Congestion Revenue Rights discussion

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General Session

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ISO's efforts on CRRs

- ISO is in the process of a holistic assessment of the CRR market performance
  - Auction efficiency
  - Revenue adequacy
  - Pro-rata funding logic
- Tackling the drivers of one of them will have collateral implications for the others
- ISO implemented a targeted enhancement in early September to address settlement impacts due to application of shift factor threshold
- This presentation is a partial update on the ongoing performance analysis on CRRs

CRR enhancements implemented since 2017

Analysis Phase. Nov 2017**:**
Understand the drivers to guide the policy discussion

Phase 0. First half of 2018.
Enhance ISO processes under existing Tariff requirements

Phase 1A. 2019 Annual process:
Additional reporting requirements for transmission outages
Elimination of non-delivery paths

Phase 1B. 2019:
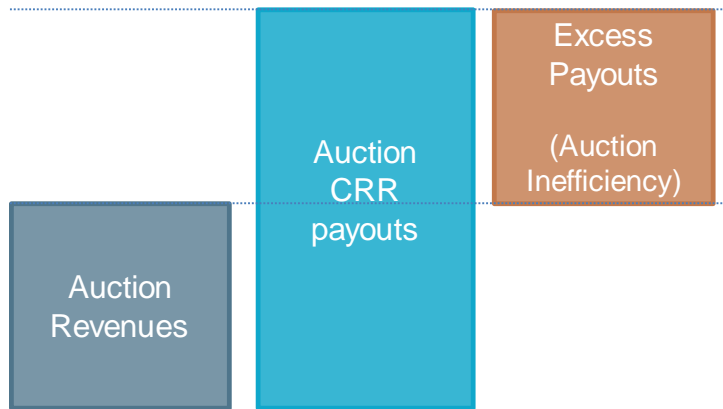Pro-rata funding for CRRs on a constraint by constraint basis
Capacity released in annual allocation reduced from 75% to 65%

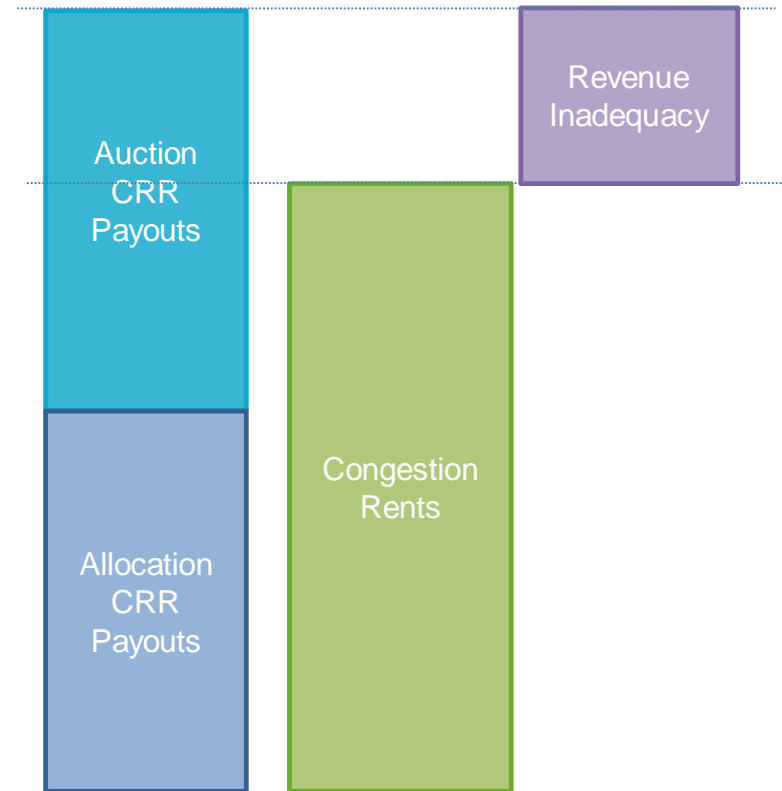**Targeted Enhancement**. September 2023.
Reduction of shift factor threshold to aggregated locations

The dichotomy between Revenue Adequacy and Auction Efficiency

Auction efficiency is about how well CRR auctions price discover DA congestion

Revenue adequacy is about how well CRR processes converge to DA market

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# There are some nuances about the basic concept of auction efficiency

- Auction efficiency is measured as the difference between the CRR payments relative to the auction revenues for auctioned CRRs

  Excess payout = CRR payout – auction revenues

- This does not consider the value of money over time

- This does not reflect the risk premium associated with CRRs

- The drivers for excess payouts are diverse

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The condition of CRR payments greater than Auction revenues (excess payouts) arises from more nuanced interplays between the CRR processes

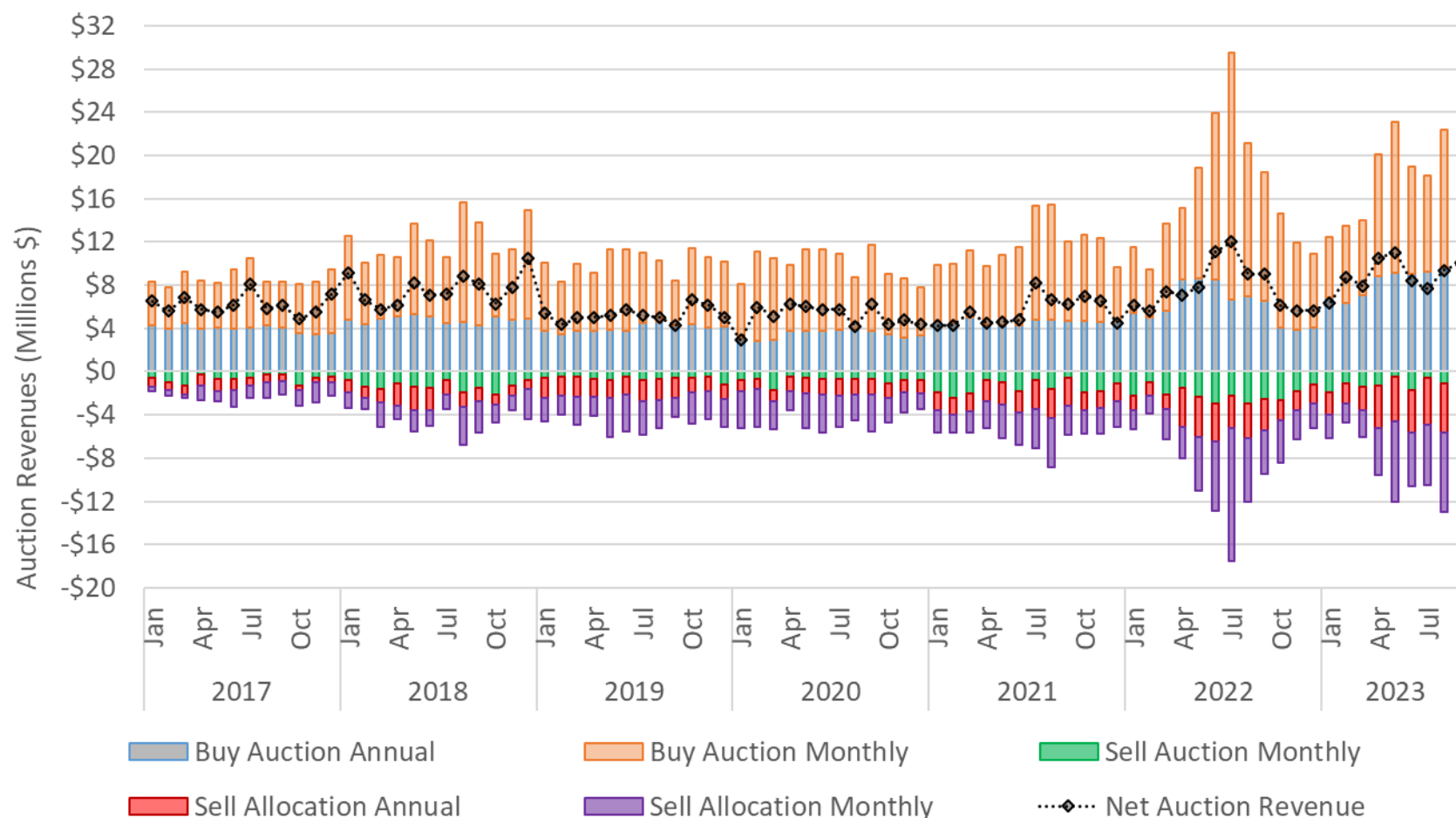A : Annual
M : Monthly
Migration: CRRs transferred between LSEs
due to load migration
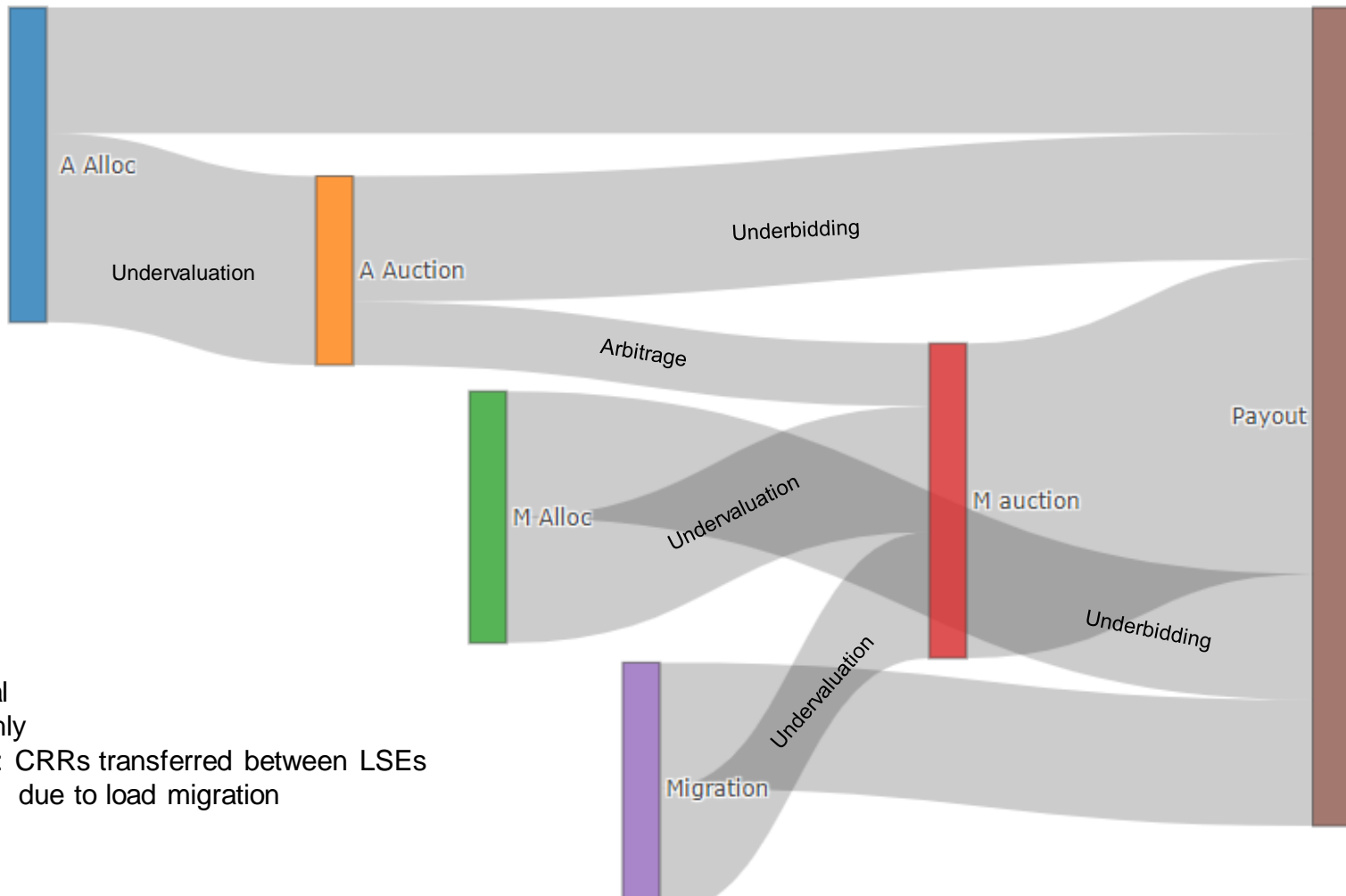
Auction revenues have increased over the years and have been evenly collected between annual and monthly auctions
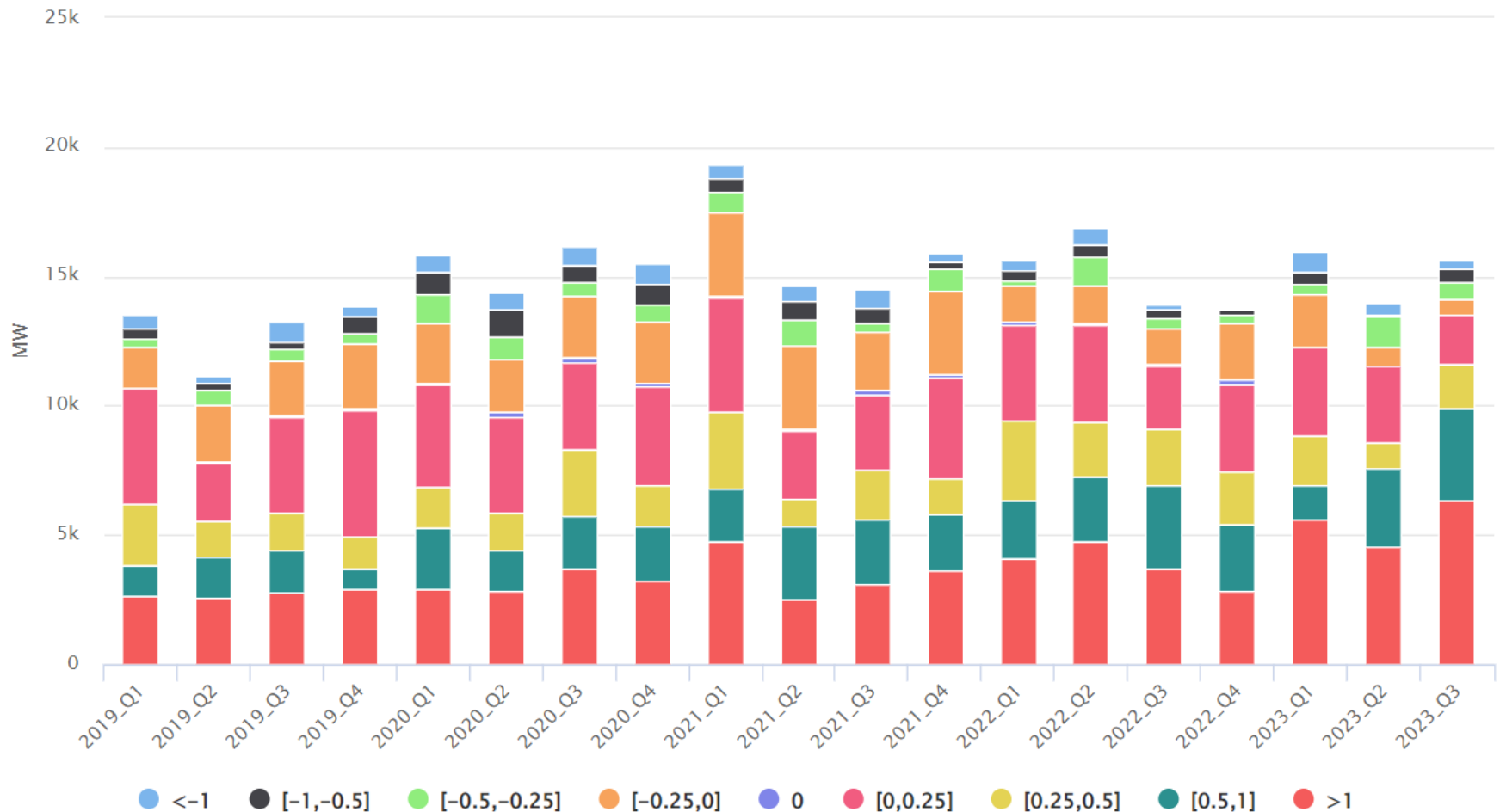

