



Power Markets for Bitcoin Miners, 4/10/23

Financial Hedging Power Introduction

Financially hedging power on exchanges is essentially managing a financial book focused on the change of value from the hedge point. Power contracts on exchanges are not homogenous, other than the around the clock (ATC) pricing. Each power market has its own description of On and Off peaks. Many assume that power only spikes in On-peak. In general, that could be true depending on the markets; however, the definition of off-peak typically includes weekends and holidays. Weather anomalies do occur on weekends and holidays, making the situation more precarious at times, as staffing at plants could cause a slower-than-expected response during those days, leading to power spikes. Also, considering winter risk, the coldest time periods are typically in off-peak hours. On-peak products are much more liquid than off-peak products on the exchange.

Setting aside the time period structure, power contracts can be purchased as calendar (every month) and then by month, by week, by day, and even balance of the day. An ATC calendar

contract is the easiest to explain: it's essentially every hour. For example, if you purchase a 50MW ATC Calendar 2024, this is essentially 50MW priced for 8784 hours (leap year in 2024), for a total of 439200 MWh. Therefore, the nominal value of the contract at \$60/MWh = \$26,352,000. Owning the \$60/MWh contract would not require the obligation of the full amount since financially the only risk is the delta position from the hedge point. The financial instrument is settled to the real results of the market. If the market ended each hour each day at \$60/MWh and you purchased the contract at \$60/MWh, the financial settlement is 0. There will be many days when you will accumulate value, but there will also be many days when you lose value. Being well-capitalized and allocating the appropriate capital to the hedge book will allow business continuity. If the price ended up \$1/MWh higher at \$61/MWh, the resulting settlement by the end of the year is a positive \$439,200 in your financial book. However, your physical power book with the utility (assuming 1:1 correlation) would be an extra expense

over the budgeted \$439,200. However, when combined, the net result is 0 – a perfect hedge.

Key Takeaways

- *Financial power markets are built around the physical spot market for the region.*
- *Financial contracts will be settled to the physical reality of the marketplace.*
- *Hedging power prices can be done effectively, with caution against considering the hedge book as an instrument of PNL.*
- *Trading power can be done effectively but requires stringent risk management, as the commodity has a history of blowups.*
- *Hedging can easily turn into trading without discipline. The level of sophistication needed for trading vs. hedging is significant.*
- *Mining economics and power markets saw minor change week on week.*

Research

David Bellman^{ac}

Power & Carbon Research
dbellman@bitooda.io

Tim Kelly | Head of Sales
Sam Doctor | CSO, Head of Research
Vivek Raman | Proof of Stake
Mike Tauckus | Head of Trading

BTC Price 7 day Avg	\$28,106
Hashrate 7 day Avg	342 EH/s
PJM Cal 24	47 \$/MWh
NYISO Cal 24	56 \$/MWh
ERCOT Cal 24	43 \$/MWh
CAISO Cal 24	82 \$/MWh

Weekly Variable Economics \$/TH

c/kWh	S9	S19j
\$0.02	\$0.15	\$0.40
\$0.03	(\$0.04)	\$0.33
\$0.04	(\$0.23)	\$0.27
\$0.05	(\$0.42)	\$0.20
\$0.06	(\$0.61)	\$0.14
\$0.07	(\$0.80)	\$0.07
\$0.08	(\$0.98)	\$0.01
\$0.09	(\$1.17)	(\$0.06)
\$0.10	(\$1.36)	(\$0.12)
\$0.11	(\$1.55)	(\$0.19)
\$0.12	(\$1.74)	(\$0.25)
\$0.13	(\$1.93)	(\$0.32)
\$0.14	(\$2.12)	(\$0.38)
\$0.15	(\$2.31)	(\$0.45)

Financial Hedging Power Introduction

The calendar contract is in essence 12 monthly contracts. These monthly contracts can be traded individually. As the month approaches, the weeks within the month can be traded. Then, as the week approaches, the days start being broken out typically current day / next day and the bal-week. Within the month, there is a balance-of-month contract, which represents the remaining days in the month so one can lock in or remove the remaining position. Once again, these are subject to market contracts from On and Off peak to the universal ATC contract.

A common trap among hedging, companies

start to see their hedges as PNL. There is a temptation to monetize hedges without consideration of the physical operations depending on the hedge. This essentially becomes trading, not hedging. Trading is a fine business strategy and offers significant rewards for active participants, but also carries risk. Power markets are the riskiest commodity product to trade, as the dependency on other commodities and fragmented markets makes it extremely volatile and unpredictable. With all this risk, there is a great opportunity for a market participant who can minimize spikes to actively trade and monetize this risk. This is not for the faint of heart, nor for a limited

capitalized company. Power trading risk can be minimized with physical operations, but the financial side offers a path risk like no other. Hence, capitalization combined with trade size management is needed. Being right only works if you can stay in the trade long enough to be proven right.

At BitOoda, we have decades of experience in the power markets. We can advise on hedging strategies, risk management, and even power trading and market fundamentals. The compute/mining world is converging with the power markets, and only those who can merge the two will likely survive.



