

# Petal Gas Storage

Storage Valuation Analysis — 2,000,000 Dth (2 BCF) Working Gas — TRANSCO Zone 4 (Station 85), Mississippi  
2-Year (2027–2029) and 5-Year (2027–2032)

Prepared for Chris Kralich

Date: March 30, 2026

Forward Curves as of: March 20, 2026 (Henry Hub + TRANSCO Zone 4, Station 85)

Cash Prices: Station 85 daily (Jan 2020 — Mar 2026, 2,270 observations)

Prepared by: Valor Analytics

## Deal Summary

Parameter	Value
Facility	Petal Gas Storage — TRANSCO Zone 4 (Station 85), Mississippi
Operator	Gulf South Pipeline (Boardwalk Pipelines)
Facility Type	Non-salt (Depleted Reservoir)
Deal Size	2,000,000 Dth (2 BCF) Working Gas
Service Type	Firm Storage Service (FSS)
Terms Analyzed	2-Year (2027–2029) and 5-Year (2027–2032)
Starting Inventory	Empty (0 Dth)
Reservation Fee	\$0.32/Dth/month (\$7.68M/yr, \$640K/mo)
Delivery Point	TRANSCO Zone 4, Station 85
Settlement	Platts IFERC (forwards), ICE Day-Ahead (spot)

## Valuation Comparison — 2-Year vs 5-Year

Intrinsic: optimal schedule on delivered forward curve (HH + Z4 basis). Extrinsic: Monte Carlo simulation (10,000 scenarios) with seasonal calibration, cash-to-prompt modeling from Station 85 data, 14-month lookahead. All values PV at 5%.

	2-Year	5-Year
Intrinsic Value (LP)	\$6,209,235	\$14,795,150
<b>Calendar Extrinsic</b>	<b>\$2,473,819</b>	<b>\$4,561,902</b>
<b>C2P Extrinsic</b>	<b>\$5,802,424</b>	<b>\$14,541,391</b>
<b>Total Extrinsic</b>	<b>\$8,276,243</b>	<b>\$19,103,293</b>
<b>Gross Value</b>	<b>\$14,485,477</b>	<b>\$33,898,443</b>
Less: PV Reservation Fee	\$14,588,095	\$33,914,052
<b>Net Deal Value</b>	<b>(\$102,618)</b>	<b>(\$15,609)</b>
<b>C2P % of Extrinsic</b>	<b>70.1%</b>	<b>76.1%</b>
Extrinsic % of Intrinsic	133.3%	129.1%
\$/MMBtu (Gross)	\$7.24	\$16.95
Paths / Std Error	10,000 / ±\$67,120	6,000 / ±\$141,427

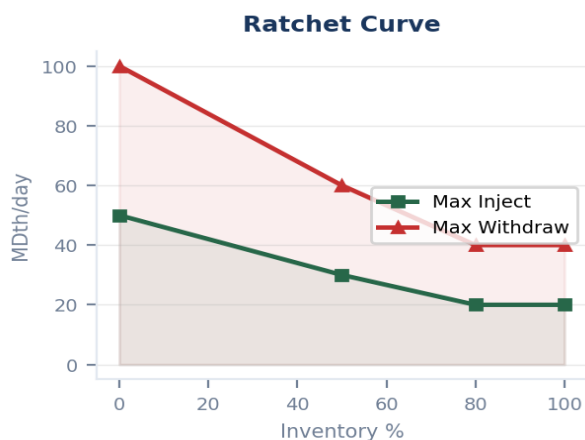
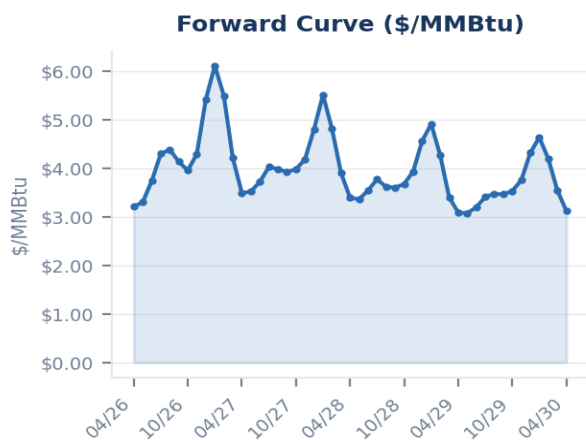
The three-way decomposition splits total extrinsic into **calendar re-optimization** (value from forward curve rebalancing) and **C2P spot execution** (incremental value from daily cash pricing). C2P represents the optionality of daily nomination timing against the cash market.

