

Revision 2



Resource Capacity Accreditation in the Forward Annual Capacity Market

Impact Analysis Market Clearing Results

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RCA Forward, Annual Design – Preliminary Impact Analysis Results

Proposed Effective Date: Forward Capacity Auction 19 (FCA 19) with a one-year delay

- The Resource Capacity Accreditation (RCA) project proposes improvements to ISO-NE's accreditation processes in the Forward Capacity Market (FCM) to further support a reliable, clean-energy transition by implementing methodologies that will more appropriately accredit resource contributions to resource adequacy as the resource mix transforms
- At the April 2024 Markets Committee (MC) meeting, the ISO reviewed seasonal performance factors and gas performance details for sensitivity scenarios 1-3
- This presentation provides market clearing results for the RCA impact analysis base case

Proposed Effective Date: Forward Capacity Auction 19 (FCA 19) with a one-year delay

Outline of today's discussion:

- Introduction (slides 4-7)
- Pre-RCA Case Clearing (slides 8-13)
- Post-RCA Case Clearing (slides 14-23)
- Impacts of RCA Proposal (slides 24-30)
- Conclusion (slides 31-32)
- Stakeholder Schedule (slides 33-35)
- Appendix (slides 36-45)

INTRODUCTION

Impact Analysis Phases

- The impact analysis has three phases
 - Phase 1: Base Case Resource Accreditation
 - [February 2024](#)
 - Phase 2: Resource Accreditation Sensitivities
 - [March 2024](#), [April 2024](#)
 - Phase 3: Base Case Capacity Market Clearing Impact
- This presentation summarizes market clearing results for the base case FCA 18/19 framework

Market Clearing Cases

- To compare pre-RCA market clearing with post-RCA market clearing, production FCA clearing software was run for two FCA 18/19 cases
 1. Pre-RCA case (status quo design)
 2. Post-RCA case (forward annual RCA design)
- Outcome differences reflect the **directional impact** of proposed RCA changes under the stated assumptions for the forward annual design
- Zonal demand curves were not considered

Disclaimer

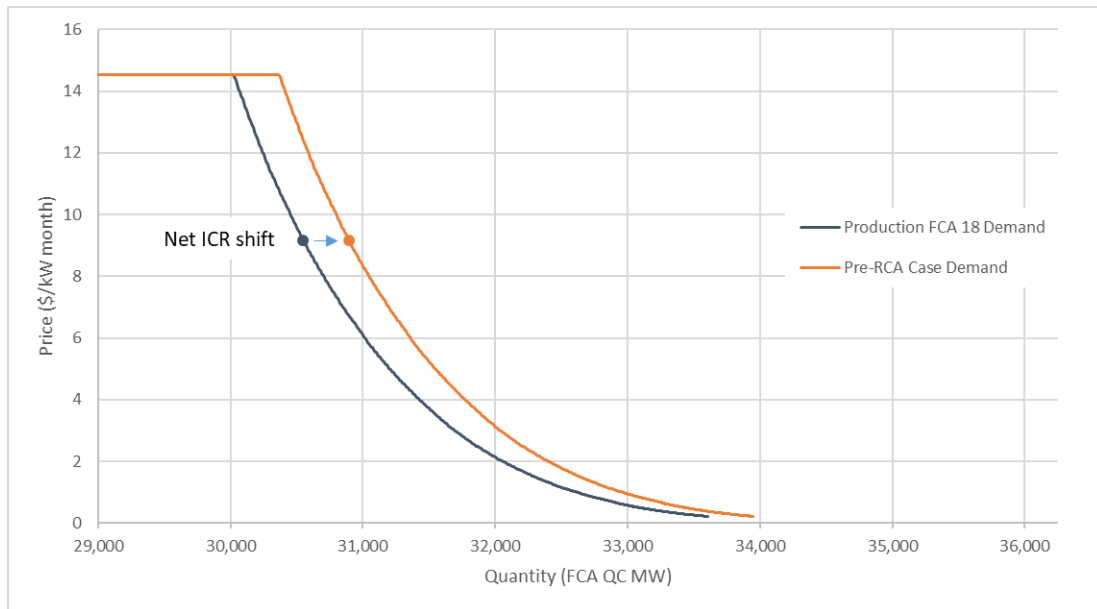
- These results represent the ISO's best efforts to reflect the proposed design; however, they do not reflect a full production-level implementation
- The results should be understood as indicative; no claim is made as to their validity under other assumptions
- Results are limited to the forward annual RCA design; they provide no information about outcomes under a potential prompt seasonal RCA design