Miner WoW View

- Mining economics were flat WoW.
- The S19JPro breakeven price is between \$70-\$80/MWh.

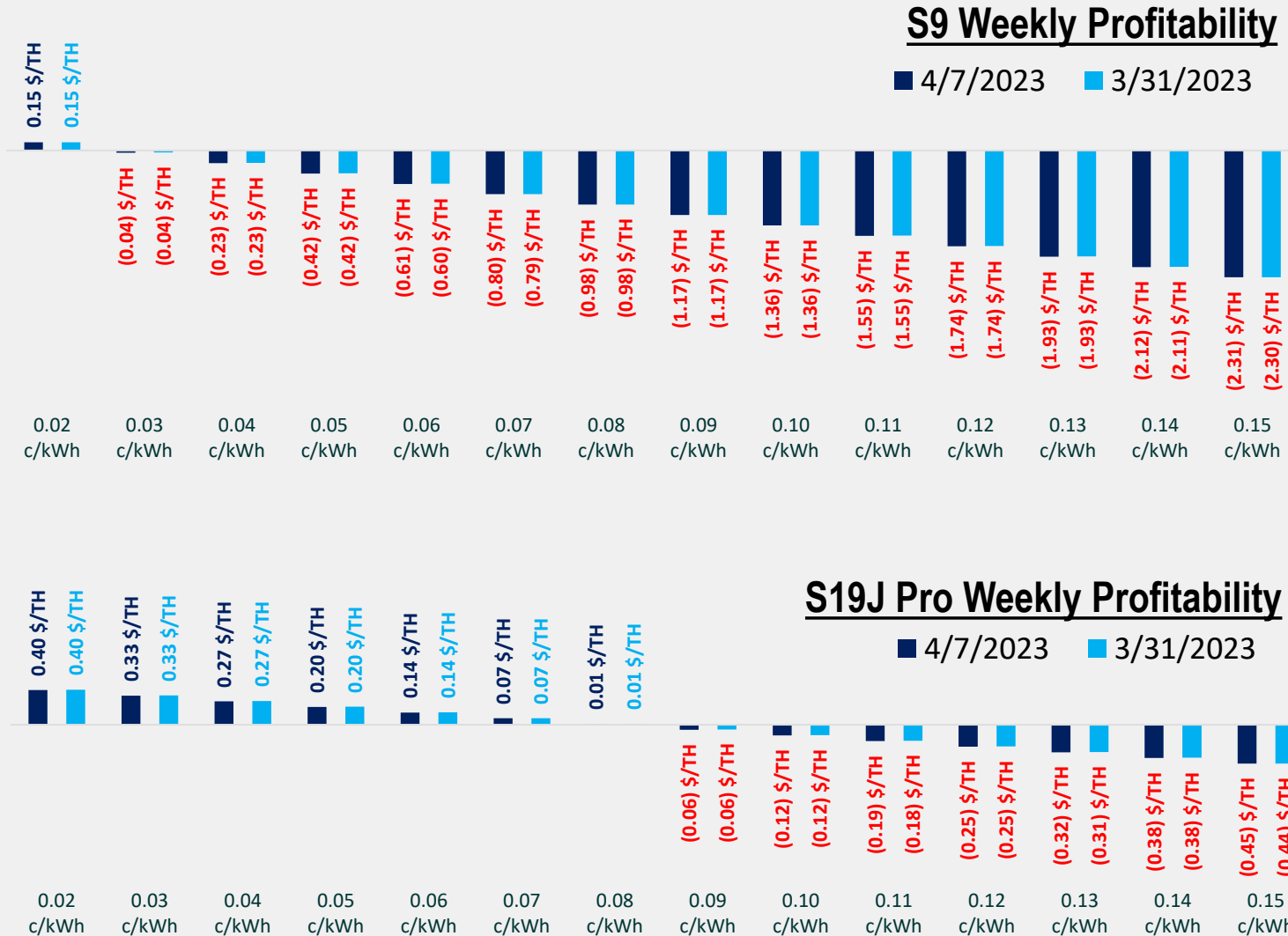


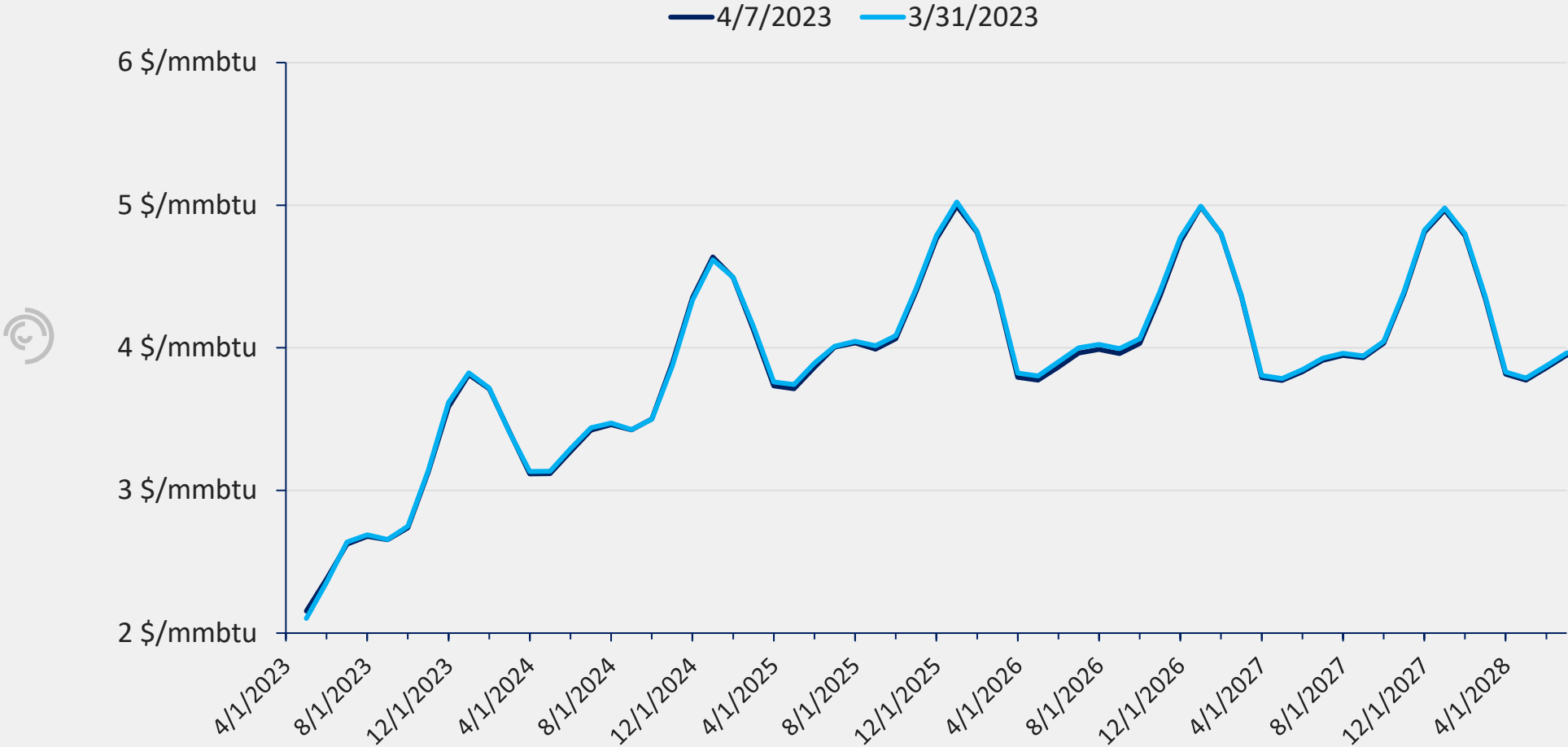
Figure: Weekly Average Cash Contribution After Power Expense
Note: Assumes a PUE of 1.12

Source: BitOoda, Bloomberg, Coinmetrics

Henry Hub WoW

- We saw only minor change WoW.