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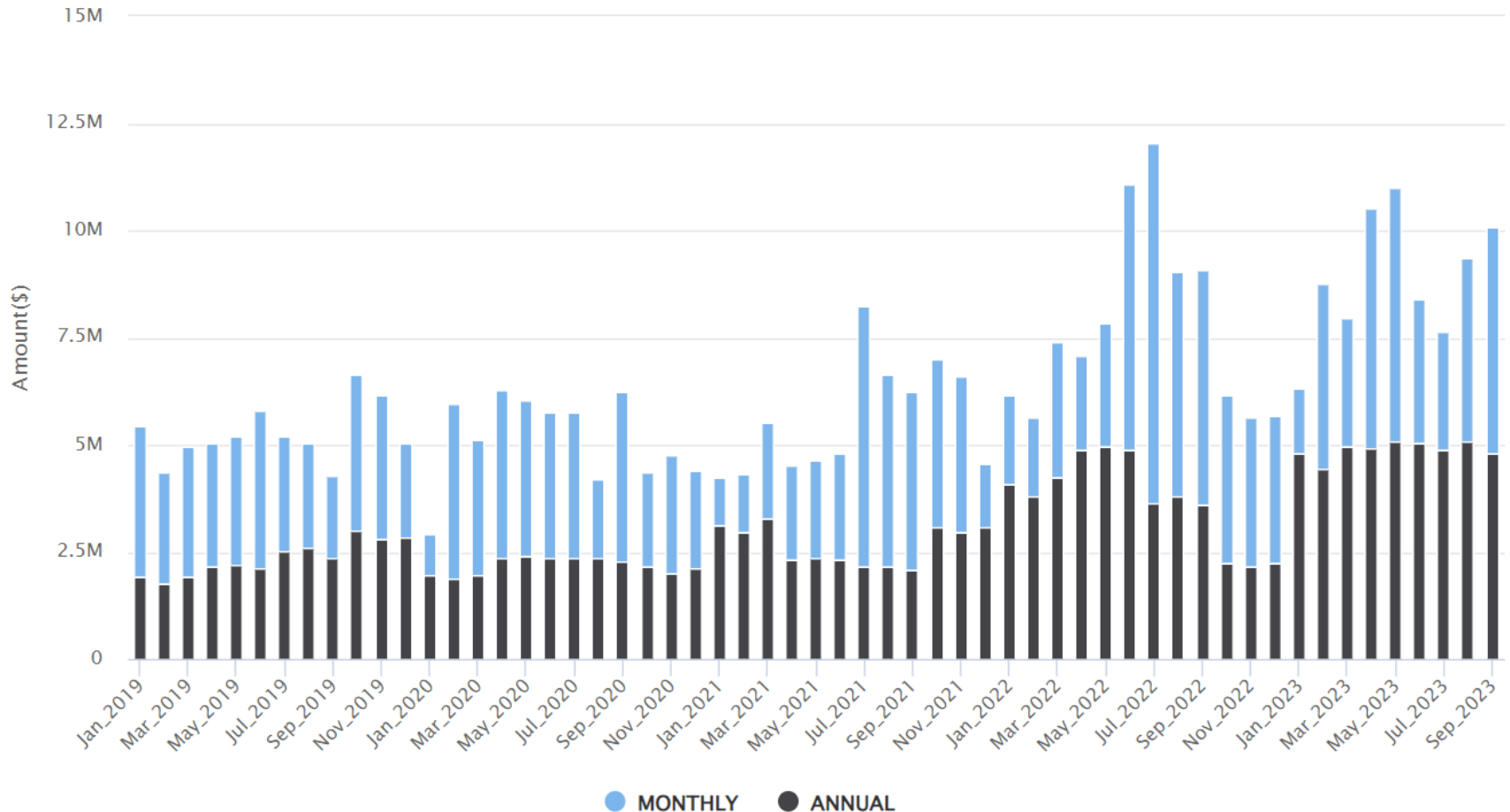
With buy and sell capability in the CRR auctions, sell-type CRRs are becoming an increasing share of the auction activity
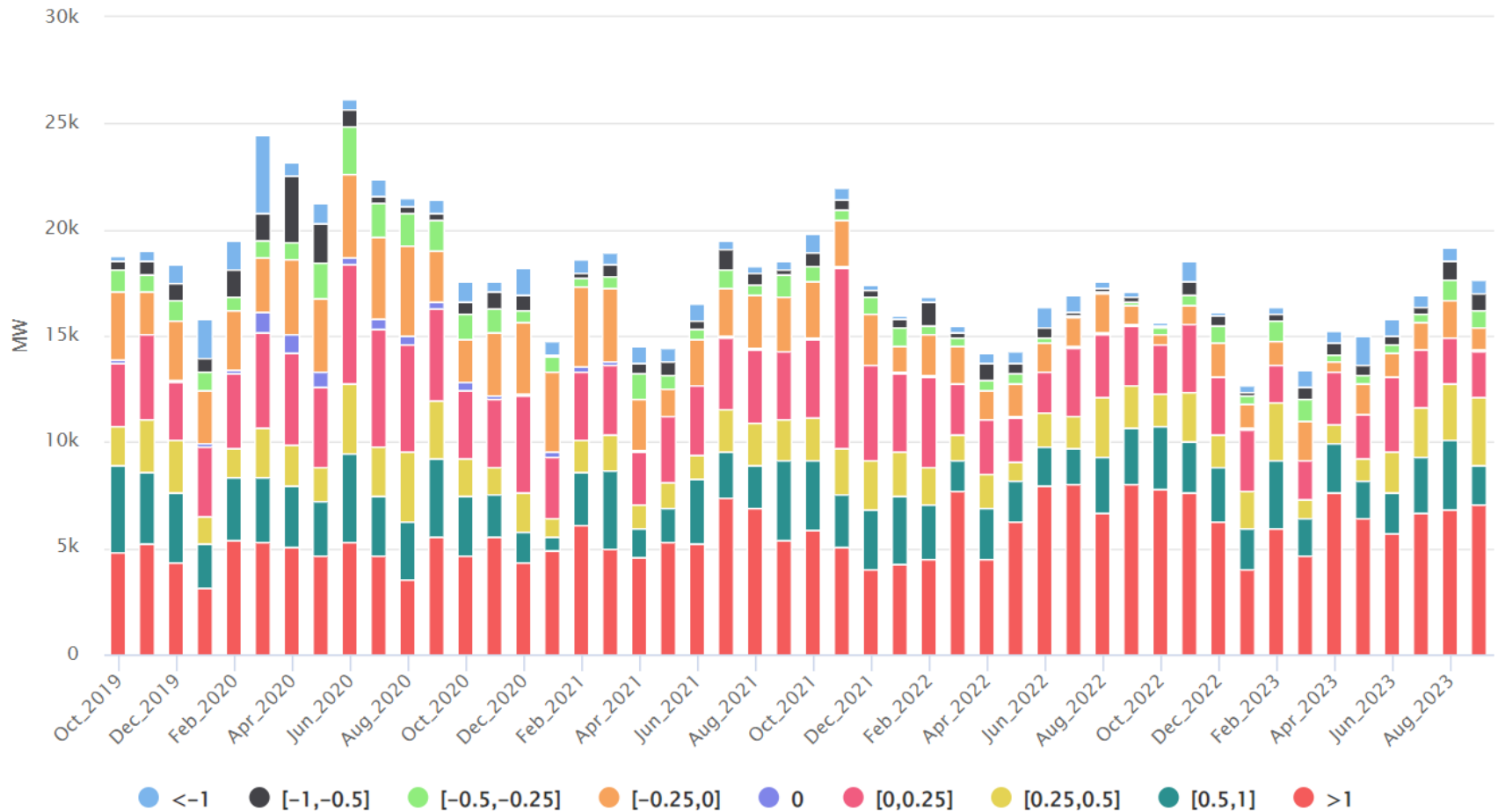
Annual auction price distribution for on-peak period shows the CRR awards in a diverse range of prices

Monthly auction price distribution for on-peak period shows the CRR awards in a diverse range of prices

Revenue adequacy at the system level is at 81 percent with $540 million shortfall
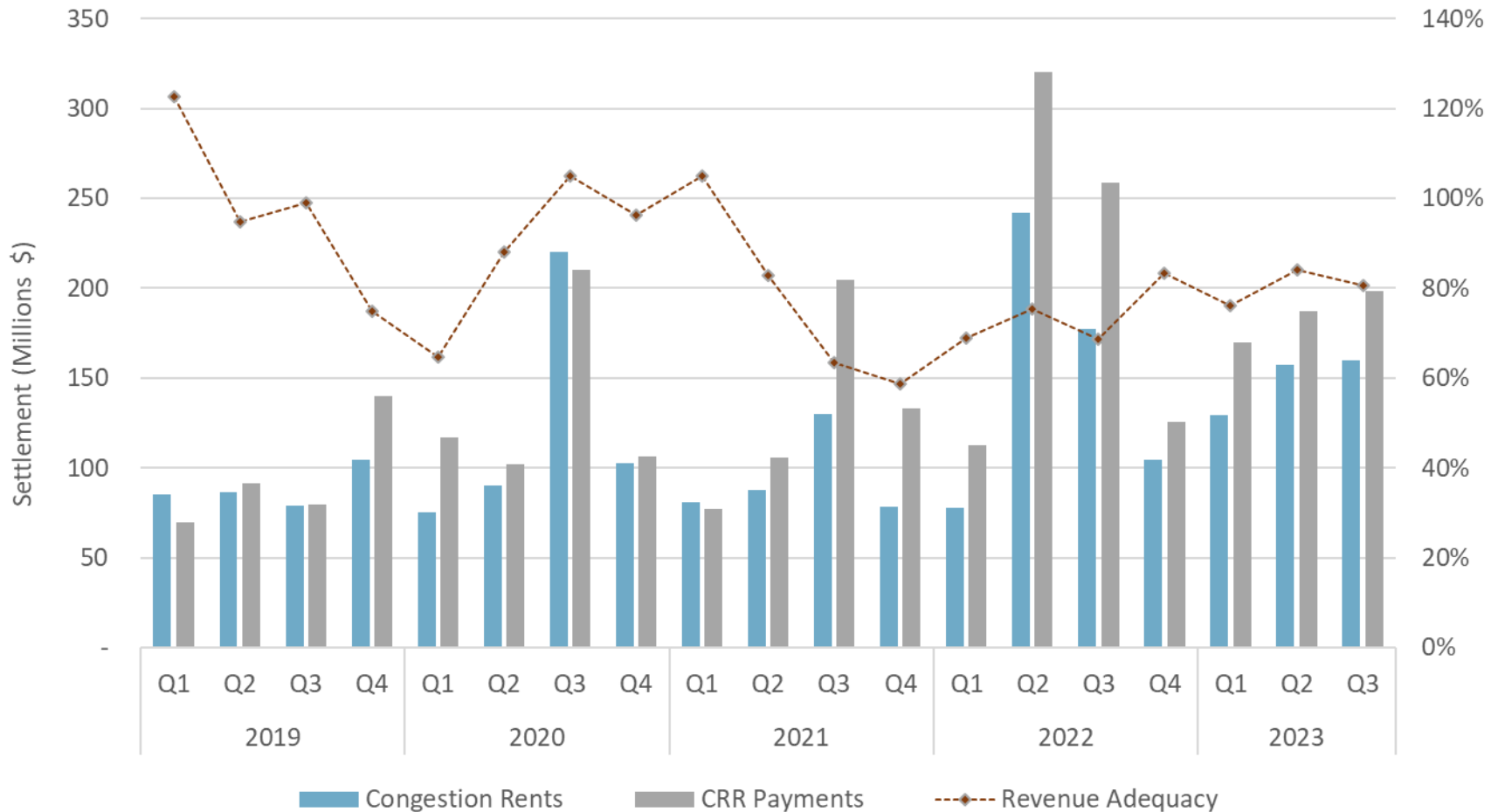
This is the natural revenue adequacy (CRR payments at full notional value less congestion rents). It does not include auction revenues. Although this metric is no longer settled since there is pro-rata funding, it is meaningful to assess the convergence of CRRs towards DAM.