PRE-RCA CASE CLEARING

Change from Production FCA 18

- The pre-RCA case is based on the status quo FCA design
 - Resource accreditation = FCA QC
 - Demand curve based on ICR model with status quo RAA assumptions
- The only difference between production FCA 18 and the pre-RCA case was the application of an updated assumption for annual peak load (FCA 18 → FCA 19)

Pre-RCA Case Demand Curve in FCA QC



- Updating annual peak from FCA 18 to FCA 19 increased Net Installed Capacity Requirement (Net ICR) by 344 MW
 - 30,550 MW → 30,894 MW
- Demand curve shape was otherwise unchanged

Pre-RCA Case Clearing Summary

- Clearing price = \$3.840/kW month
- Total CSO = 31,804 MW
- FCA revenue = \$1.478 billion

Pre-RCA Case Class Clearing

Class	FCA QC	CSO	Cleared %	Revenue
Dual Fuel	9,044	8,568	94.7%	\$394,817,910
Gas-only	7,862	7,632	97.1%	\$351,697,628
Other Non-IPR	4,264	3,779	88.6%	\$174,123,325
Passive DR	2,103	2,070	98.4%	\$95,408,548
Oil-only	2,822	2,319	82.2%	\$106,849,659
Energy Storage (pumped storage, battery)	3,801	3,430	90.2%	\$158,041,728
Import	2,525	601	23.8%	\$27,691,085
Other IPR	225	217	96.5%	\$10,357,908
ADCR	747	544	72.7%	\$25,048,166
IPR Wind	552	552	100.0%	\$45,834,547
IPR PV	576	485	85.0%	\$7,800,510
Hybrid (Config. 3 & 4)	256	250	94.3%	\$11,499,264
Fuel Cell	51	41	80.8%	\$1,895,316
Non-IPR Hydro	1,190	1,190	100.0%	\$54,854,922
IPR Hydro	127	127	100.0%	\$12,056,079
Total	36,145	31,804	88.0%	\$1,477,976,597

- Revenue was calculated using pre-RCA logic, which adjusts IPR winter CSOs
 - Hybrid resources were treated as non-IPR for the revenue calculation

Impact of IPR Winter CSO Adjustment

- Currently, IPR CSO in winter months is $CSO \times \frac{Winter\ QC}{Summer\ QC}$
 - If Winter QC > Summer QC, adjustment increases FCA revenue
 - IPR Wind, IPR Hydro
 - If Winter QC < Summer QC, adjustment decreases FCA revenue
 - IPR PV
- IPR winter CSO adjustment increased IPR revenue (and FCA revenue) by \$12.5 million

Class	Revenue	Hypothetical Revenue (remove IPR winter CSO adjustment)
Other IPR	\$10,357,908	\$10,004,383
IPR Wind	\$45,834,547	\$25,419,663
IPR PV	\$7,800,510	\$22,331,336
IPR Hydro	\$12,056,079	\$5,833,498

POST-RCA CASE CLEARING

RCA Changes to the RAA Modeling Assumptions

- The RCA proposal will make several changes to the Resource Adequacy Assessment (RAA) model, including but not limited to
 - Resource modeling enhancements
 - Load year adjustment (2002 → 2021 summer, 2013/14 winter)
 - Import inclusion rules
 - Tie benefit seasonality
- The post-RCA case reflects the RCA design, so the QC-denominated demand curve needed to be recalculated
 - Net ICR and MRIs used in demand curve construction must be updated