Henry Hub Forward Curve

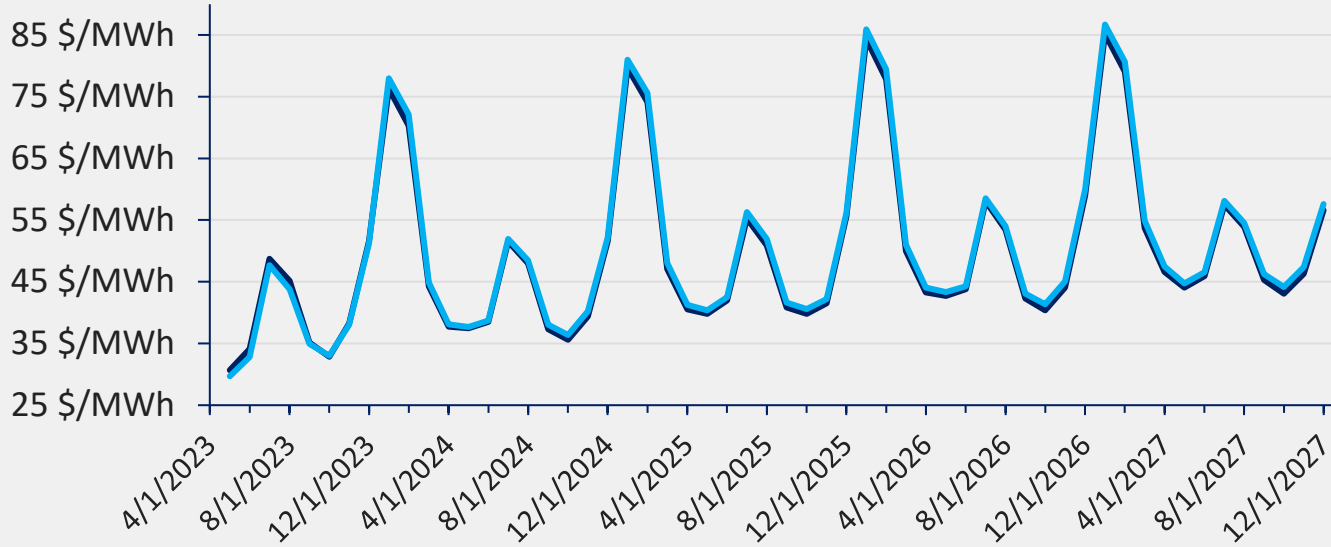


Source: BitOoda, CME Group

PJM WoW

PJM ATC Forward Curve

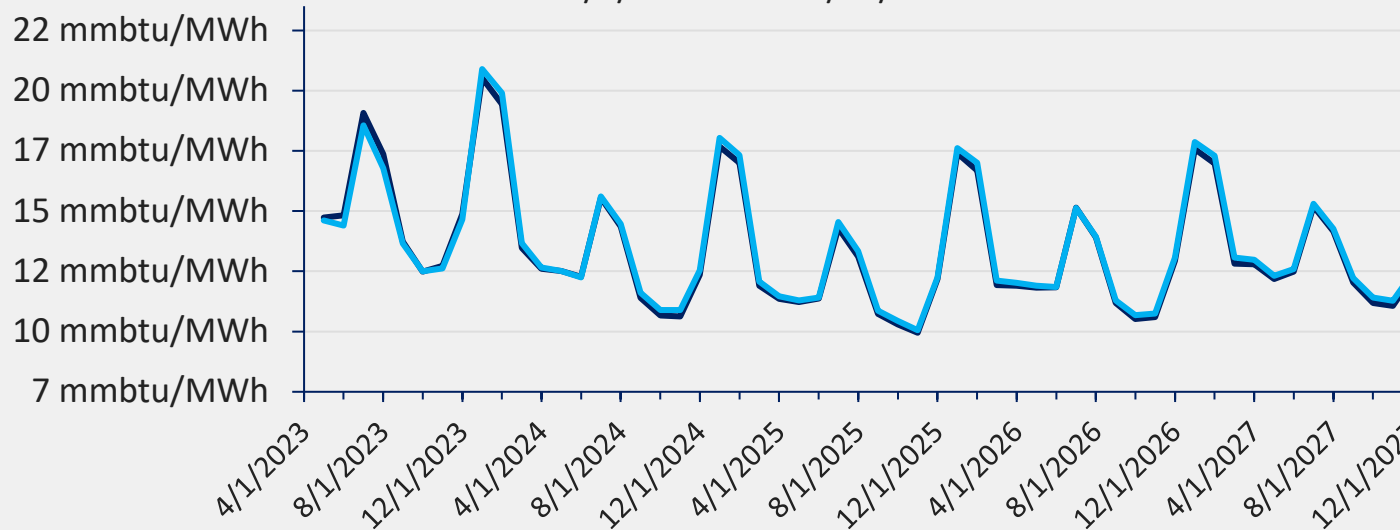
— 4/7/2023 — 3/31/2023



- For the PJM region, we use PJM-W hub as the benchmark. PJM-W is the most traded power hub in the US.
- PJM saw only minor changes WoW.