**C2P Contribution:** 2-year C2P = 70% of extrinsic, 5-year C2P = 76% of extrinsic. Industry benchmark for fast-cycle storage: 50–80% of extrinsic. **Hedge guidance:** lock in seasonal calendar spreads (sell winter, buy summer). Sell-side (winter withdrawal): hedge 80–90% to protect revenue, leave 10–20% for cash spike capture. Buy-side (summer injection): hedge 60–70%, leave 30–40% uncommitted — the longer injection season gives more days to time purchases against favorable cash prices. The uncommitted daily capacity on both sides is where C2P value is captured.

**Key Finding:** Net deal value: 2-year (\$102,618), 5-year (\$15,609). Breakeven reservation fee: 2-year \$0.32/Dth/mo, 5-year \$0.32/Dth/mo.

# Forward Curve & Deal Structure

Left: delivered forward curve (HH + basis) used for intrinsic optimization. Right: ratchet constraints governing maximum injection/withdrawal rates as a function of inventory level.



**Forward Curve:** 49 tenors, range \$3.07–\$6.12/MMBtu, mean \$3.99/MMBtu. Summer–winter spreads drive intrinsic value.

# Valuation Methodology

## A. How We Value Storage

Storage value has two components: **intrinsic** (the value of the optimal buy-low / sell-high schedule based on today's forward curve) and **extrinsic** (the additional value from being able to re-optimize as market conditions change). The extrinsic is the optionality premium — it's what makes storage more valuable than a simple forward contract.

Value Component	What It Means	How to Capture
Intrinsic Value	Optimal inject/withdraw schedule at current forward curves	Hedges the monthly forwards
Calendar Extrinsic	Value from re-optimizing as forward curves evolve	Rebalance of monthly hedges
Cash-to-Prompt (C2P)	Value from timing daily nominations against the cash market	Active daily trading desk

## B. Market Calibration

The forward curve simulation is calibrated from **one year of daily NG price history**, with seasonal adjustments for Winter (Nov–Mar), Summer (Jun–Aug), and Shoulder months. Near-term contracts are modeled with higher volatility than deferred contracts, reflecting the well-documented observation that futures prices become more volatile as delivery approaches.

The cash-to-prompt model is calibrated from **6 years of Station 85 daily cash prices** (Jan 2020–Mar 2026, 2,270 observations). The model captures the mean-reverting nature of cash-futures spreads, seasonal volatility patterns (higher in winter and summer peaks), and occasional price spikes during extreme weather events.