Net ICR Calculation

Revision 1

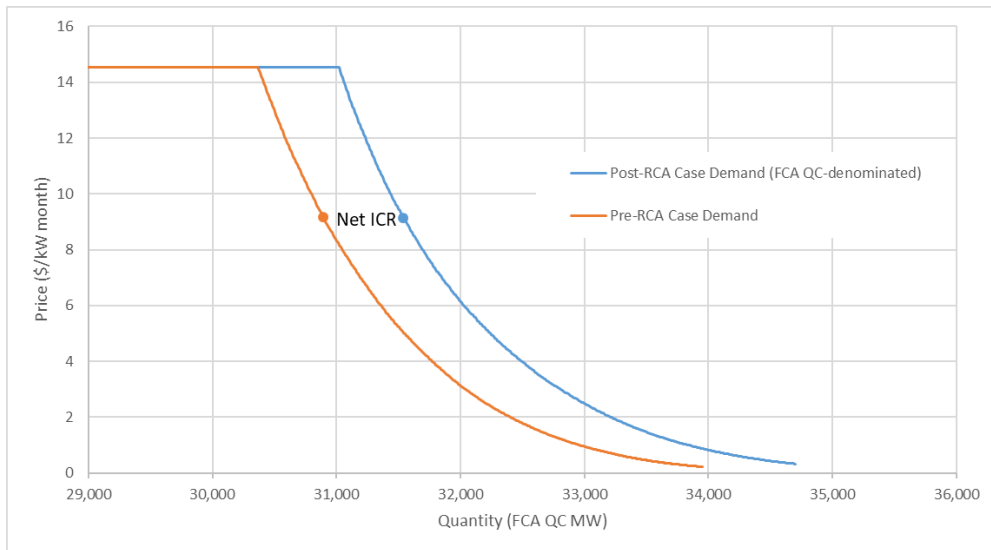
Total MW Breakdown	FCA18/19 Base Case (Summer QC MW)
Generating Capacity Resources	29,618
Demand Resources	3,058
Import Capacity Resources	1,188
Tie Benefits	2,115
OP-4 Actions 6 & 8 (Voltage Reduction)	262
Minimum System Reserve	(700)
Total MW	35,613
Other Details	
Annual Peak (50/50)	27,748
ALCC	2,044
Net ICR	31,540

← Correction to [February 2024](#)

← Net ICR is 67 MW lower than previously presented

Post-RCA Demand Curve in FCA QC

Revision 1



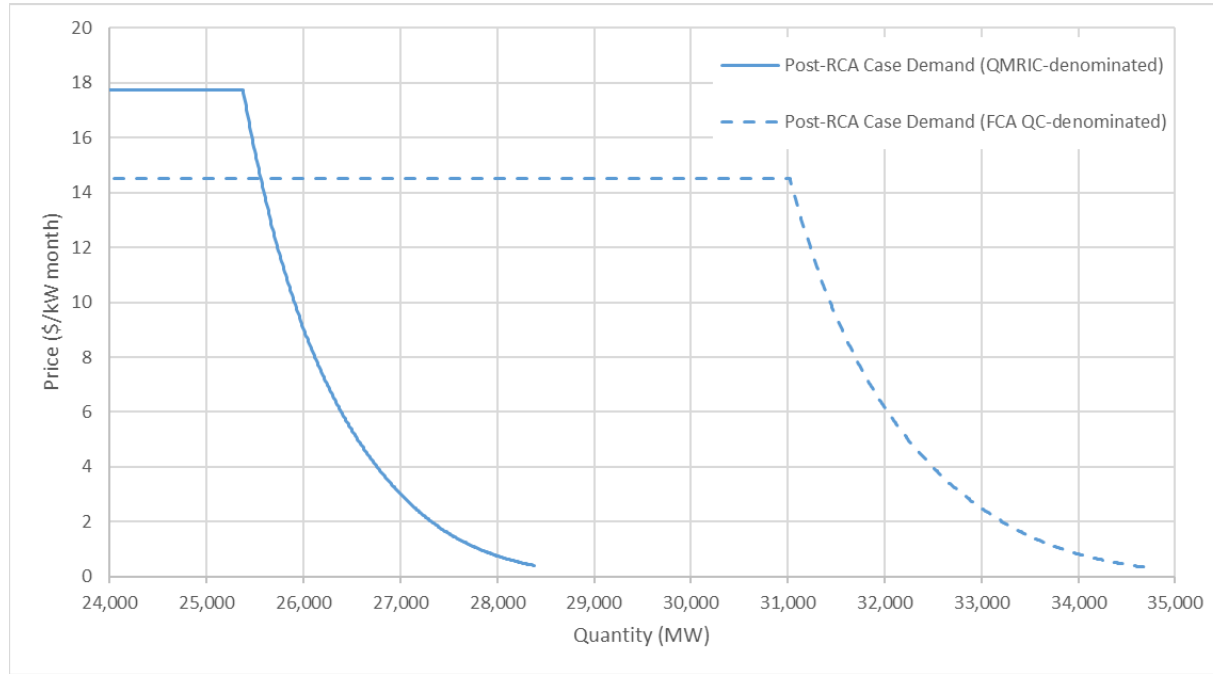
- Net ICRs (in terms of QC) were
 - Pre-RCA case: 30,894 MW
 - See Slide 10
 - Post-RCA case: 31,540 MW
 - See Slide 16
- Rightward demand curve shift implies the need for more QC than estimated by existing RAA model

