-
2010/11	2.4%	-	-	0.029	0.000	-	-	0.001
2011/12	0.0%	-	-	-	-	-	-	-
2012/13	14.2%	-	-	0.008	-	-	-	0.001
2013/14	0.4%	-	0.001	0.064	0.001	-	-	0.000
2014/15	4.0%	-	0.000	0.017	0.017	-	-	0.001
2015/16	5.7%	-	-	-	0.015	-	-	0.001
2016/17	0.0%	-	-	-	-	-	-	-
2017/18	2.4%	-	0.019	0.038	-	-	-	0.001
2018/19	3.8%	-	-	0.162	0.002	-	-	0.006
2019/20	0.0%	-	-	-	-	-	-	-
2020/21	0.0%	-	-	-	-	-	-	-
2021/22	0.0%	-	-	-	-	-	-	-
2022/23	32.6%	-	-	-	0.003	-	-	0.001
Total	100.0%	-	0.001	0.046	0.004	0.000	-	0.050

LOLH Monthly Distribution by Load Year

- LOLH risk is similarly distributed across different weather years

Load Year	Weight	CCP 19 Summer						
		May	Jun	Jul	Aug	Sep	Oct	Total
2007	6.0%	-	0.001	-	0.004	-	-	0.000
2008	4.7%	-	0.001	-	-	-	-	0.000
2009	4.6%	-	-	-	0.000	-	-	0.000
2010	6.0%	-	-	1.015	0.456	-	-	0.088
2011	5.9%	-	-	0.390	-	-	-	0.023
2012	10.8%	-	0.001	0.021	-	-	-	0.002
2013	5.9%	-	-	0.286	-	-	-	0.017
2014	4.6%	-	-	-	-	-	-	-
2015	4.7%	-	-	0.003	-	0.039	-	0.002
2016	17.2%	-	-	0.004	0.025	-	-	0.005
2017	4.7%	-	0.001	0.004	-	-	-	0.000
2018	5.9%	-	-	0.055	0.158	-	-	0.012
2019	3.6%	-	-	0.019	0.023	-	-	0.001
2020	5.9%	-	-	0.088	0.001	-	-	0.005
2021	0.0%	-	-	-	-	-	-	-
2022	3.7%	-	-	0.051	0.008	-	-	0.002
2023	5.9%	-	-	0.021	-	0.071	-	0.005
Total	**100.0%**	-	0.000	0.116	0.042	0.006	-	0.164

Load Year	Weight	CCP 19 Winter						
		Nov	Dec	Jan	Feb	Mar	Apr	Total
2002/03	12.3%	-	-	0.518	0.029	-	-	0.067
2003/04	2.7%	-	-	4.350	0.004	-	-	0.120
2004/05	4.3%	-	0.007	0.373	-	-	-	0.016
2005/06	0.0%	-	-	-	-	-	-	-
2006/07	4.9%	-	-	0.080	0.028	0.001	-	0.005
2007/08	4.0%	-	-	0.008	0.000	-	-	0.000
2008/09	6.2%	-	-	0.040	0.005	-	-	0.003
2009/10	0.0%	-	-	-	-	-	-	-
2010/11	2.4%	-	-	0.127	0.001	-	-	0.003
2011/12	0.0%	-	-	-	-	-	-	-
2012/13	14.2%	-	-	0.045	-	-	-	0.006
2013/14	0.4%	-	0.006	0.331	0.004	-	-	0.001
2014/15	4.0%	-	0.001	0.080	0.093	-	-	0.007
2015/16	5.7%	-	-	-	0.117	-	-	0.007
2016/17	0.0%	-	-	-	-	-	-	-
2017/18	2.4%	-	0.100	0.189	-	-	-	0.007
2018/19	3.8%	-	-	0.767	0.016	-	-	0.029
2019/20	0.0%	-	-	-	-	-	-	-
2020/21	0.0%	-	-	-	-	-	-	-
2021/22	0.0%	-	-	-	-	-	-	-
2022/23	32.6%	-	-	-	0.013	-	-	0.004
Total	**100.0%**	-	0.003	0.254	0.021	0.000	-	0.277