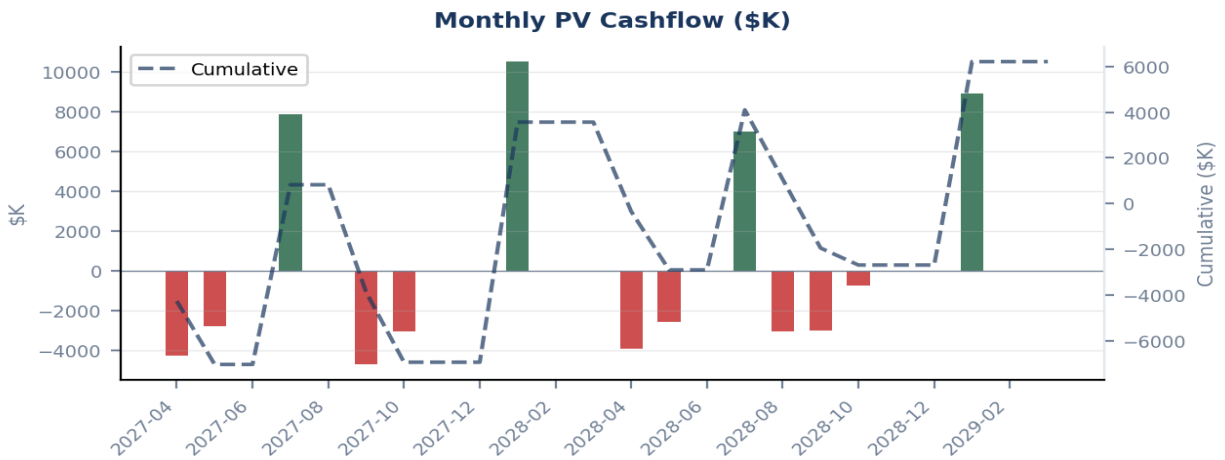
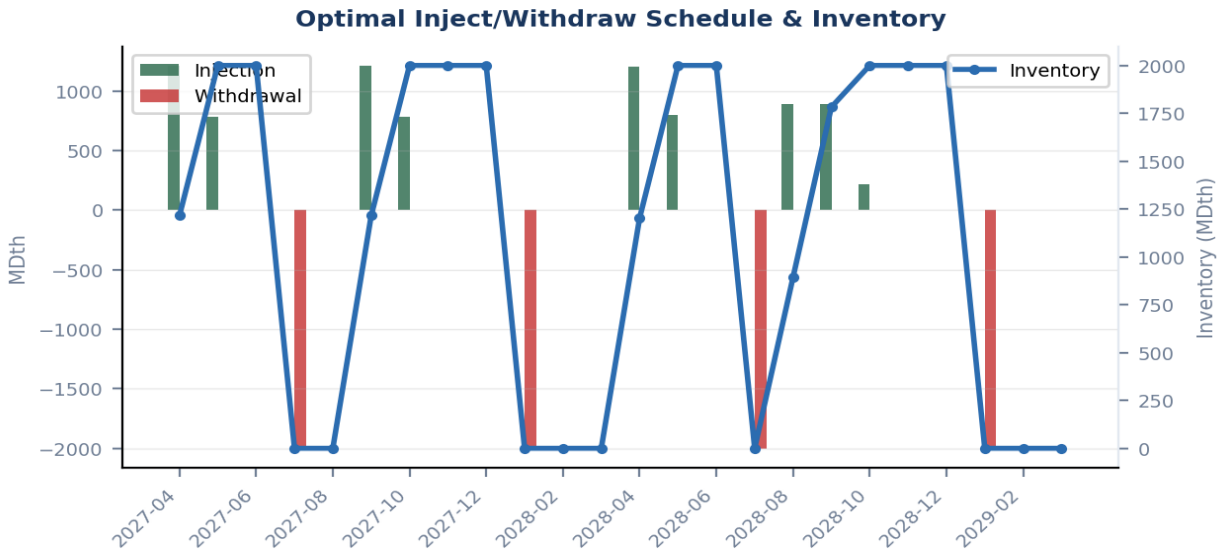
Input	Source	Coverage
Forward Curve	Henry Hub + TRANSCO Z4 Basis	49 monthly prices (Apr 2026–Apr 2030)
Historical Prices	Daily NG settlements	252 trading days (1 year)
Cash Prices	Station 85 (TRANSCO Z4)	2,270 daily observations (Jan 2020–Mar 2026)
Seasonal Regimes	Winter / Summer / Shoulder	Separate volatility profiles per season

## C. Simulation Parameters

Parameter	Value
Monte Carlo Paths	10,000 (5,000 + antithetic pairs)
Rebalance Frequency	Every 21 gas days (~monthly)
Optimization Window	14 months (one full seasonal cycle)
Discount Rate	5.0% annual
Reservation Fee Treatment	Excluded from NPV (sunk cost — shown separately)