Converting Post-RCA Demand Curve to QMRIC

- Because the post-RCA QMRIC case clears QMRIC, the post-RCA demand curve must be converted from QC to QMRIC
- For this conversion, the ratio $\frac{\sum QMRIC}{\sum Summer QC}$ was used*
 - In base case accreditation,
$$\frac{\sum QMRIC}{\sum Summer QC} = \frac{27,721}{33,903} = 0.818$$
 - Demand curve quantity was multiplied by 0.818
 - Demand curve price was divided by 0.818

* [February 2024 presentation](#) incorrectly divided by $\sum FCA QC$ instead of $\sum Summer QC$

Post-RCA Demand Curve in QMRIC



- Relative to the FCA QC-denominated demand curve, prices increased and quantities decreased
 - Steeper slope ↘

Converting Supply Curve to QMRIC

- Production FCA 18 data contains FCA QC-based supply offers
 - All capacity remaining at Descending Clock Auction’s final end-of-round price was assigned a price of \$0/kW month, consistent with the current “price-taking” assumption
 - Different assumption would change clearing results
- Resource-level, aggregation-level, or class-level rMRIs (as appropriate) from [February 2024](#) were used for offer adjustment
 - Production FCA QC was multiplied by rMRI to obtain QMRIC offer quantity
 - Production price was divided by rMRI to obtain QMRIC offer price
- Just like the QMRIC demand curve, the QMRIC supply curve is steeper than the QC supply curve
 - Steeper slope ↗

Post-RCA Case Clearing Summary

- Clearing price = \$5.153/kW month
- Total CSO (financial) = 26,524 MW
 - Total Summer Effective CSO (ECSO; physical) = 33,487 MW
 - Total Winter ECSO (physical) = 33,270 MW

See Appendix for CSO → ECSO conversion
- FCA revenue = \$1.640 billion

Post-RCA Case Class Clearing

Class	QMRIC	CSO	Cleared %	Summer ECSO	Winter ECSO	Revenue
Dual Fuel	7,949	7,651	96.3%	8,717	9,247	\$473,106,989
Gas-only	6,351	6,314	99.4%	7,812	8,489	\$390,435,967
Other Non-IPR	3,914	3,635	92.9%	3,828	3,841	\$224,748,569
Passive DR	2,156	2,134	99.0%	2,267	2,056	\$131,933,042
Oil-only	2,219	1,522	68.6%	2,130	2,382	\$94,090,276
Energy Storage (pumped storage, battery)	1,973	1,618	82.0%	2,925	2,888	\$100,039,270
Import	2,402	811	33.8%	2,431	535	\$50,154,128
Other IPR	209	209	100.0%	225	239	\$12,941,904
ADCR	423	311	73.5%	552	570	\$19,230,625
IPR Wind	677	677	100.0%	552	1,216	\$41,865,322
IPR PV	228	177	77.8%	457	0	\$10,971,561
Hybrid (Config. 3 & 4)	108	89	82.7%	232	184	\$5,503,528
Fuel Cell	45	37	80.8%	41	42	\$2,265,238
Non-IPR Hydro	1,148	1,148	100.0%	1,191	1,251	\$71,000,837
IPR Hydro	191	191	100.0%	127	329	\$11,823,538
Total	29,993	26,524	88.4%	33,487	33,270	\$1,640,110,794

- Revenue was calculated using post-RCA logic, which does not adjust IPR winter CSOs

Impact of IPR Winter CSO Adjustment Removal

- Removing the IPR winter CSO adjustment decreased IPR revenue (and FCA revenue) by \$42.2 million