EUE Monthly Distribution by Load Year

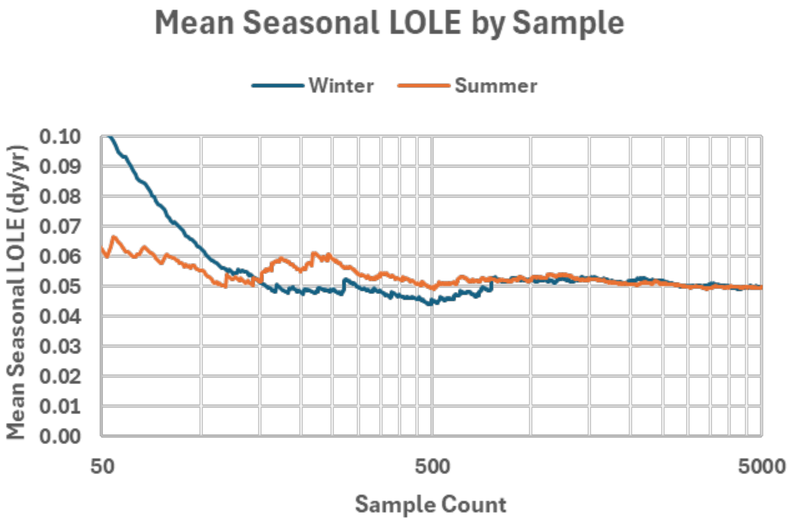
- EUE risk is similarly distributed across different weather years

Load Year	Weight	CCP 19 Summer						
		May	Jun	Jul	Aug	Sep	Oct	Total
2007	6.0%	-	1	-	2	-	-	0
2008	4.7%	-	1	-	-	-	-	0
2009	4.6%	-	-	-	0	-	-	0
2010	6.0%	-	-	1,321	434	-	-	105
2011	5.9%	-	-	403	-	-	-	24
2012	10.8%	-	0	15	-	-	-	2
2013	5.9%	-	-	275	-	-	-	16
2014	4.6%	-	-	-	-	-	-	-
2015	4.7%	-	-	1	-	29	-	1
2016	17.2%	-	-	1	15	-	-	3
2017	4.7%	-	0	2	-	-	-	0
2018	5.9%	-	-	43	109	-	-	9
2019	3.6%	-	-	16	17	-	-	1
2020	5.9%	-	-	68	0	-	-	4
2021	0.0%	-	-	-	-	-	-	-
2022	3.7%	-	-	42	5	-	-	2
2023	5.9%	-	-	17	-	51	-	4
Total	100.0%	-	0	130	36	4	-	171

Load Year	Weight	CCP 19 Winter						
		Nov	Dec	Jan	Feb	Mar	Apr	Total
2002/03	12.3%	-	-	745	37	-	-	96
2003/04	2.7%	-	-	7,456	7	-	-	205
2004/05	4.3%	-	6	478	-	-	-	21
2005/06	0.0%	-	-	-	-	-	-	-
2006/07	4.9%	-	-	113	37	2	-	7
2007/08	4.0%	-	-	11	0	-	-	0
2008/09	6.2%	-	-	49	9	-	-	4
2009/10	0.0%	-	-	-	-	-	-	-
2010/11	2.4%	-	-	175	0	-	-	4
2011/12	0.0%	-	-	-	-	-	-	-
2012/13	14.2%	-	-	59	-	-	-	8
2013/14	0.4%	-	8	461	4	-	-	2
2014/15	4.0%	-	1	103	111	-	-	9
2015/16	5.7%	-	-	-	167	-	-	9
2016/17	0.0%	-	-	-	-	-	-	-
2017/18	2.4%	-	140	270	-	-	-	10
2018/19	3.8%	-	-	1,197	26	-	-	46
2019/20	0.0%	-	-	-	-	-	-	-
2020/21	0.0%	-	-	-	-	-	-	-
2021/22	0.0%	-	-	-	-	-	-	-
2022/23	32.6%	-	-	-	15	-	-	5
Total	100.0%	-	4	396	27	0	-	427

Metric Convergence

- For each season, MARS was run for 5000 samples to ensure the expected LOLE result converges to 0.05 dy/yr
  - This expected result is the combination of load year weighting and averaging
  - As the number of samples increases, the confidence around the result increases