PJM ATC Heat Rate Curve

— 4/7/2023 — 3/31/2023

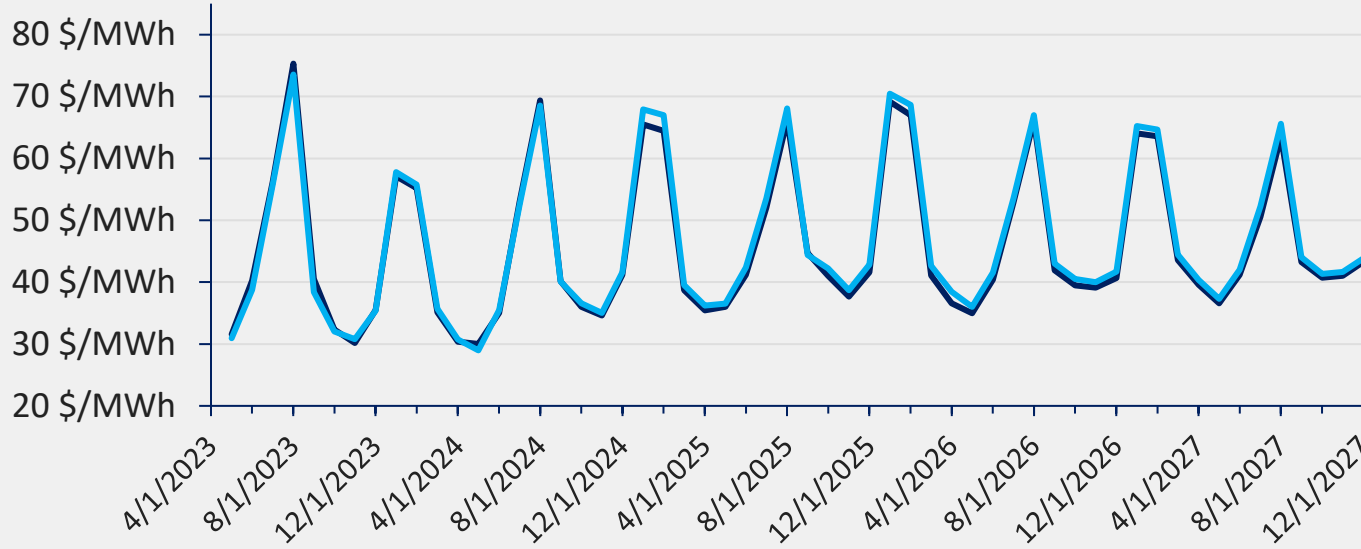


Source: BitOoda, CME Group

ERCOT WoW

ERCOT ATC Forward Curve

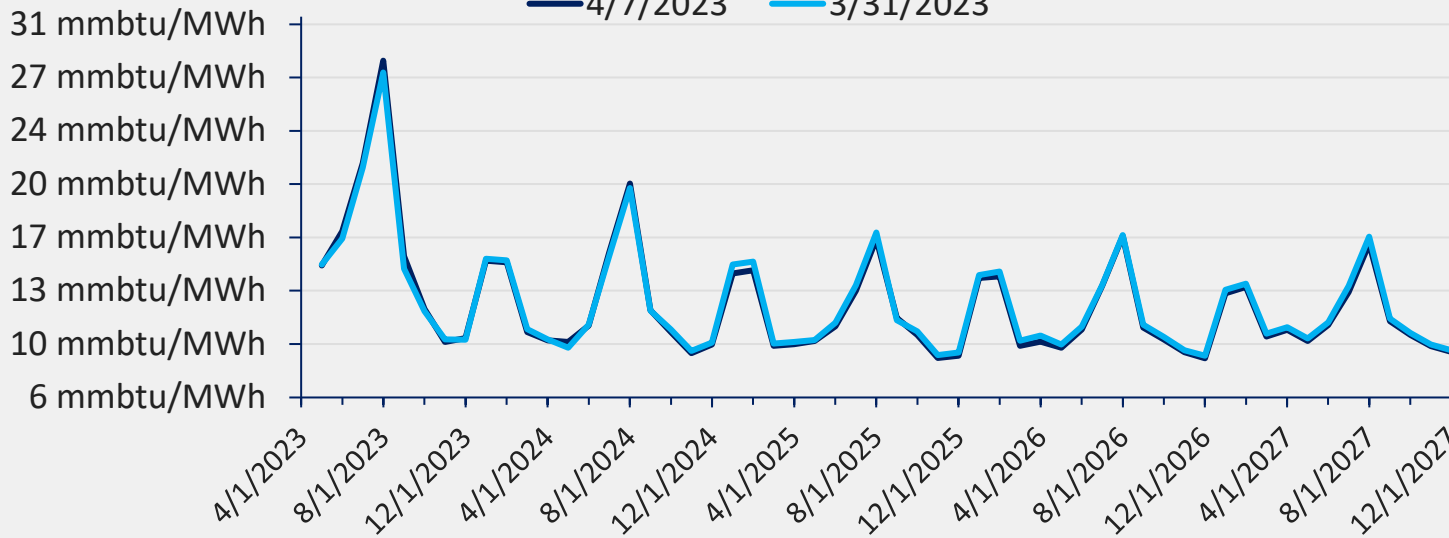
— 4/7/2023 — 3/31/2023



- For the ERCOT region, we use ERCOT-North