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Pro-rata adjustments reduced CRR payouts to auction CRRs, raising the ratio of auction price to payouts from 49 percent to 65 percent
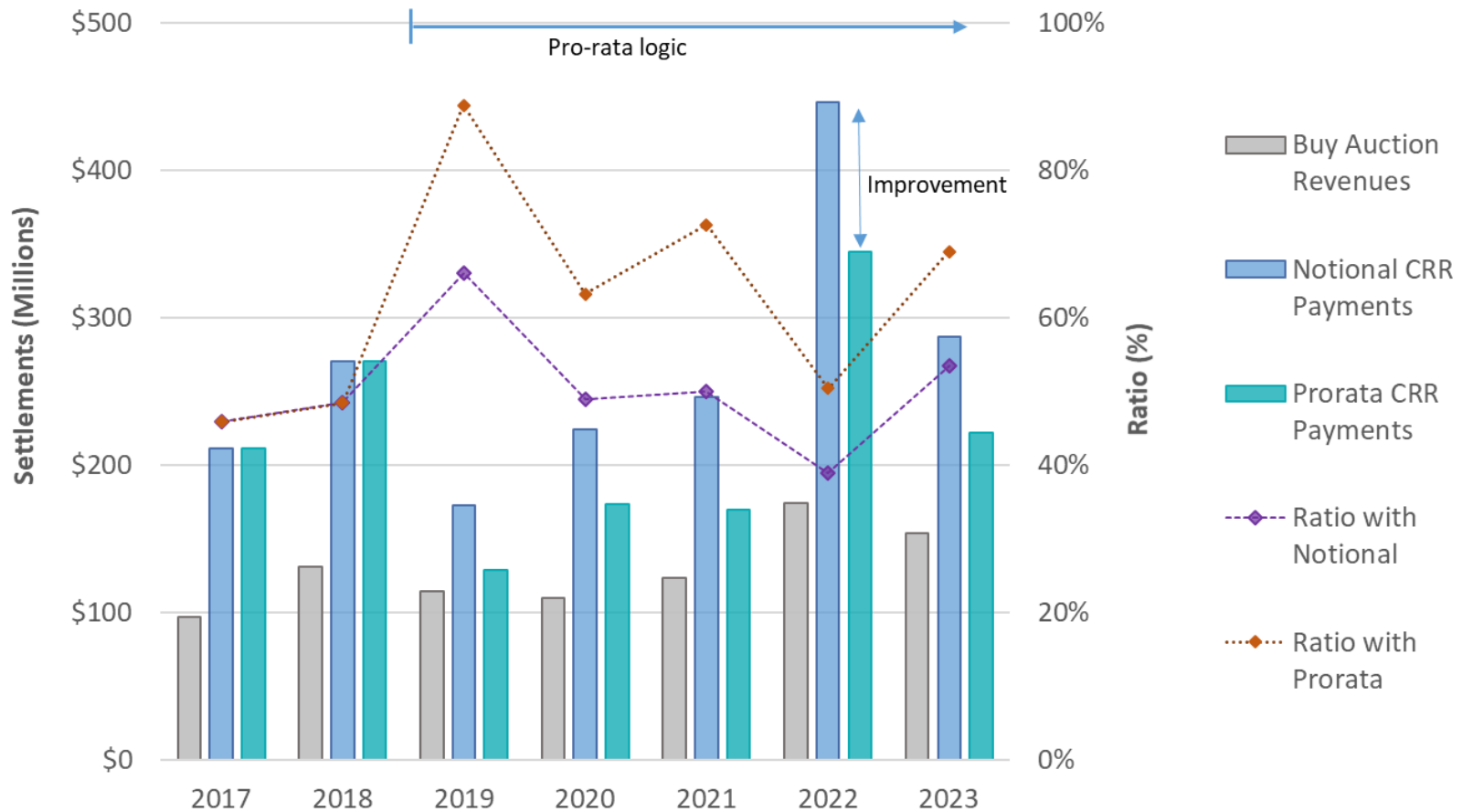
About 53 percent of CRR offsets have been allocated to auction CRRs and 47 percent to allocation CRRs

Legend: Annual Auction, Monthly Auction, LT Allocation, Annual Allocation, Monthly Allocation, Load Migration

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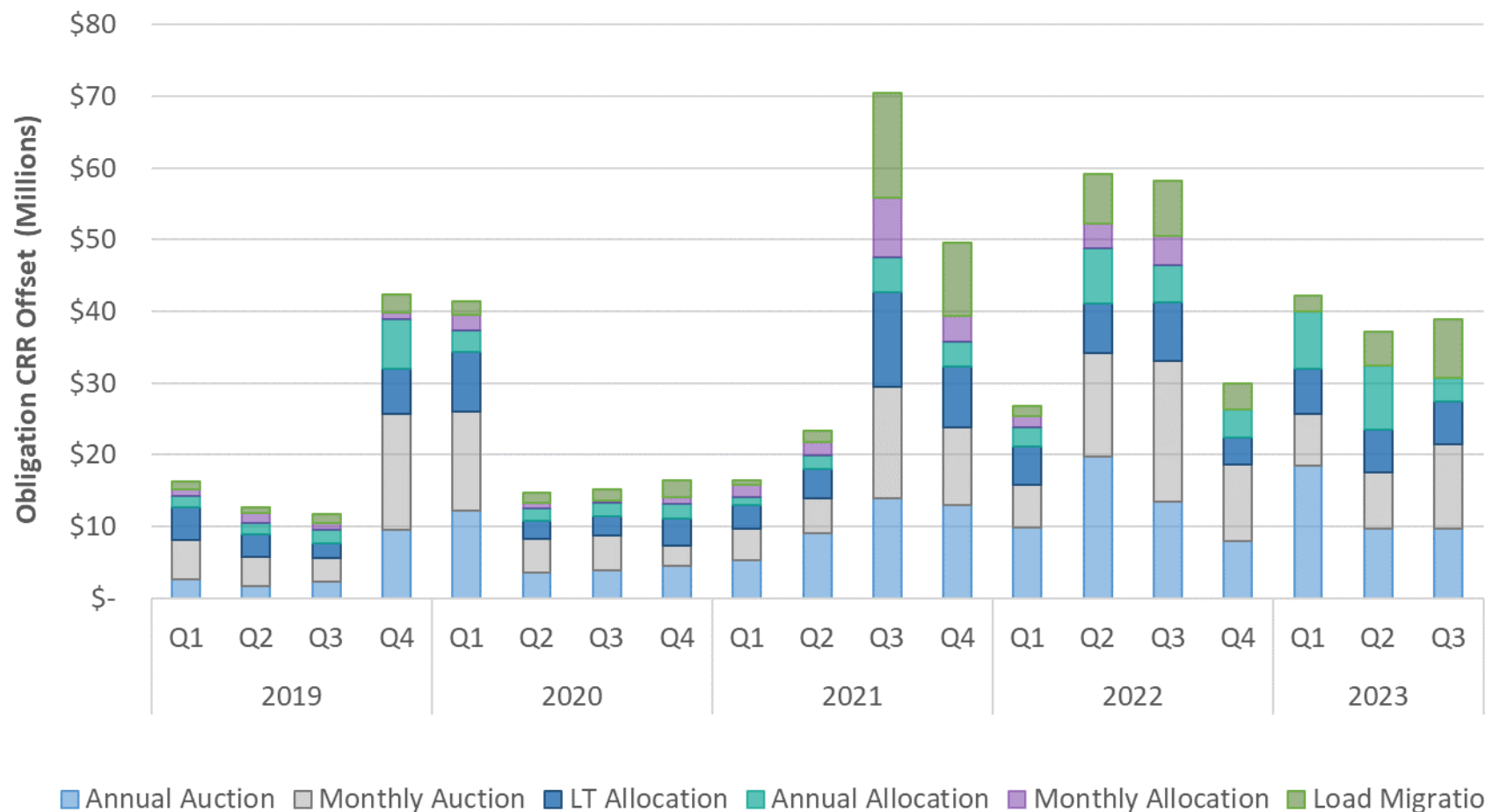
About 60 percent of CRR surplus (revenue adequacy) are accrued CRRs from auctions
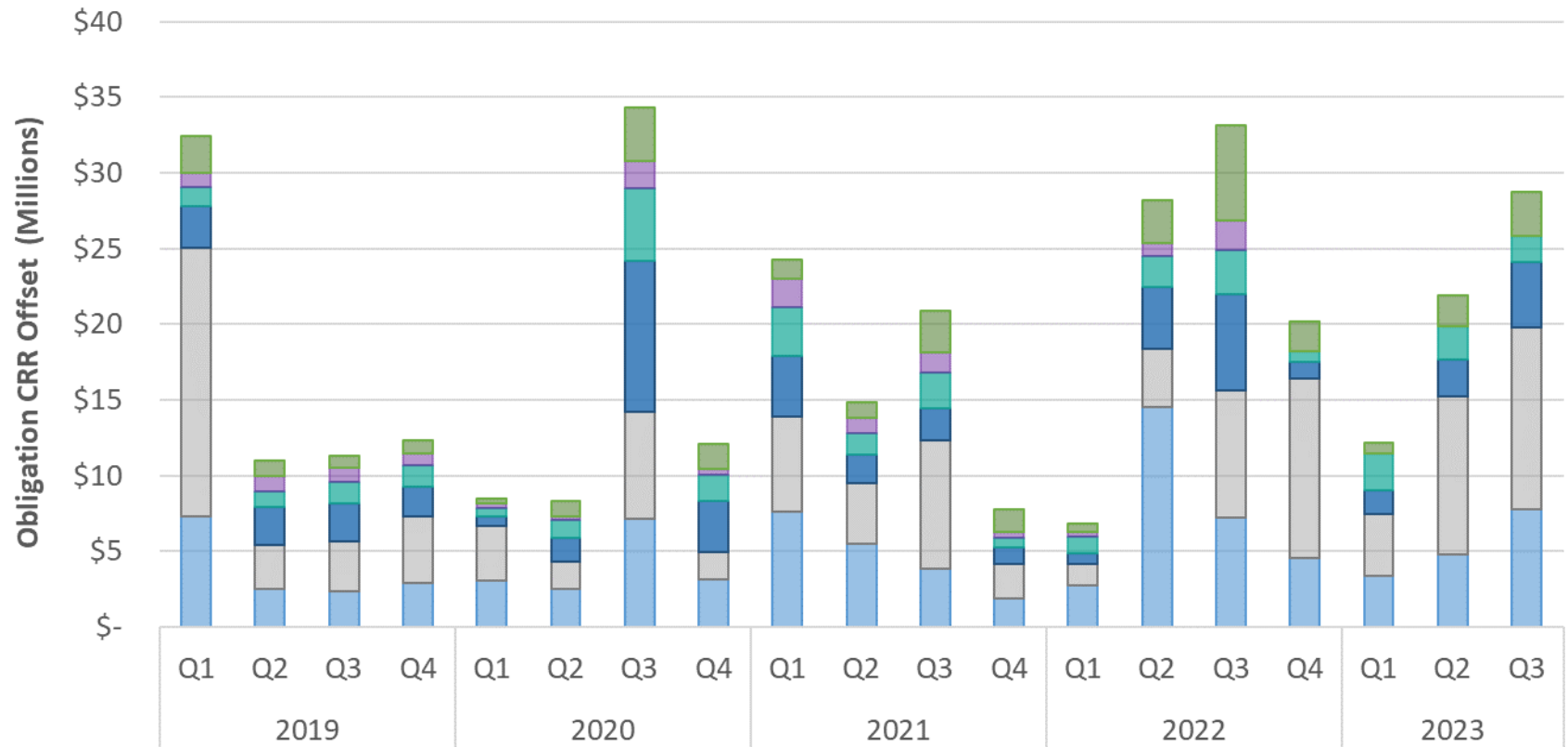
Legend: Annual Auction, Monthly Auction, LT Allocation, Annual Allocation, Monthly Allocation, Load Migration