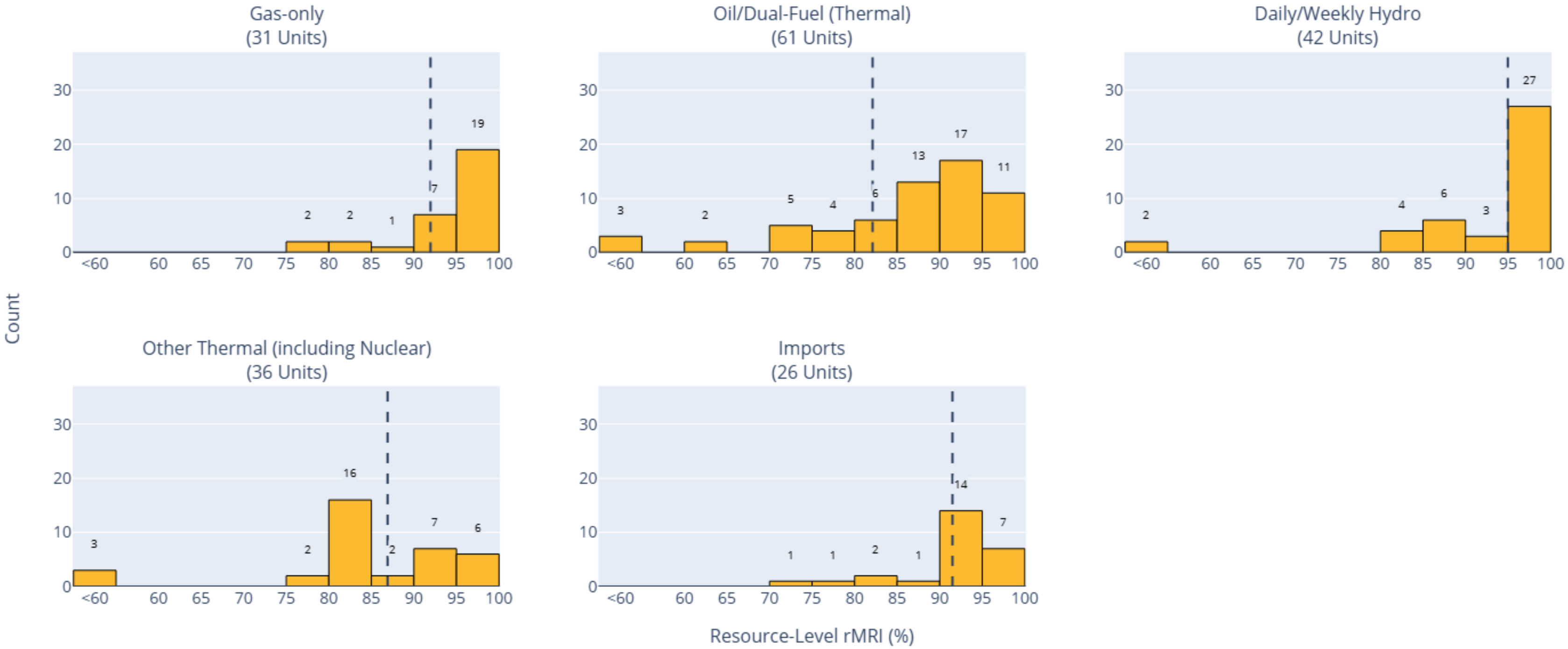
APPENDIX D: ADDITIONAL ACCREDITATION OUTPUTS FOR NEAR-TERM BASE CASE

Distributional Information on rMRI Values

- The following slides provide additional information on the distribution of rMRI values across resources by resource type