hub as the benchmark. ERCOT-North is the most traded power hub for ERCOT.
- ERCOT saw only minor change WoW.

ERCOT ATC Heat Rate Curve

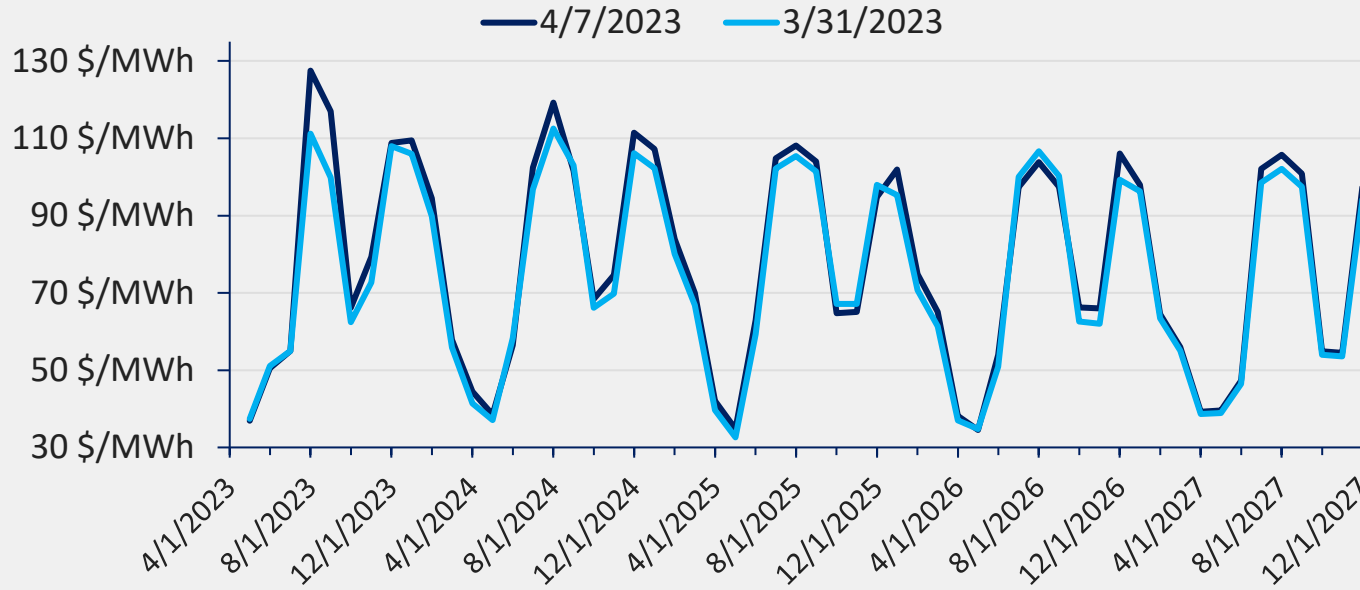
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Source: BitOoda, CME Group