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The pro-rata logic has reduced the CRR payout by 48 percent between 2019 and 2023 Q3
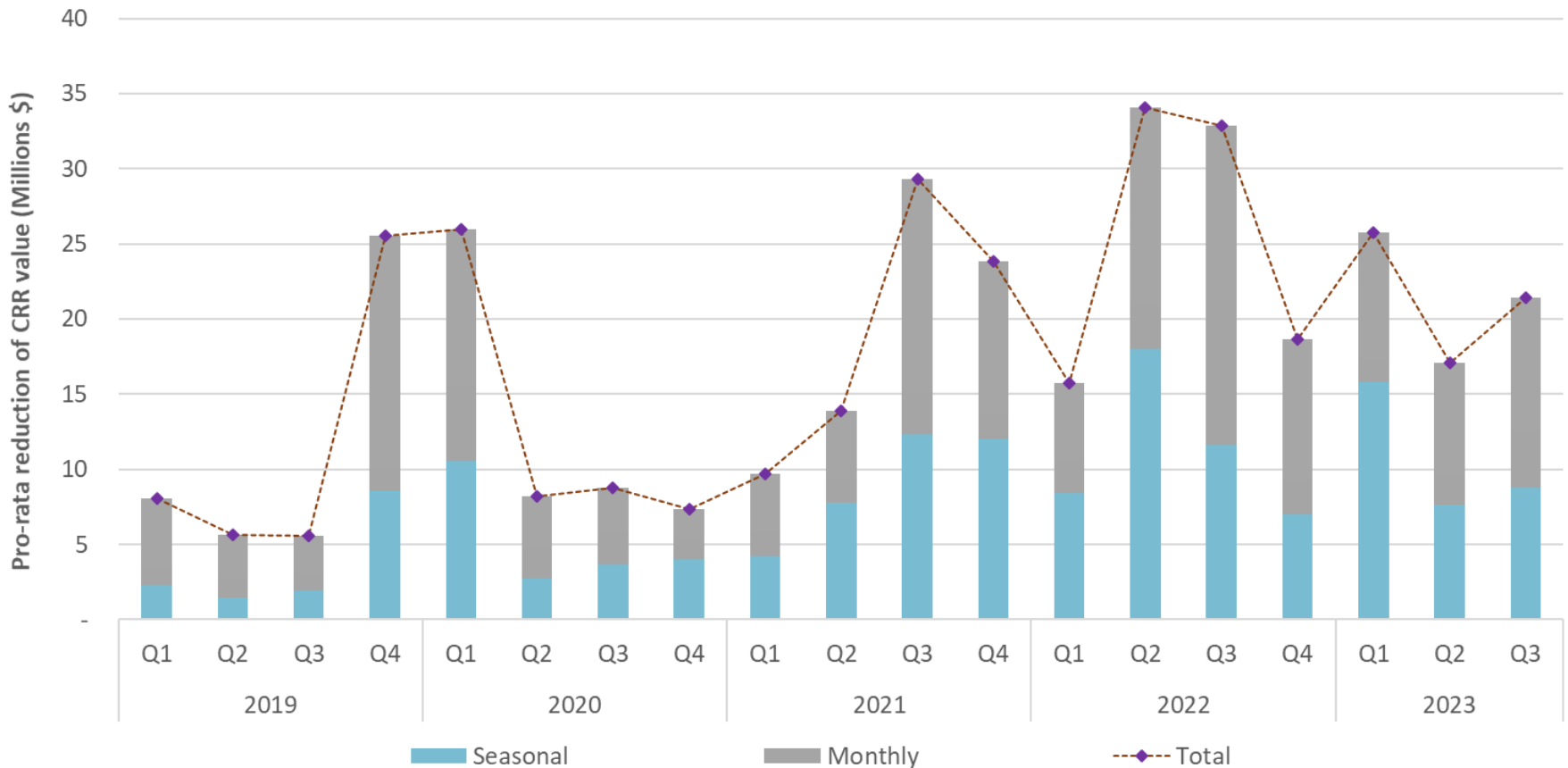
The offset to auction CRRs in this reported period was over $330 million

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ISO has been reporting on CRR metrics and the CRR auction efficiency trend in particular
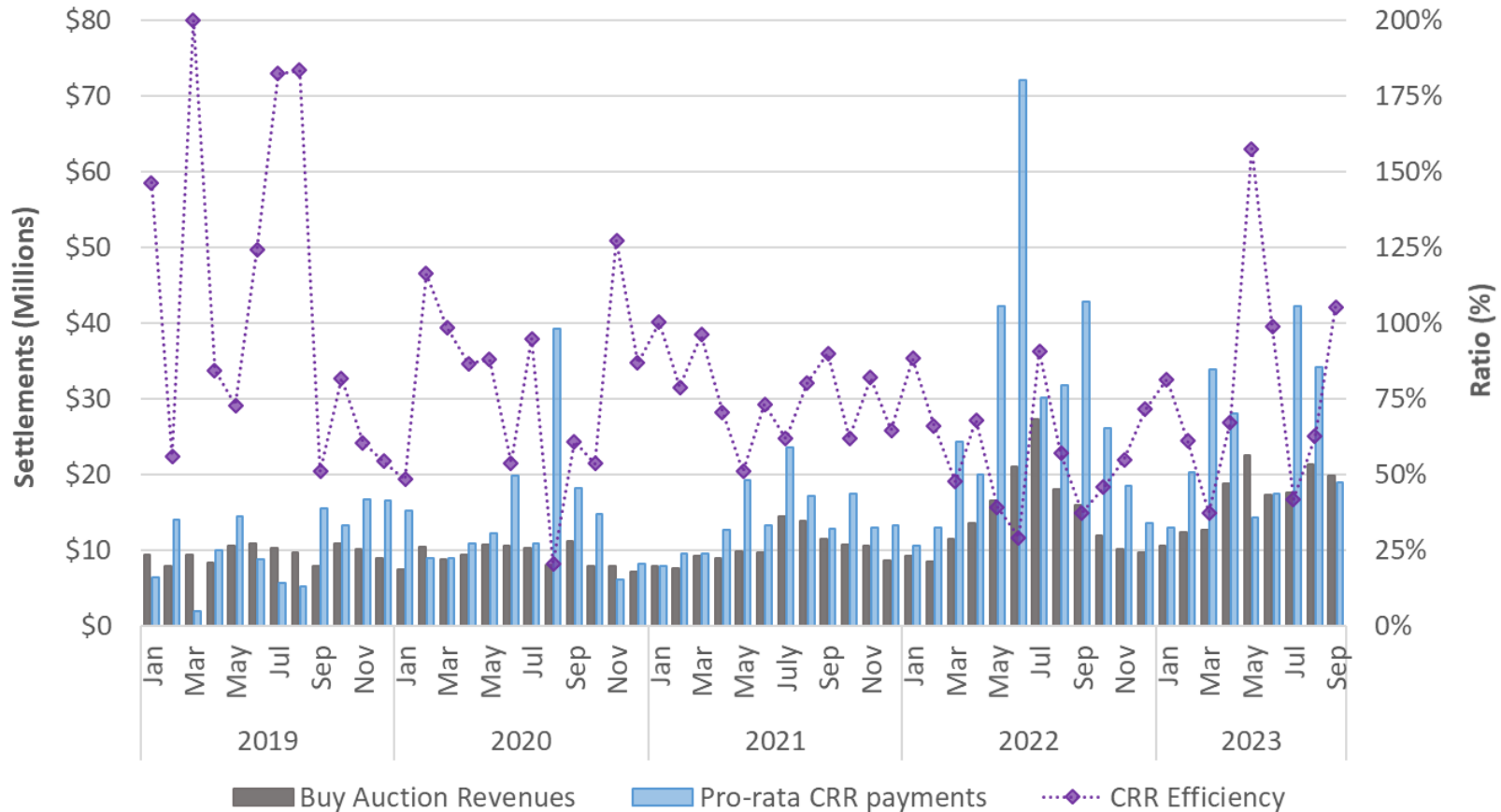
MSC expressed concerns with reporting monthly efficiency due to values of seasonal CRRs being spread pro-rata over the months of the season

63 percent of the payouts in excess of the auction price are related to monthly CRRs
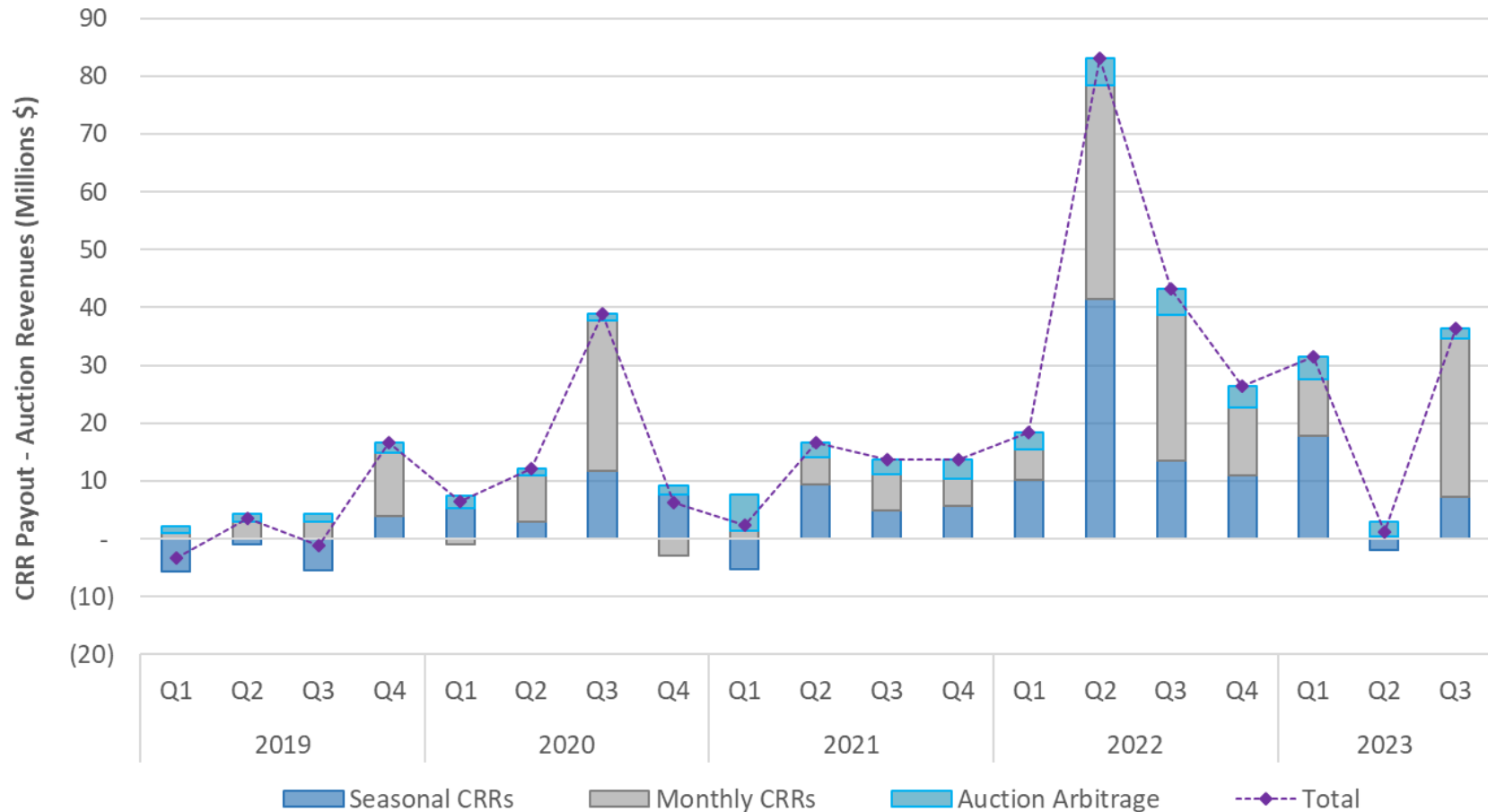
Reporting efficiency on a seasonal basis, however, obscures the impact of monthly CRRs

14 percent of the excess payouts are by arbitraging from the seasonal (buy low) to the monthly auction (sell high)

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On average, the magnitude of losses in CRR payouts are about 62 percent relative to the gains in CRRs payouts