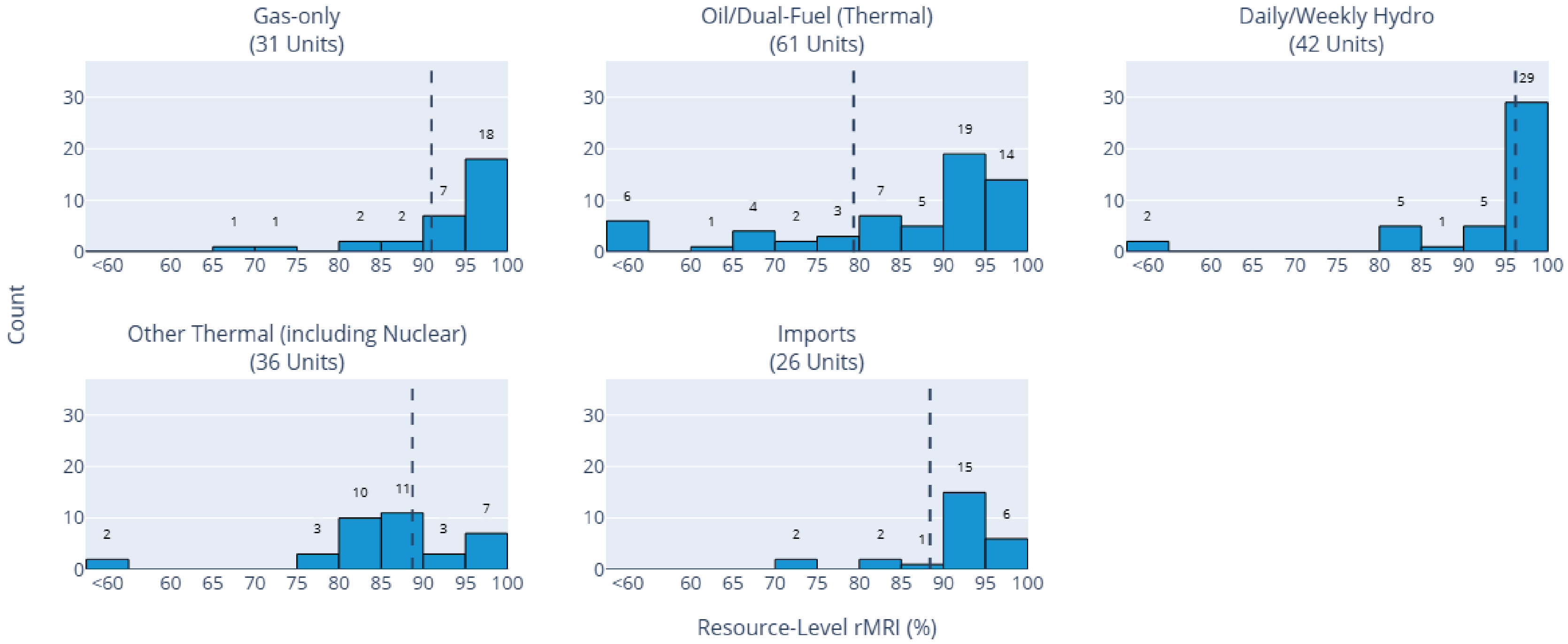
Summer rMRI Histogram of Thermal Modeled Resources

- rMRI distributions within each resource type generally mirror the underlying distribution of individual EFORd values. Most resource types cluster within a narrow band, while oil and dual-fuel units show a wider spread



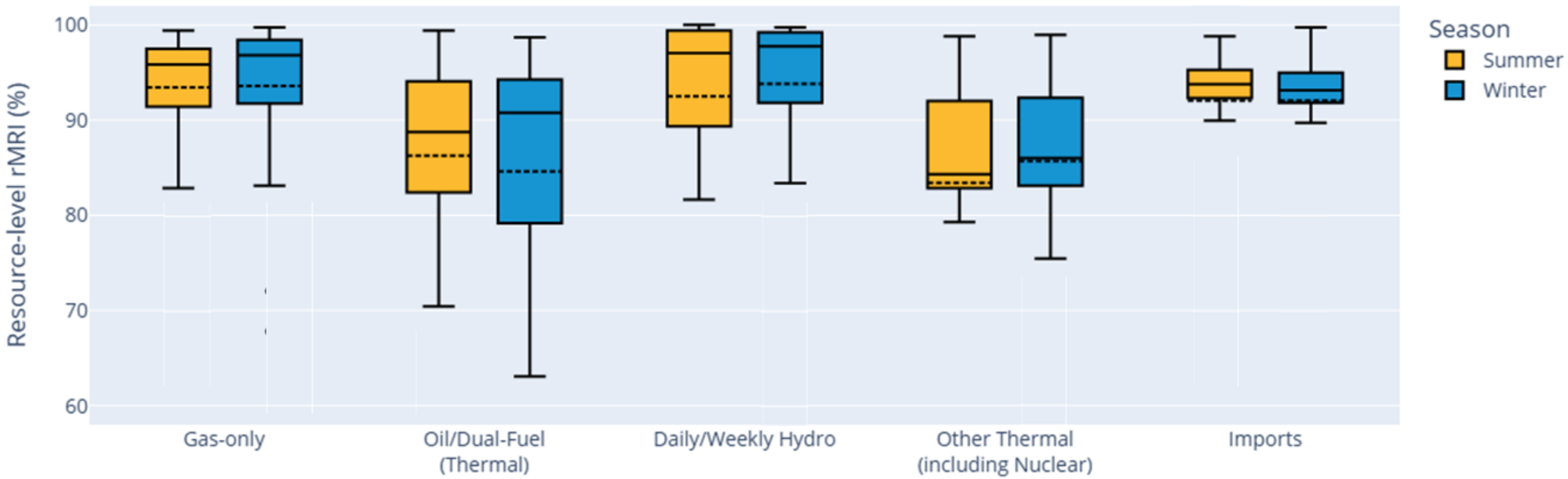
Winter rMRI Histogram of Thermal Modeled Resources