Class	Revenue	Hypothetical Revenue (keep IPR winter CSO adjustment)
Other IPR	\$12,941,904	\$13,516,755
IPR Wind	\$41,865,322	\$75,984,932
IPR PV	\$10,971,561	\$3,657,187
IPR Hydro	\$11,823,538	\$26,667,634

IMPACTS OF RCA PROPOSAL

RCA Impact on Cleared %

- *Implied rMRI = Total QMRIC / Total FCA QC*
 - Differences from [February 2024](#) class averages are due to the presence of new resources and QC differences between RAA model and production FCA 18
- Classes with higher (lower) than average implied rMRIs generally had higher (lower) cleared % in the post-RCA case
 - Higher rMRI → Lower QMRIC offer price
 - Lower rMRI → Higher QMRIC offer price
- The ADCR class did not follow this pattern
 - Price-taking QC offers become price-taking QMRIC offers

Class	Implied rMRI	Cleared %	
		Pre-RCA QC	Post-RCA QMRIC
Dual Fuel	0.879	94.7%	96.3%
Gas-only	0.808	97.1%	99.4%
Other Non-IPR	0.918	88.6%	92.9%
Passive DR	1.025	98.4%	99.0%
Oil-only	0.786	82.2%	68.6%
Energy Storage (pumped storage, battery)	0.519	90.2%	82.0%
Import	0.951	23.8%	33.8%
Other IPR	0.930	96.5%	100.0%
ADCR	0.566	72.7%	73.5%
IPR Wind	1.227	100.0%	100.0%
IPR PV	0.395	85.0%	77.8%
Hybrid (Config. 3 & 4)	0.420	94.3%	82.7%
Fuel Cell	0.891	80.8%	80.8%
Non-IPR Hydro	0.965	100.0%	100.0%
IPR Hydro	1.510	100.0%	100.0%
Resource mix	0.830		

RCA Impact on Quantities and Prices

	Pre-RCA Case	Post-RCA Case	Delta
Accredited Quantity	36,145 MW	29,993 MW	-17.0%
Total CSO	31,804 MW	26,524 MW	-16.6%
Clearing Price	\$3.840/kW month	\$5.153/kW month	+34.2%

- Ignoring IPR winter CSO rules,
$$FCA\ revenue = Total\ CSO \times Clearing\ price \times 12,000$$
- Impact of deltas on FCA revenue is multiplicative, not additive
 - Ignoring IPR winter CSO rules, FCA revenue should increase by 11.9%
$$(1 + \Delta CSO) \times (1 + \Delta Price) - 1 = (1 - 0.166) \times (1 + 0.342) - 1 = 0.119$$

Factors Impacting Class Revenue

- Class revenue differences between pre-RCA clearing and post-RCA clearing are driven by several factors
 - Non-IPR classes
 - Clearing price (p) } Affects price
 - rMRI (r) } Affects quantity
 - Cleared % (c) }
 - IPR classes
 - Clearing price (p) } Affects price
 - rMRI (r) }
 - Cleared % (c) } Affects quantity
 - IPR winter CSO adjustment (w) }

RCA Impact on Revenue

Class	Implied rMRI	Cleared %		Revenue				Main Drivers
		Pre-RCA QC	Post-RCA QMRIC	Pre-RCA QC	Post-RCA QMRIC	Delta		
Dual Fuel	0.879	94.7%	96.3%	\$394,817,910	\$473,106,989	\$78,289,079	19.8%	p, r
Gas-only	0.808	97.1%	99.4%	\$351,697,628	\$390,435,967	\$38,738,339	11.0%	p, r
Other Non-IPR	0.918	88.6%	92.9%	\$174,123,325	\$224,748,569	\$50,625,244	29.1%	p, r, c
Passive DR	1.025	98.4%	99.0%	\$95,408,548	\$131,933,042	\$36,524,494	38.3%	p
Oil-only	0.786	82.2%	68.6%	\$106,849,659	\$94,090,276	-\$12,759,383	-11.9%	p, r, c
Energy Storage (pumped storage, battery)	0.519	90.2%	82.0%	\$158,041,728	\$100,039,270	-\$58,002,458	-36.7%	p, r, c
Import	0.951	23.8%	33.8%	\$27,691,085	\$50,154,128	\$22,463,044	81.1%	p, c
Other IPR	0.930	96.5%	100.0%	\$10,357,908	\$12,941,904	\$2,583,995	24.9%	p, r, w
ADCR	0.566	72.7%	73.5%	\$25,048,166	\$19,230,625	-\$5,817,541	-23.2%	p, r
IPR Wind	1.227	100.0%	100.0%	\$45,834,547	\$41,865,322	-\$3,969,225	-8.7%	p, r, w
IPR PV	0.395	85.0%	77.8%	\$7,800,510	\$10,971,561	\$3,171,052	40.7%	p, r, c, w
Hybrid (Config. 3 & 4)	0.420	94.3%	82.7%	\$11,499,264	\$5,503,528	-\$5,995,736	-52.1%	p, r, c
Fuel Cell	0.891	80.8%	80.8%	\$1,895,316	\$2,265,238	\$369,922	19.5%	p, r
Non-IPR Hydro	0.965	100.0%	100.0%	\$54,854,922	\$71,000,837	\$16,145,915	29.4%	p
IPR Hydro	1.510	100.0%	100.0%	\$12,056,079	\$11,823,538	-\$232,541	-1.9%	p, r, w
Resource mix	0.830			\$1,477,976,597	\$1,640,110,794	\$162,134,198	11.0%	