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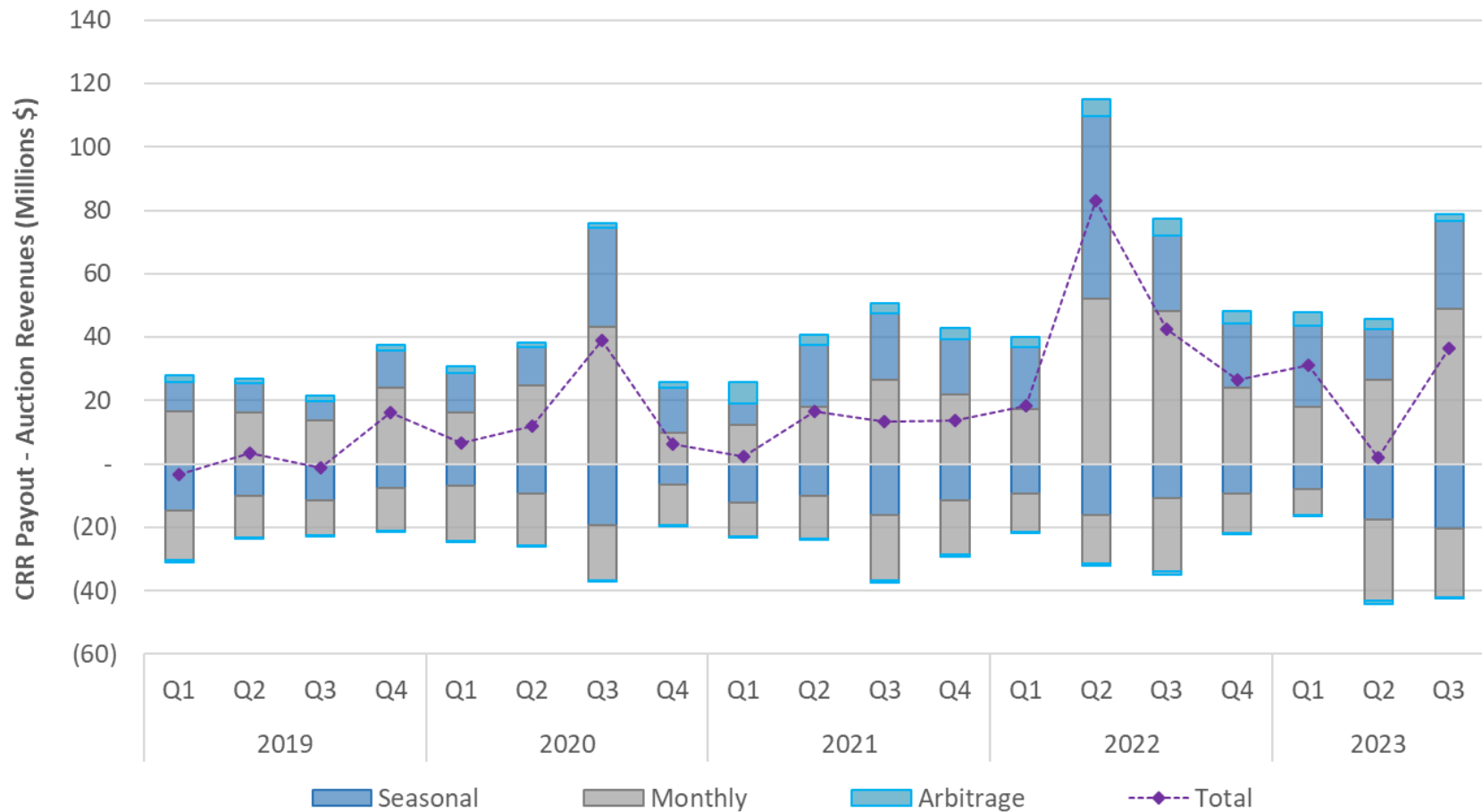
The top path for seasonal CRRs with excess payouts is from generation to SLAP locations

Auction efficiency is measured as the ratio of auction revenues to CRR pro-rata payments

If CRR payment is $1 and auction revenue $.6, then auction efficiency is 60%

Placeholders of 111% or 1% are used for ratios that are negative, reflecting tails of the sample of auction efficiency where participants are either paid in the auction or charged in CRR payouts

Excess payouts (Millions $)

|	Source	CLAP	DLAP	MLAP	SLAP	SP	TH
				Sink			
2019	GEN	0.3	0.7	2.2	3.1	2.6	(4.2)
	SP	0.1	0.3	(0.3)	0.5	-	(13.6)
	TH	(0.0)	(0.2)	0.0	0.1	0.2	-
2020	GEN	0.8	0.3	2.2	0.0	(2.2)	10.2
	SP	0.3	(2.1)	0.2	2.4	-	15.9
	TH	(0.0)	(0.2)	0.0	0.0	(0.3)	-
2021	GEN	1.0	2.0	3.5	12.0	2.5	2.8
	SP	(0.3)	(1.0)	0.1	(0.3)	-	(7.3)
	TH	0.1	(0.1)	(0.0)	0.7	(1.2)	-
2022	GEN	0.9	2.1	11.3	32.4	5.1	5.3
	SP	0.0	0.2	(0.0)	3.2	-	9.8
	TH	0.0	2.5	0.1	2.1	0.1	-
2023	GEN	2.6	2.0	3.4	5.9	3.6	6.9
	SP	0.0	(0.4)	(0.4)	(0.9)	-	(2.3)
	TH	0.0	1.4	(0.0)	(0.2)	1.6	-

Auction efficiency (%)

	Source	CLAP	DLAP	MLAP	SLAP	SP	TH
				Sink			
2019	GEN	57%	71%	55%	72%	1%	195%
	SP	68%	71%	164%	73%		233%
	TH	111%	283%	46%	1%	312%	
2020	GEN	72%	93%	67%	99%	13%	1%
	SP	73%	111%	81%	58%		46%
	TH	111%	165%	95%	85%	18%	
2021	GEN	50%	76%	56%	43%	39%	44%
	SP	111%	223%	95%	110%		158%
	TH	31%	161%	101%	26%	111%	
2022	GEN	63%	72%	28%	30%	37%	36%
	SP	85%	86%	101%	45%		70%
	TH	40%	68%	49%	20%	338%	
2023	GEN	47%	83%	64%	77%	50%	33%
	SP	93%	156%	140%	131%		119%
	TH	58%	87%	122%	118%	>100%	

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The top path for monthly CRRs with excess payouts is from generation to SLAP locations

Excess payouts (Millions $)

	Source	CLAP	DLAP	MLAP	SLAP (Sink)	SP	TH
2019	GEN	1.2	0.6	(0.1)	5.7	1.6	5.9
	SP	0.2	0.5	(0.2)	0.5	-	2.1
	TH	(0.0)	(0.3)	(0.0)	0.0	(0.0)	-
2020	GEN	(0.1)	(5.2)	0.3	2.3	(2.0)	11.2
	SP	1.2	(1.2)	0.5	3.2	-	18.5
	TH	(0.0)	(0.4)	0.0	(0.0)	1.6	-
2021	GEN	0.1	1.1	1.8	10.8	3.3	1.8
	SP	(0.0)	0.2	(0.1)	1.8	-	1.6
	TH	0.0	(5.1)	0.0	0.4	(1.1)	-
2022	GEN	1.5	3.5	2.2	41.7	3.3	7.8
	SP	(0.3)	0.2	0.4	3.8	-	8.1
	TH	0.3	1.9	0.4	3.2	0.8	-
2023	GEN	2.4	2.9	4.0	12.9	4.7	10.6
	SP	(0.4)	(0.6)	(0.3)	(0.4)	-	0.5
	TH	0.4	1.5	0.2	1.3	(2.1)	-

Auction efficiency (%)

	Source	CLAP	DLAP	MLAP	SLAP (Sink)	SP	TH
2019	GEN	72%	94%	102%	77%	38%	18%
	SP	88%	91%	108%	93%		89%
	TH	113%	122%	101%	99%	96%	
2020	GEN	108%	141%	95%	86%	179%	16%
	SP	51%	150%	87%	65%		44%
	TH	197%	136%	82%	101%	111%	
2021	GEN	94%	83%	76%	69%	51%	83%
	SP	108%	92%	104%	78%		89%
	TH	30%	226%	64%	69%	111%	
2022	GEN	66%	75%	81%	47%	61%	53%
	SP	142%	95%	84%	69%		75%
	TH	49%	82%	45%	44%	1%	
2023	GEN	67%	79%	61%	67%	57%	53%
	SP	442%	146%	131%	111%		87%
	TH	56%	74%	71%	64%	240%	

Placeholders of 111% or 1% are used for ratios that are negative, reflecting tails of the sample of auction efficiency where participants are either paid in the auction or charged in CRR payouts

The top path for arbitrage opportunities between auctions is from generation to SLAP locations

Placeholders of 111% or 1% are used for ratios that are negative, reflecting tails of the sample of auction efficiency where participants are either paid in the auction or charged in CRR payouts

Excess payouts (Millions $)

				Sink			
	Source	CLAP	DLAP	MLAP	SLAP	SP	TH
2019	GEN	0.2	0.4	2.0	2.2	0.9	(0.5)
	SP	0.1	0.0	0.4	0.2	-	(0.2)
	TH	0.0	0.0	0.0	0.0	0.0	-
2020	GEN	0.5	0.8	0.5	1.8	0.8	0.8
	SP	0.0	(0.0)	0.1	0.5	-	0.1
	TH	0.0	0.0	0.0	0.0	0.0	-
2021	GEN	0.5	2.6	1.5	4.2	1.5	0.8
	SP	0.1	0.2	0.3	1.8	-	1.3
	TH	0.0	0.0	0.0	0.1	0.1	-
2022	GEN	0.4	1.4	2.0	6.5	1.3	0.6
	SP	0.3	0.1	0.3	2.3	-	0.2
	TH	0.0	0.1	0.0	0.4	0.1	-
2023	GEN	0.4	0.8	0.8	2.8	2.5	0.1
	SP	0.1	0.0	0.1	0.1	-	0.3
	TH	(0.0)	0.0	0.0	0.1	(0.0)	-

Auction efficiency (%)

				Sink			
	Source	CLAP	DLAP	MLAP	SLAP	SP	TH
2019	GEN	17%	16%	10%	23%	10%	>100%
	SP	33%	56%	37%	41%	0%	156%
	TH	9%	85%	10%	10%	10%	0%
2020	GEN	28%	38%	41%	37%	10%	11%
	SP	71%	116%	50%	53%	0%	64%
	TH	10%	66%	80%	20%	10%	0%
2021	GEN	28%	10%	24%	15%	10%	23%
	SP	46%	60%	46%	29%	0%	33%
	TH	45%	55%	68%	27%	>100%	0%
2022	GEN	41%	37%	35%	31%	37%	33%
	SP	37%	74%	63%	32%	0%	76%
	TH	36%	64%	66%	32%	38%	0%
2023	GEN	17%	37%	39%	27%	10%	79%
	SP	21%	46%	58%	87%	0%	54%
	TH	140%	65%	65%	56%	97%	0%