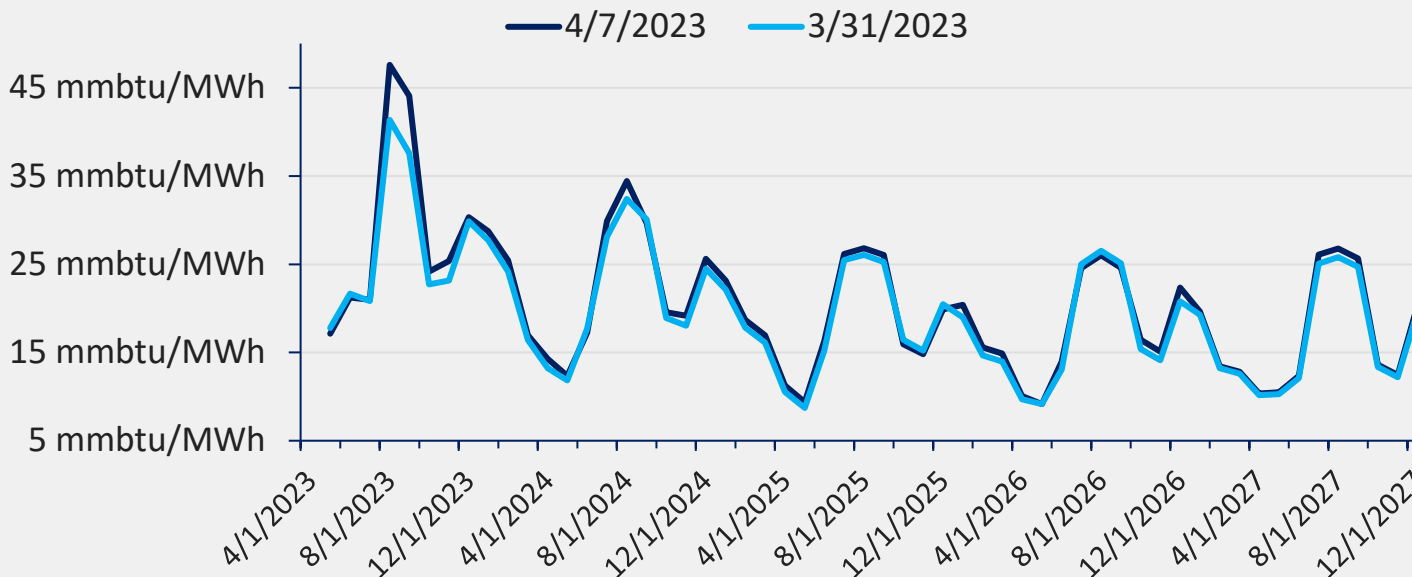
CAISO WoW

CAISO ATC Forward Curve



- For the CAISO region, we use SP-15 hub as the benchmark. SP-15 is located in Southern California.
- We saw an increase in this summer pricing.