- FCA revenue was 11.0% higher in the post-RCA clearing

Implied Clearing Reliability

- Because of the RCA project's RAA improvements, the post-RCA demand curve better reflects system reliability
 - Each point on the demand curve has a specific LOLE

	Total CSO	Post-RCA Demand Curve LOLE
Pre-RCA Clearing	31,804	0.0814
Post-RCA Clearing	26,524	0.0508

- The post-RCA demand curve indicates a “longer” clearing from the post-RCA case

RCA Impact on Consumer Cost

- To convert FCA revenue into ¢/kWh, leveraging expected energy use from June 2028 – May 2029 (FCA 19) would be preferred
 - Unfortunately, this energy use forecast is not available
- Bounds can still be established using calendar year forecasts
 - 2028 annual energy use forecast, [2023 CELT](#) = 133,214 GWh
 - 2029 annual energy use forecast, 2023 CELT = 136,526 GWh

	2028 Energy Use	2029 Energy Use
Pre-RCA Clearing	1.11¢/kWh	1.08¢/kWh
Post-RCA Clearing	1.23¢/kWh	1.20¢/kWh
Delta	+10.8%	+11.1%

CONCLUSION

Conclusion

- Using the assumptions detailed in this presentation, clearing results were provided for a pre-RCA QC case and a post-RCA case
 - Post-RCA clearing had ↑ clearing price, ↑ FCA revenue, longer system based on post-RCA demand curve
- FCA consumer cost increased ~11% for the post-RCA clearing
- Different offer and resource mix assumptions could produce different conclusions

STAKEHOLDER SCHEDULE

Parallel Stakeholder Processes

- The ISO has recommended taking additional time to prepare for CCP 19 to develop a seasonal, prompt capacity market and has [filed a request to further delay FCA 19](#) with the Commission
- While the FCA 19 further delay filing is pending before the Commission, ISO is continuing to develop and prepare to implement RCA in a forward, annual construct in 2026
 - As noted in the ISO's [March MC material](#), if FEREC accepts the further delay, ISO will focus on evaluating scope and phasing of work for a combined accreditation design with a seasonal/prompt capacity market to implement for CCP 19 and would target discussing initial scope considerations with the MC in July
- Below are the parallel stakeholder processes associated with these CCP 19-related efforts

		2023			2024											
		Q4			Q1			Q2			Q3			Q4		
		O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
RCA Forward, Annual Design	Refresher	Conceptual and Detail Design					Final Design, Review Tariff, and Amendments			MC/RC Vote	PC Vote; File		Eff. Date			
RCA Forward, Annual IA			Review revised input assumptions and scenarios	Review Base Case Resource Accreditation	Review Resource Accreditation Sensitivities			Review Base Case Capacity Market Impact			Final Report					
Alternative FCM Commitment Horizons	Analysis - Scope & Methodology	Analysis Findings & Stakeholder Feedback		ISO recommendation on whether to develop prompt proposal If recommending to develop prompt proposal, introduce additional delay to FCA 19	MC Vote on additional FCA 19 delay	PC Vote on additional FCA 19 delay; File	Eff. Date									