- Similar to summer, winter rMRI distribution for most resource types cluster within a narrow range, with oil and dual-fuel units showing a wider spread, reflecting underlying individual EFORd variations



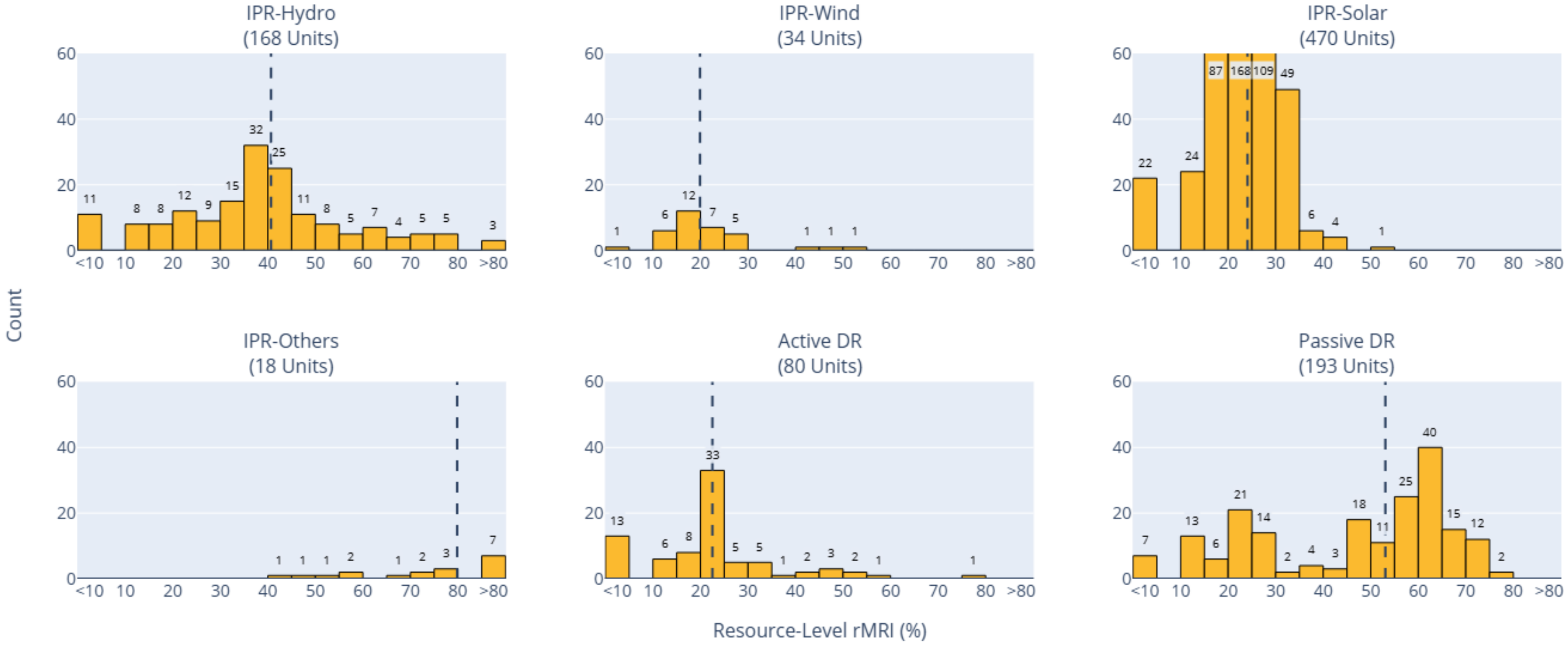
Seasonal rMRI of Thermal Modeled Resources