CAISO ATC Heat Rate Curve

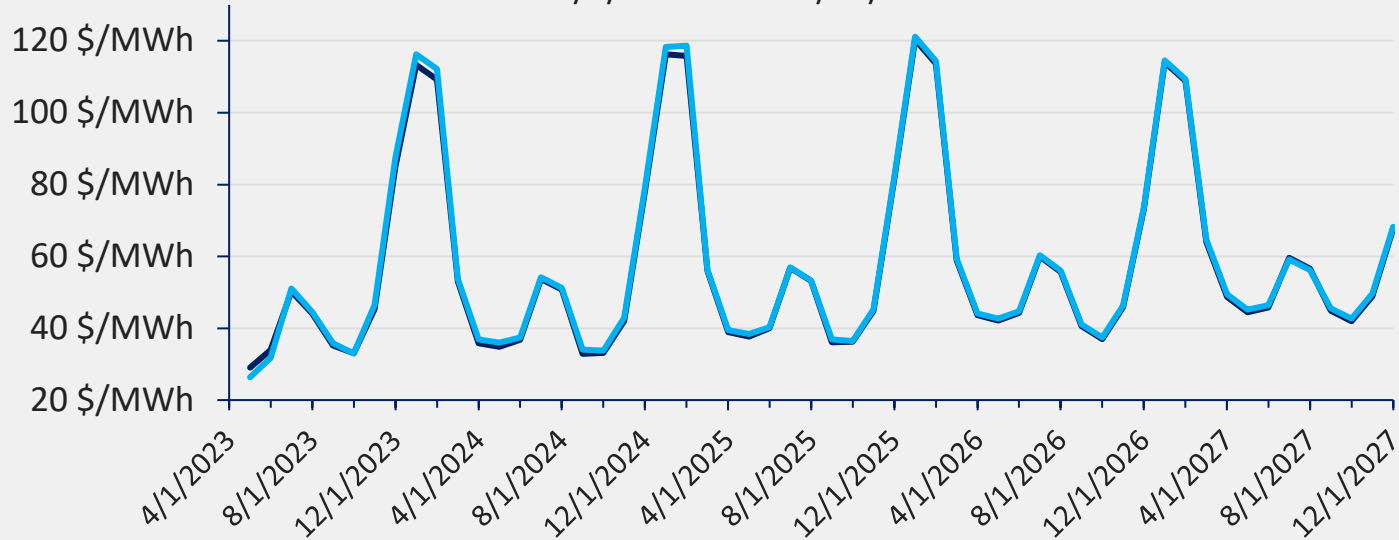


Source: BitOoda, CME Group

NYISO WoW: NY-G

NYISO NY-G ATC Forward Curve

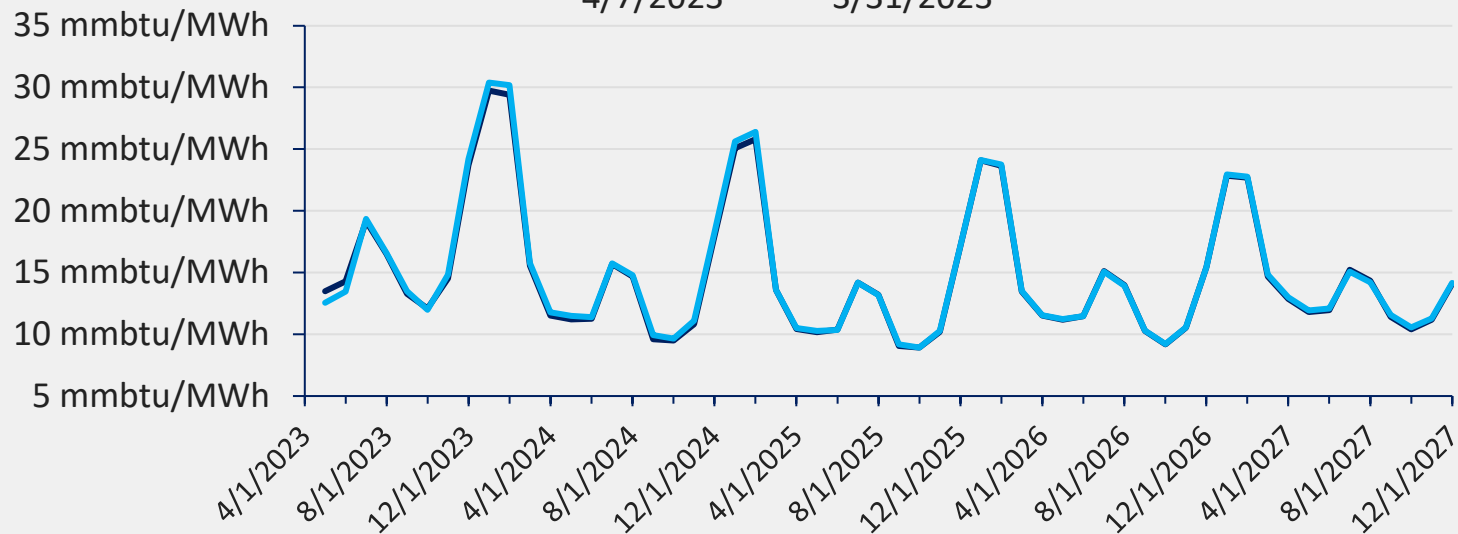
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- This slide uses the NY-G hub as the benchmark for the NYISO region. NY-G is the most traded power hub in NYISO.
- NYISO saw only minor changes last week.