Questions



APPENDIX

PRE-RCA CASE

Demand Curve Update

Consequence of Annual Peak Change

- What changes when updating annual peak from FCA 18 to FCA 19?
 - Net Installed Capacity Requirement (Net ICR) and therefore the demand curve
- How does Net ICR change?

$$\text{Net ICR} = \frac{\text{Generation} + \text{Demand Resources} + \text{Imports}}{1 + \frac{\text{Additional Load Carrying Capacity (ALCC)}}{\text{Annual Peak}}}$$

where ALCC is selected so LOLE = 0.1

- Generation, demand resources, and imports are supply-side values and do not change
- ALCC and Annual Peak are demand-side values and do change

Consequence of Annual Peak Change, continued

- Pre-RCA, annual peak and ALCC additively scale the load profile

Simulated hourly load

$$= \text{Nominal hourly load} \times (\text{Annual peak} + \text{ALCC})$$

- In the absence of supply-side changes, LOLE is the same as long as annual peak + ALCC is the same

Net ICR Change

- According to [2023 CELT](#),
 - FCA 18 annual peak, net BTM PV = 27,440 MW
 - FCA 19 annual peak, net BTM PV = 27,748 MW
- FCA 19 annual peak is 308 MW higher → ALCC must be 308 MW lower to maintain LOLE = 0.1
 - Production FCA 18 ALCC = 1,985 MW
 - Pre-RCA case ALCC = 1,677 MW

Demand Curve Change

- Pre-RCA case Net ICR = 30,894 MW

$$\text{Pre - RCA QC Case Net ICR} = \frac{\text{Generation} + \text{Demand Resources} + \text{Imports}}{1 + \frac{\text{Additional Load Carrying Capacity (ALCC)}}{\text{Annual Peak}}} = \frac{29,619 + 3,058 + 84}{1 + \frac{1,677}{27,748}} = 30,894 \text{ MW}$$

- Production FCA 18 Net ICR = 30,550 MW
- Since the Net ICR point anchors the demand curve, the pre-RCA case's demand curve is the production FCA 18 demand curve shifted right by 344 MW

CSO TO ECSO CONVERSION

ECSO is a Seasonal Concept: Resources will have a Summer and Winter ECSO

Presented
November 2022 MC /RC Meeting

- A resource's ECSO is the quantity modeled in the RAA process that provides the reliability benefit implied by their CSO (for non-intermittent resources)
- Because resources can have different summer and winter QC values, the RAA process models different quantities of the resources in the summer and winter
- Resources that have different summer and winter QC values will have summer and winter ECSO values, where the seasonal ECSO value will equal the portion of that season's QC that cleared out of the FCA:

$$\text{Seasonal ECSO} = \text{Seasonal QC} * \frac{\text{CSO}}{\text{QMRIC}}$$

PARTICIPANT REQUESTS

More Granular Results

Revision 2

Distinction	Pre-RCA Case				Post-RCA Case			
	FCA QC	CSO	Cleared %	Revenue	QMRIC	CSO	Cleared %	Revenue
Dual Fuel, Fast Start	1,780	1,780	100.0%	\$82,040,095	1,578	1,578	100.0%	\$97,570,901
Dual Fuel, Non-Fast Start	7,264	6,788	93.4%	\$312,777,815	6,371	6,073	95.3%	\$375,536,088
Oil-only, Fast Start	845	801	94.8%	\$36,921,416	724	688	95.1%	\$42,554,237
Oil-only, Non-Fast Start	1,977	1,518	76.8%	\$69,928,243	1,495	833	55.7%	\$51,536,039
RFO-only	1,916	1,457	76.0%	\$67,127,040	1,445	783	54.2%	\$48,401,758
DFO-only	906	862	95.1%	\$39,722,619	775	739	95.4%	\$45,688,518
Combined Cycle	12,954	12,725	98.2%	\$586,349,107	11,024	10,987	99.7%	\$679,380,198
Gas Turbine	2,969	2,825	95.1%	\$130,159,365	2,567	2,543	99.1%	\$157,277,454

- These more granular results are consistent with the provided class-level values
- The most significant changes occurred for oil-only, non-fast start resources and RFO-only resources
 - Relatively high xEFORd → lower QMRIC accreditation and higher QMRIC offer price → lower cleared quantity