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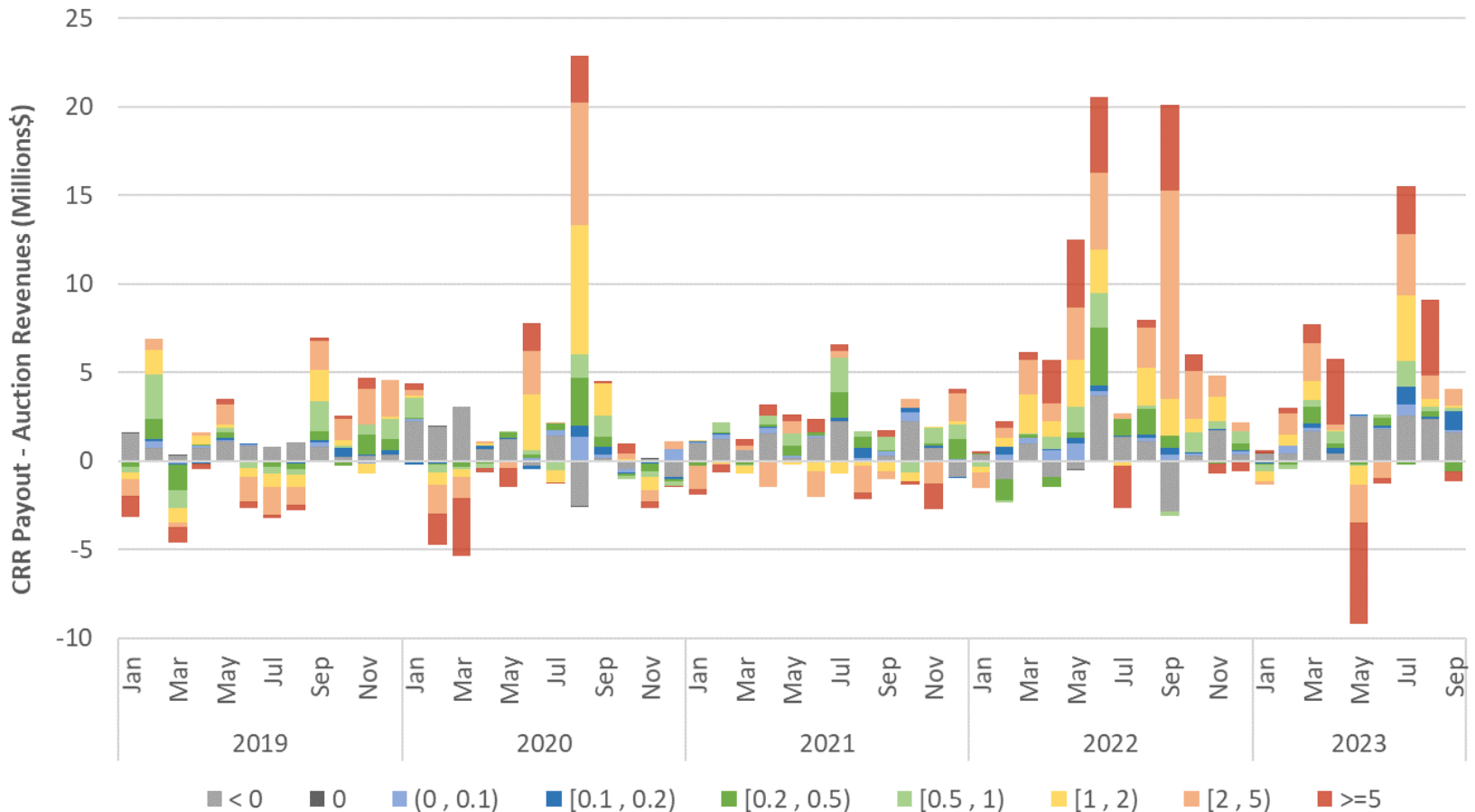# Excess CRR payouts for seasonal CRRs are not concentrated in a specific price range
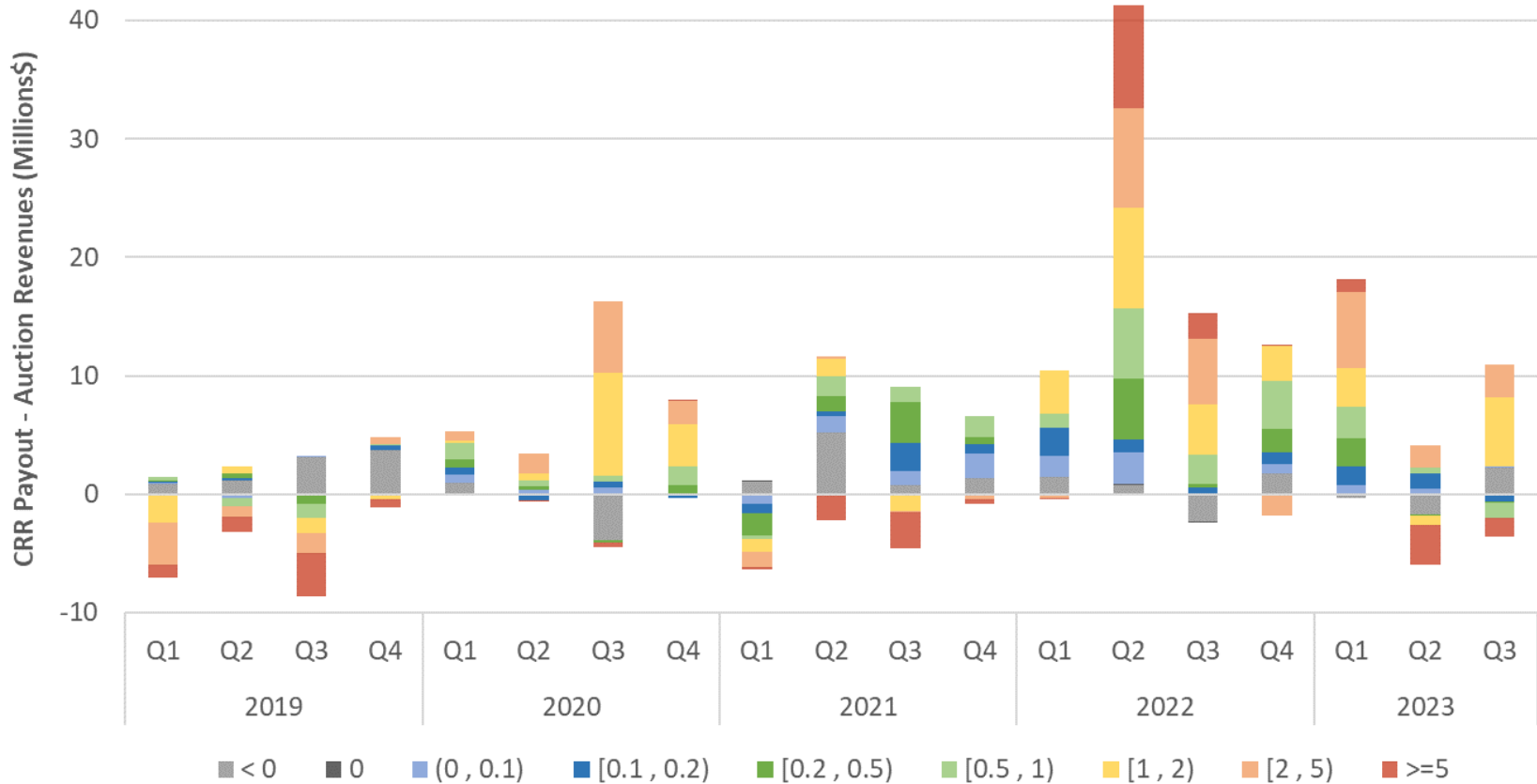
Auction revenues and CRR payouts are normalized to $/MWh
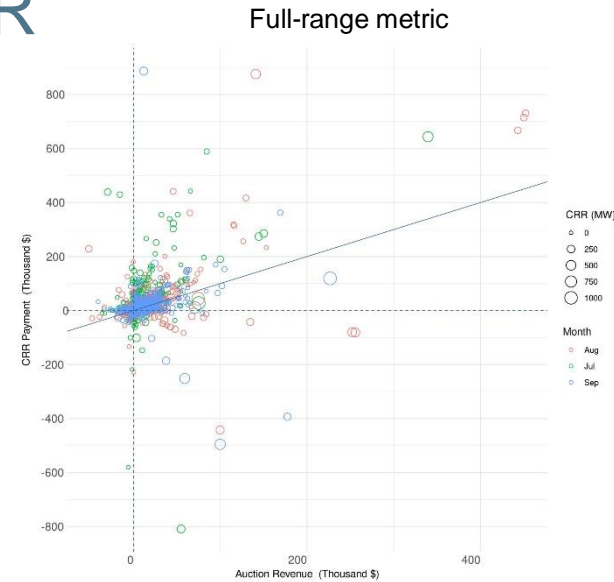
Payouts are based on pro-rata values of CRRs

Excess payouts for monthly CRRs are not concentrated in a specific price range

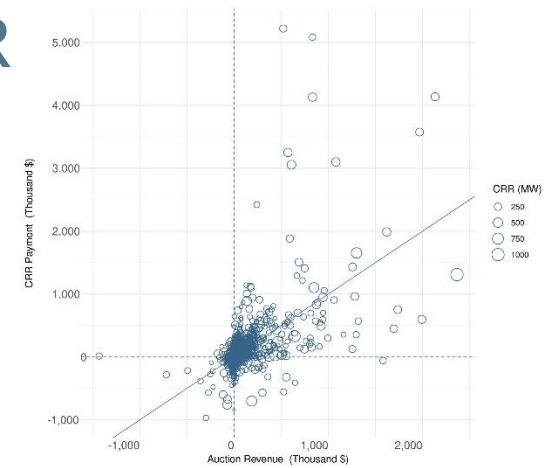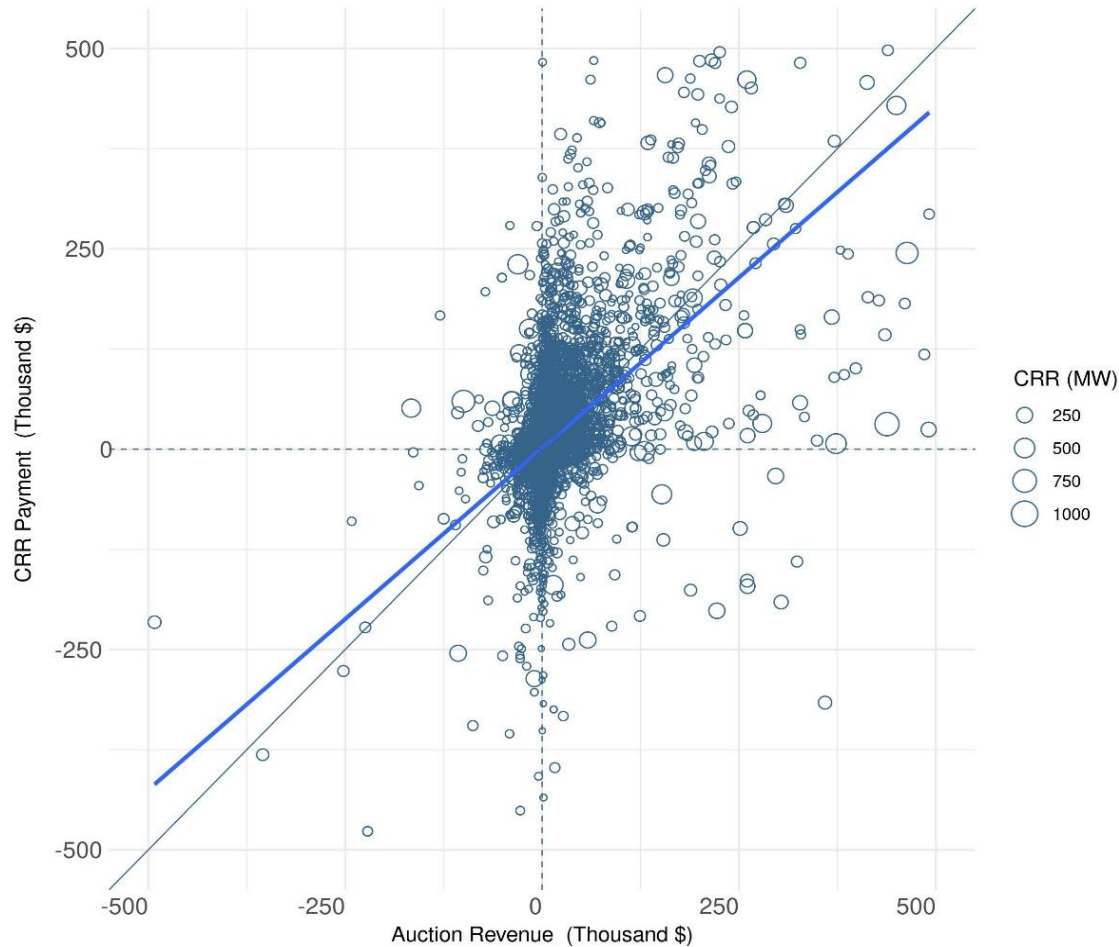Negatively priced CRRs tend to accrue consistently excess payouts

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Delta between auction revenues and CRR payments are fairly spread - Q3 2023

Full-range metric

These plots reflect only Monthly CRRs

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Delta between Auction revenues and CRR payments are fairly spread - Q3 2023

Full-range metric

This reflects only Seasonal CRRs

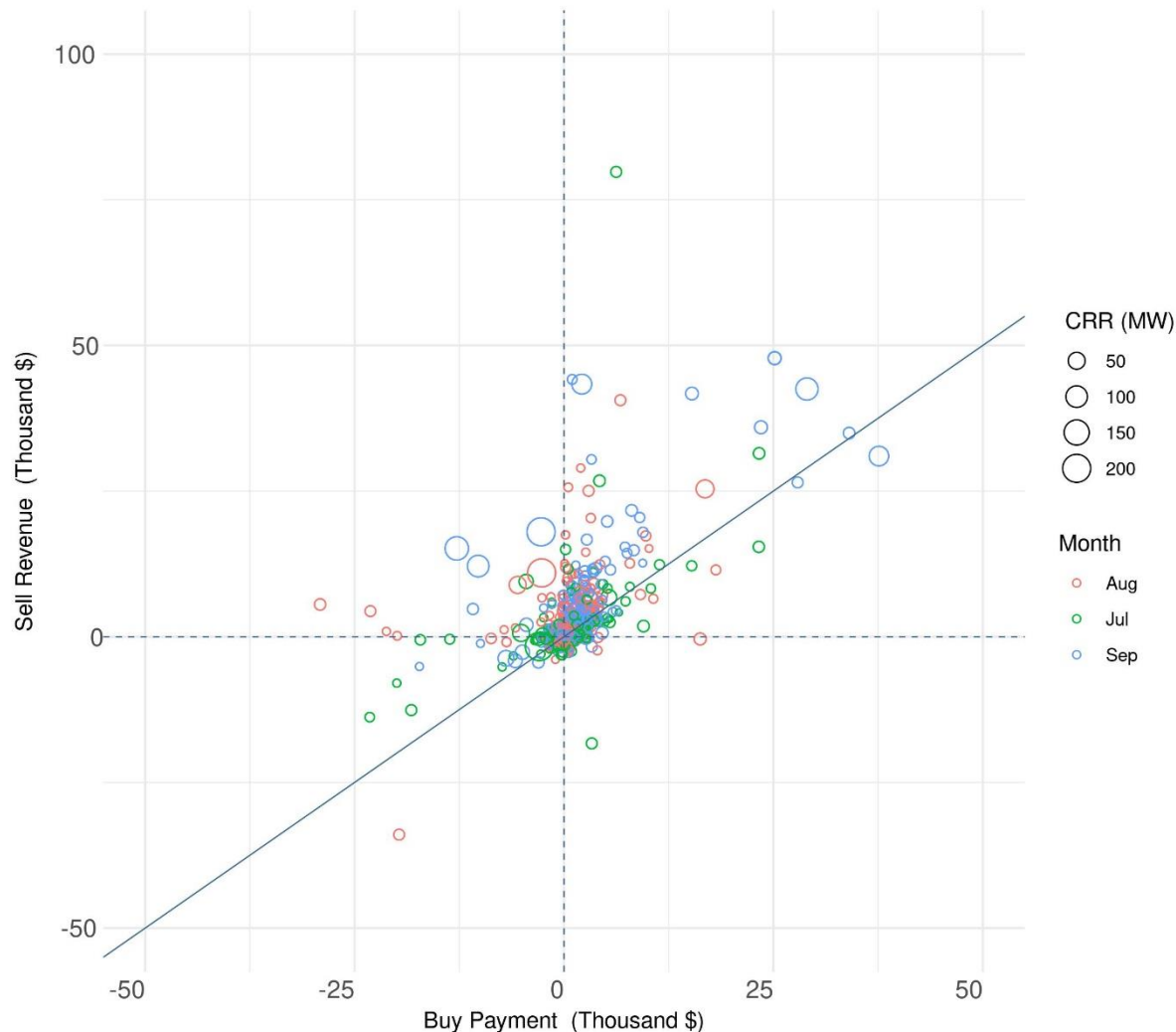Bright-blue line reflects a linear regression model