NYISO NY-G ATC Heat Rate Curve

— 4/7/2023 — 3/31/2023



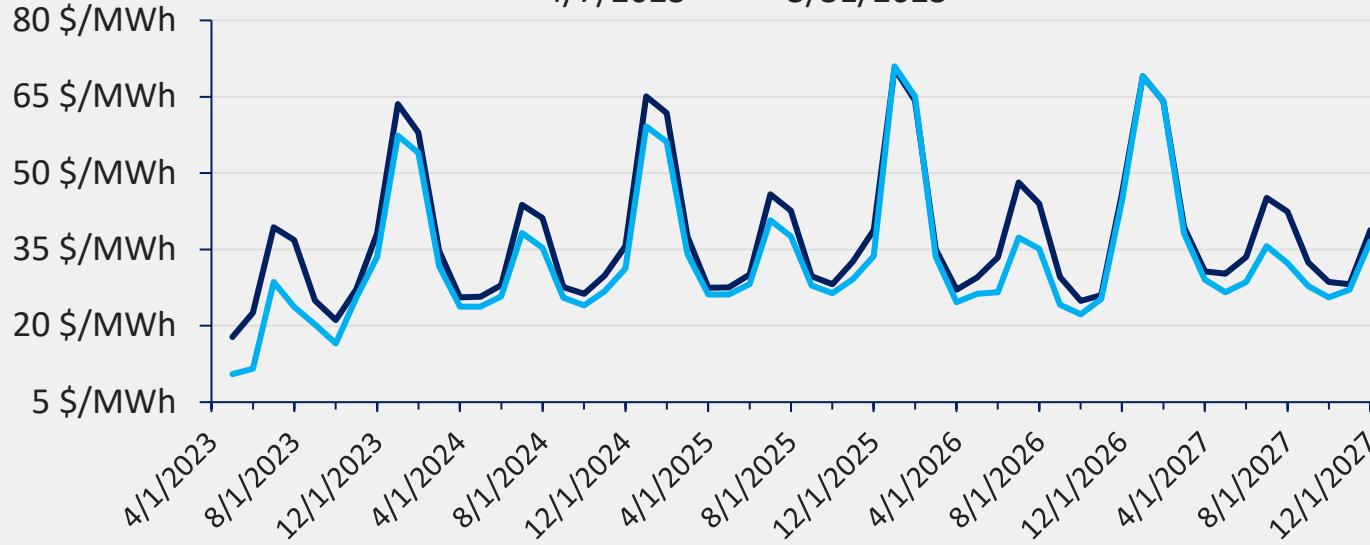
Source: BitOoda, CME Group

NYISO WoW: NY-A

- This slide adds NY-A for the NYISO region.
- NY-A is up and moving on its own again.

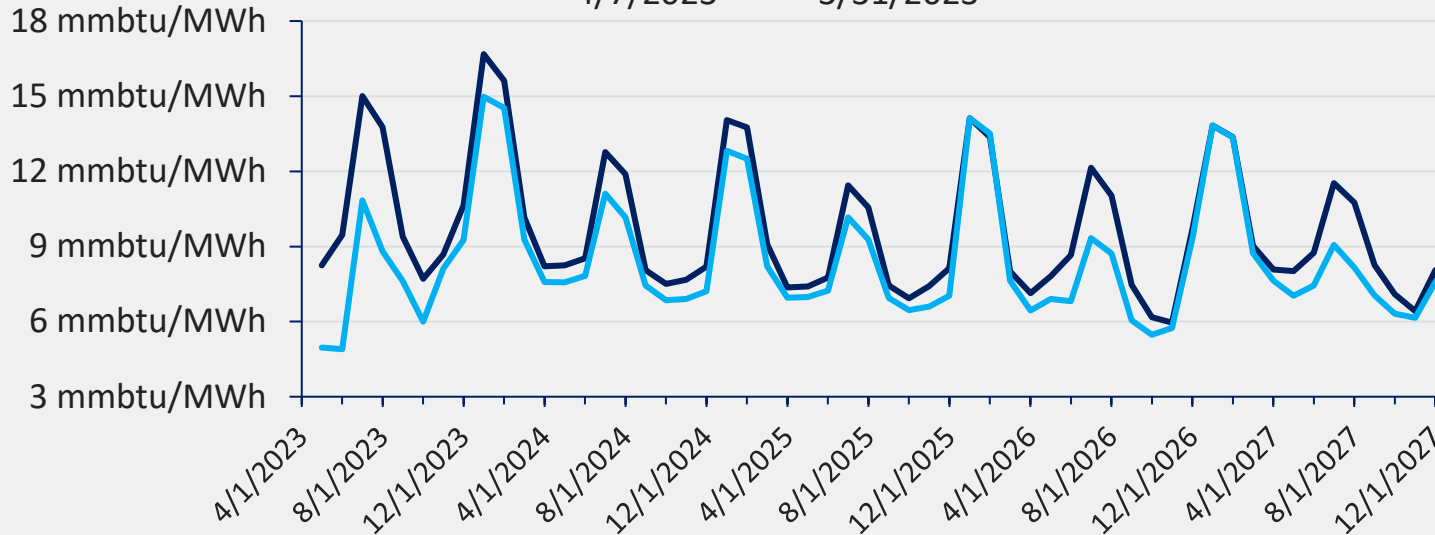
NYISO NY-A ATC Forward Curve

— 4/7/2023 — 3/31/2023



NYISO NY-A ATC Heat Rate Curve

— 4/7/2023 — 3/31/2023



Source: BitOoda, CME Group



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