- rMRI values are generally similar between summer and winter



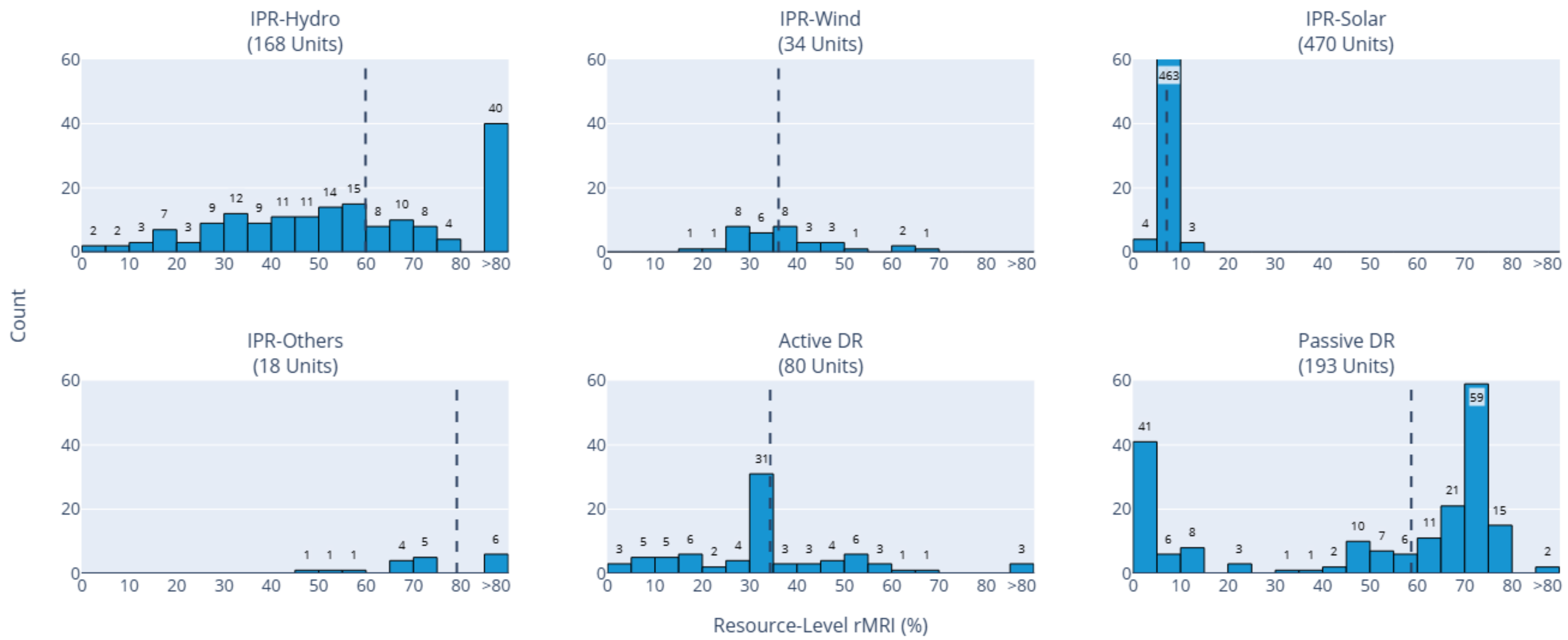
Summer rMRI Histogram for IPRs and DRs

- Unlike thermal-modeled resources, most IPRs show a wider rMRI spread, reflecting the unique variability of their hourly output. Solar is the exception, within tighter range due to its strong correlation with summer load



Winter rMRI Histogram for IPRs and DRs

- IPRs show a similar wider rMRI spread in winter



Seasonal rMRI of IPRs and DRs

- ADCR, hydro, wind, and solar demonstrate clear seasonal differences in rMRI, consistent with their seasonal output patterns typically observed in summer and winter
- Other IPR categories and PDR do not show strong seasonality but do display differences in the spread of their values
- PDR generally has higher rMRI than ADCR