Even in Q2 2022, when the largest CRR payout difference was observed, there are auction CRRs at losses
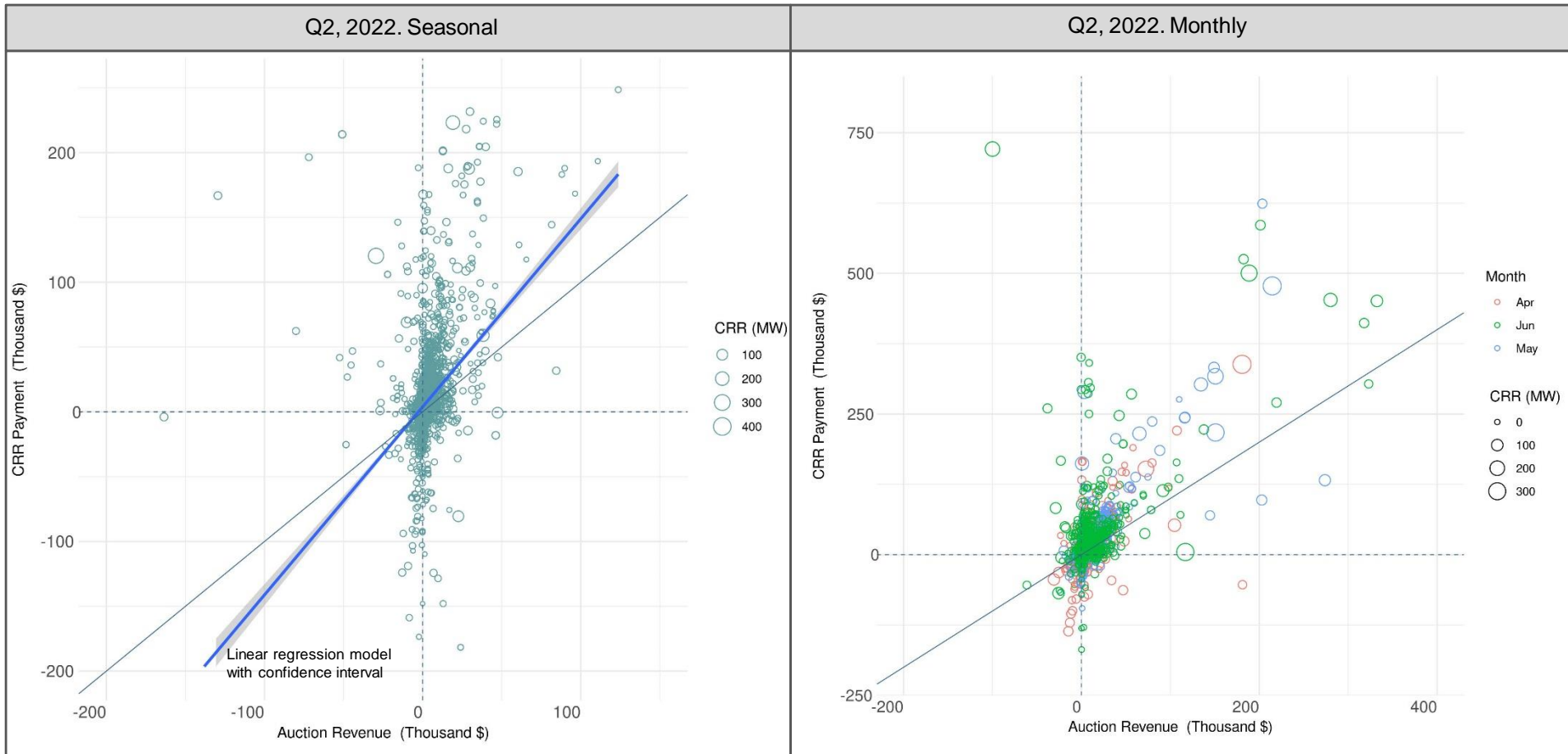
Arbitrage from annual auction to monthly auction is mostly concentrated on the upside
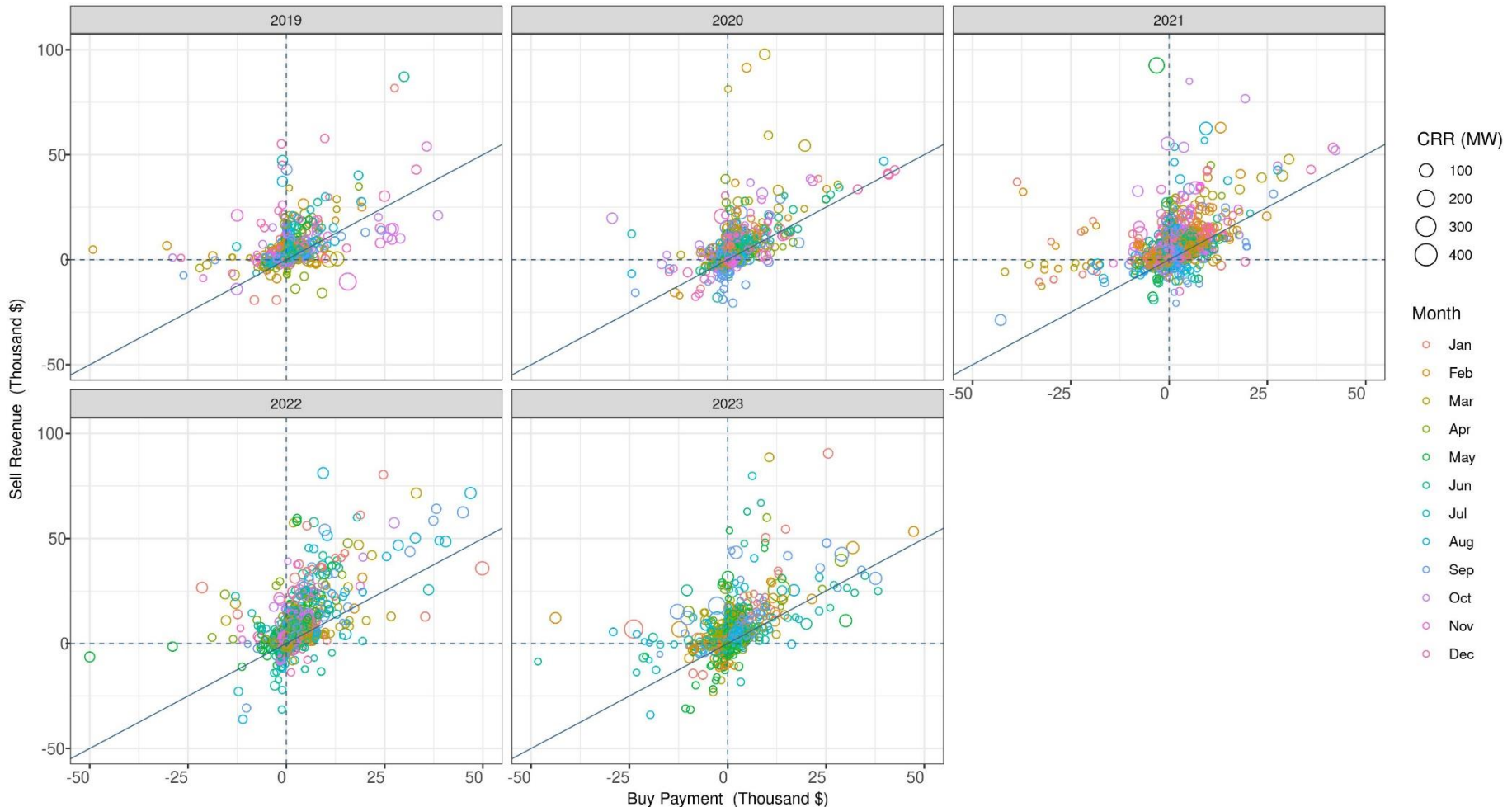

Buy payment is estimated pro-rata based on the MW and period portion being sold at the seasonal value

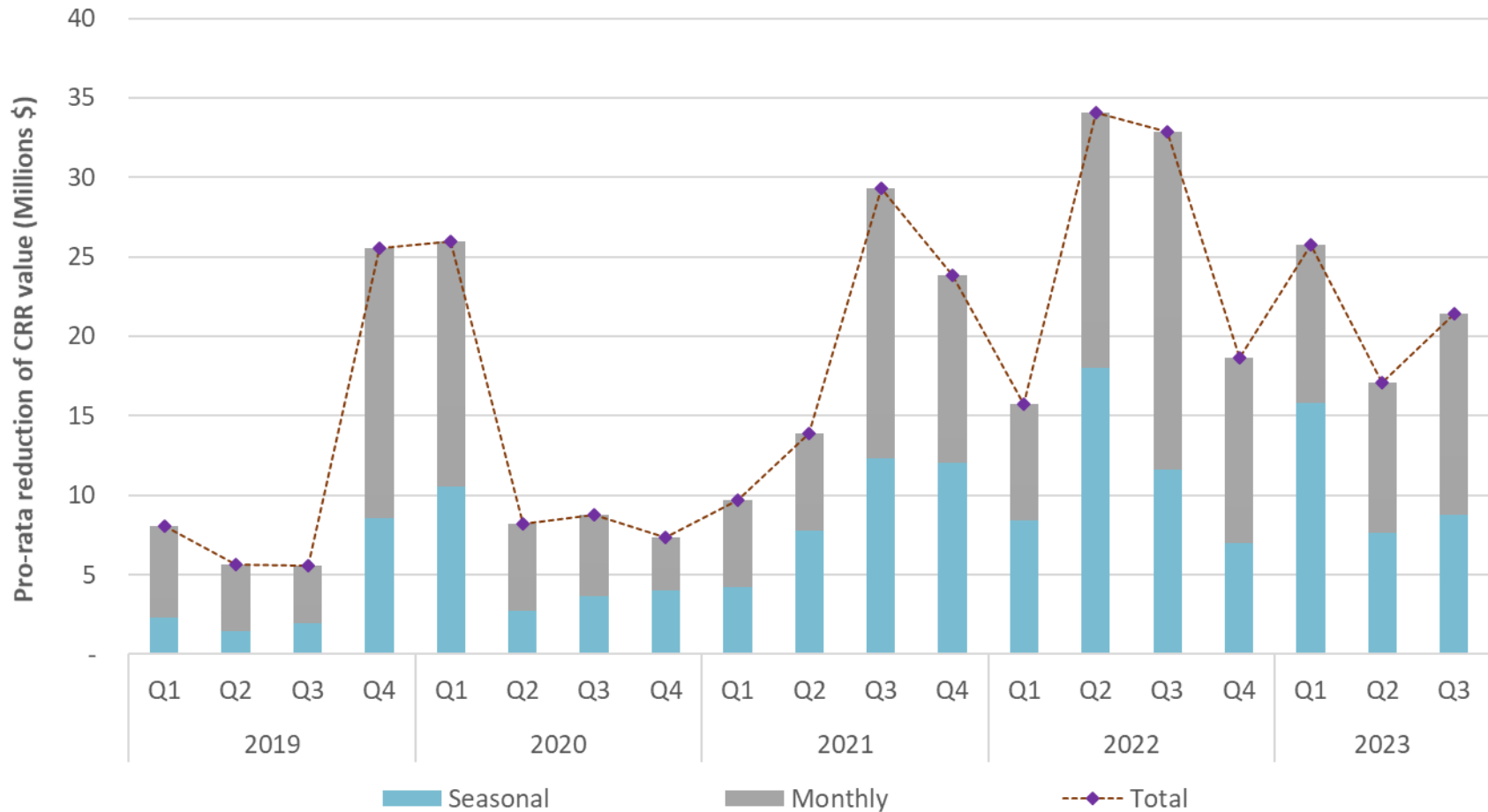This value may be different to the bid-in price submitted by the CRR seller

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Arbitrage between seasonal and monthly auctions has been a consistent practice over the years
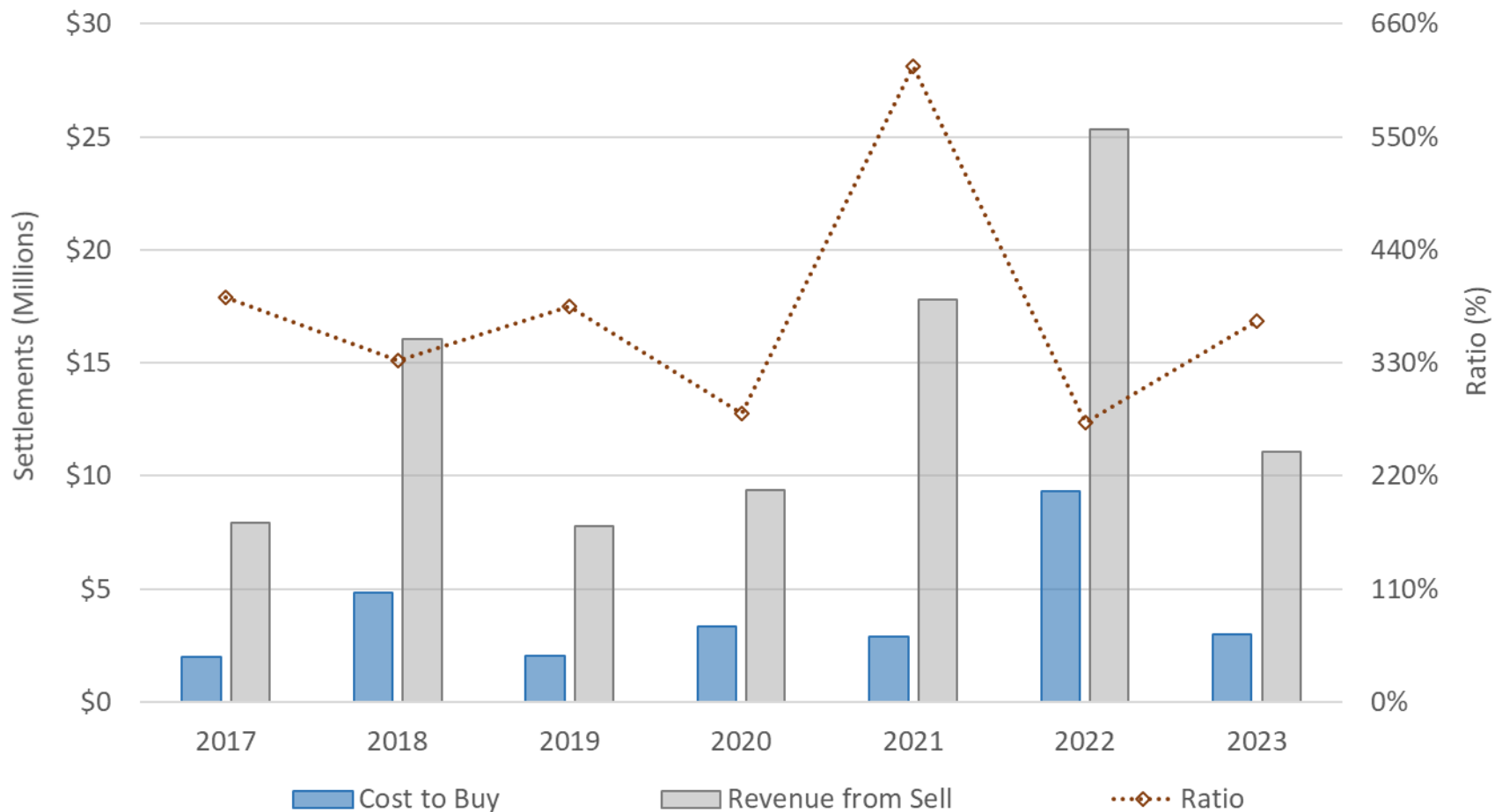
The pro-rata reduction of CRR value has been evenly allocated between seasonal and monthly CRRs
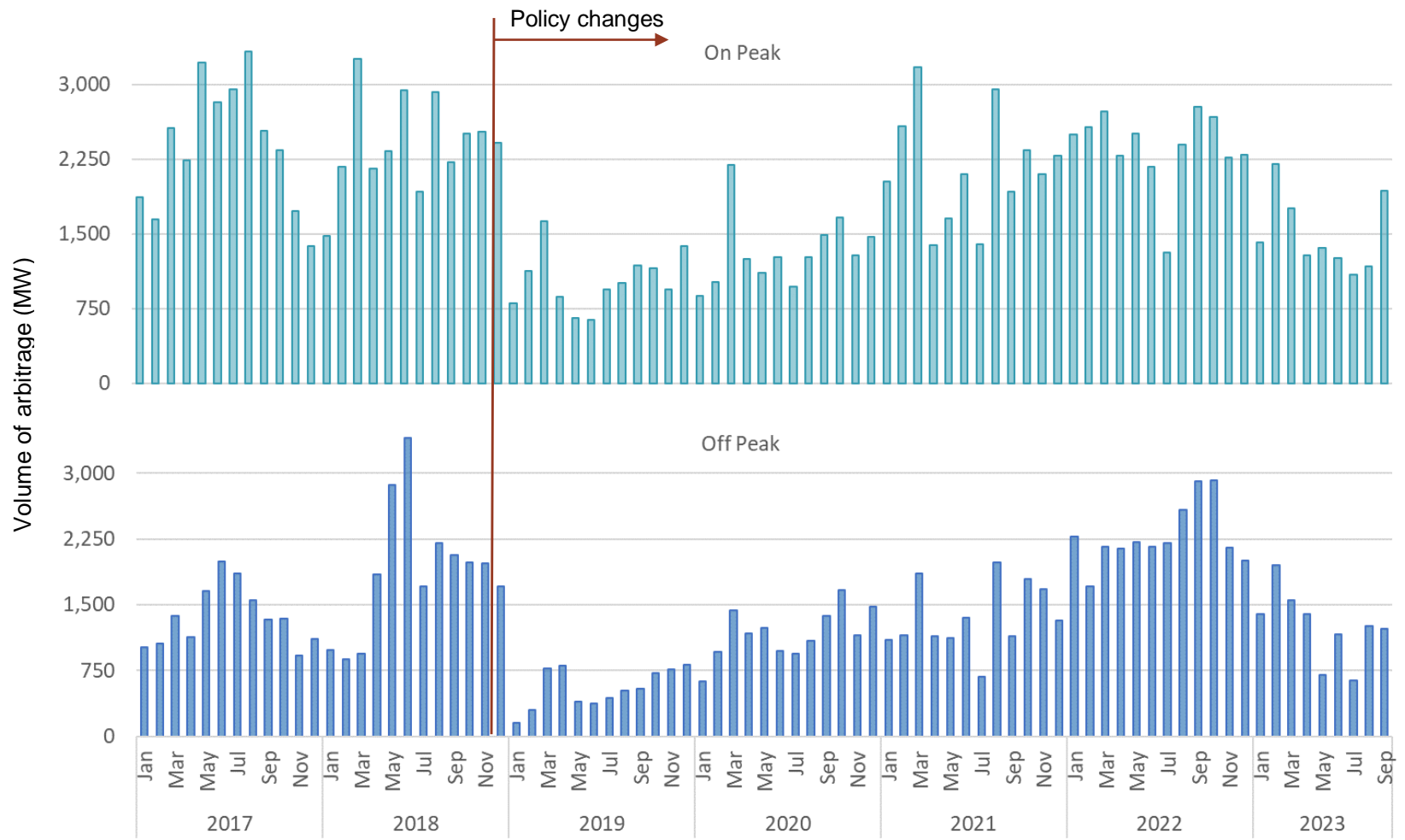
Arbitrage between the annual and monthly auctions has been profitable over the years
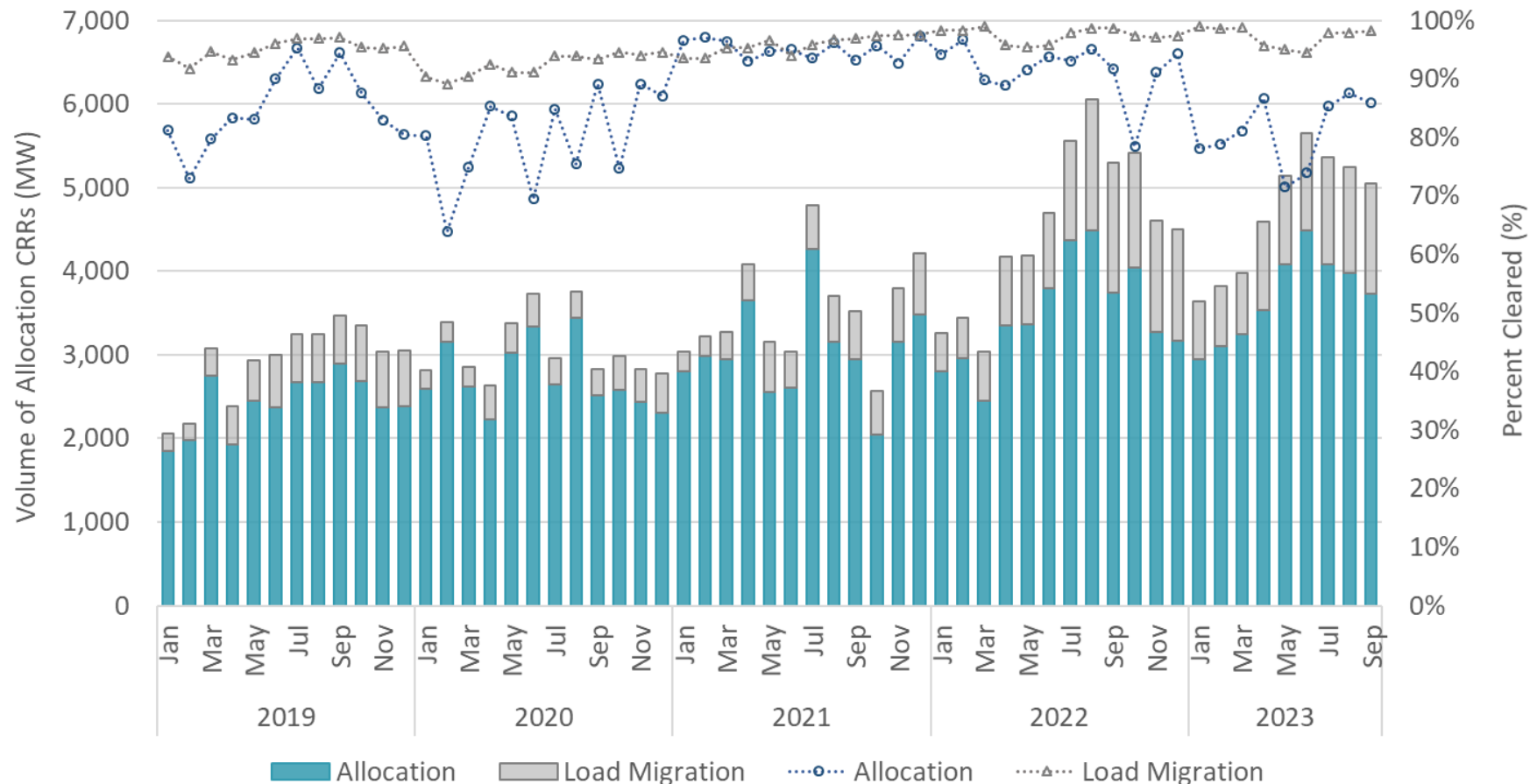
The level of arbitrage between annual and monthly auctions increased over the years after the policy changes

Volume of arbitrage (MW)

Policy changes

On Peak

Off Peak

2017 2018 2019 2020 2021 2022 2023

The volume of allocation CRRs being sold in the auctions has steadily increased over time

There is a high rate of success in load serving entities selling allocation CRRs in the auctions
Load migration ratio in particular is close to 100 percent, indicating that LSEs attach low value to the transferred CRRS

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Summary

- Revenue adequacy has been at 81%, with a shortfall of 540 million since 2019. This shortfall money is no longer charged to measured demand with the implementation of pro-rata funding

- Implementation of pro-rata funding has resulted in surplus allocated to measured demand

- CRR auction efficiency has improved from 49% to 65% with the policy changes implemented in 2019

- CRR revenue shortfalls are evenly allocated to both allocation and auction revenues

- The pro-rata logic has reduced the CRR payout by 48 percent, or over $330 million to auction CRRs

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Summary

- 63 percent of the excess payout is originated from monthly CRRs

- Even with excess payout on the net, CRRs poses risks with losses being about 63% of gains in CRR payouts

- LSEs are actively and increasingly using CRR auctions to rebalance their portfolios, but their undervaluation of CRRs is a factor in the overall auction efficiency

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Next steps in analysis

- Drivers of revenue inadequacy and low auction efficiency
  - Identifying divergence on constraints and limits between CRR and DA model
  - Outages consideration

- Flow reversal of CRR settlements

- Impact assessment of shift factor threshold enhancement