# Intrinsic Schedule Visualization

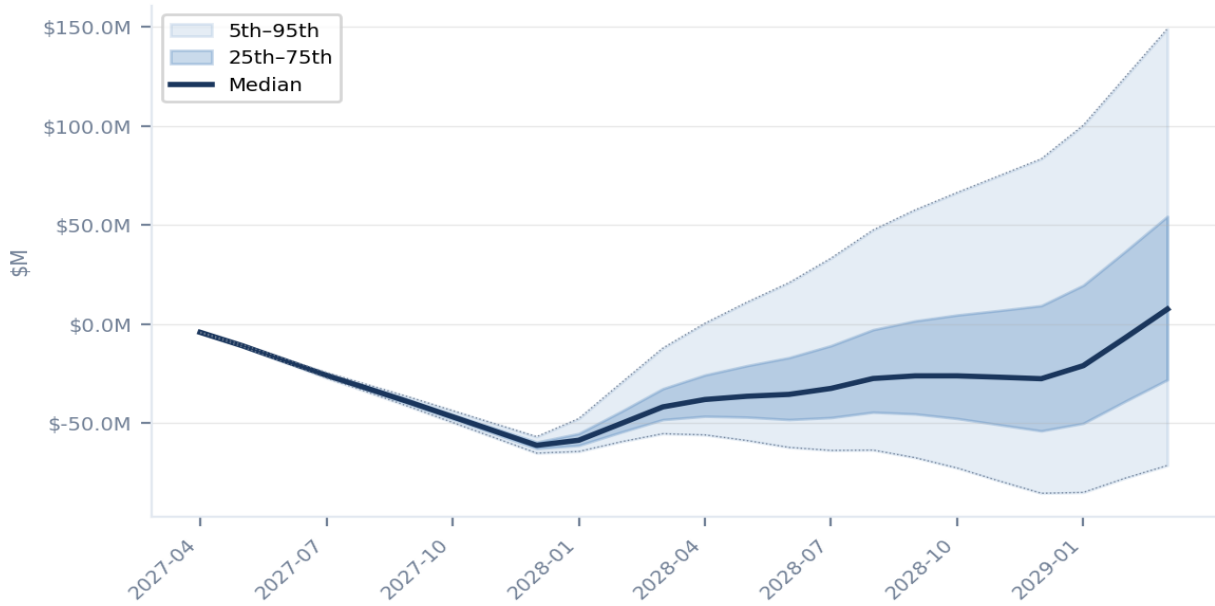
Top: monthly injection/withdrawal volumes and ending inventory for the LP-optimal 2-year schedule. Bottom: monthly present-value cashflows with cumulative NPV overlay.



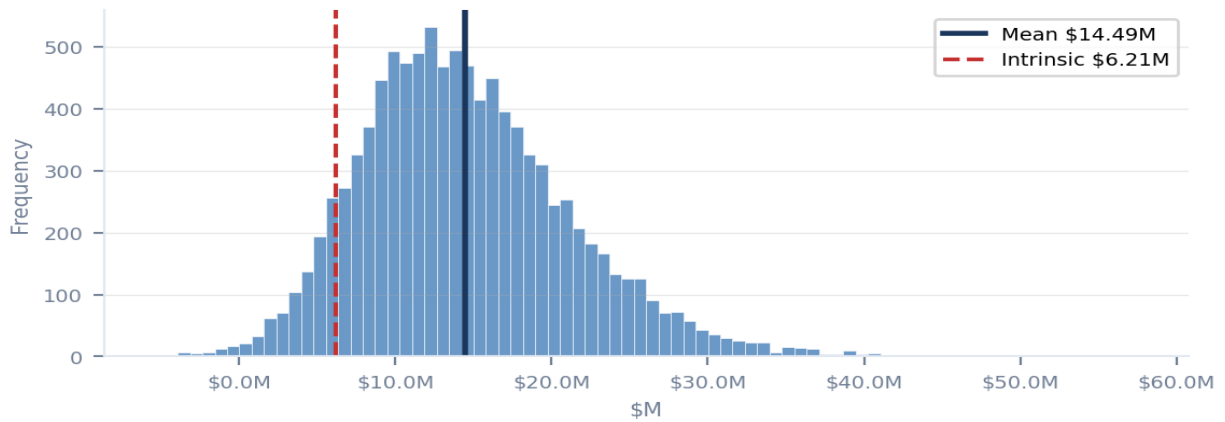
# Monte Carlo Simulation Results

Top: cumulative NPV fan chart showing percentile bands across all simulation paths. Bottom: terminal NPV distribution with mean and intrinsic reference lines.

### Rolling Intrinsic — Cumulative NPV Fan Chart



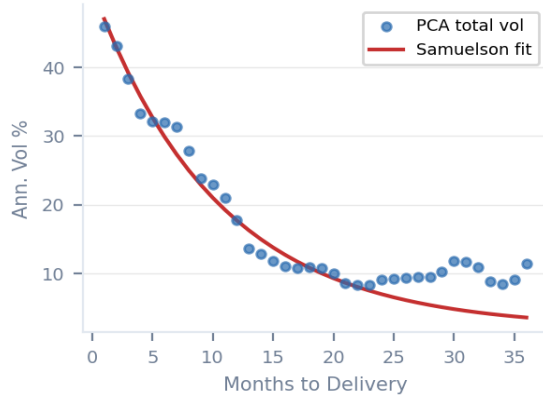
### NPV Distribution (10,000 paths)



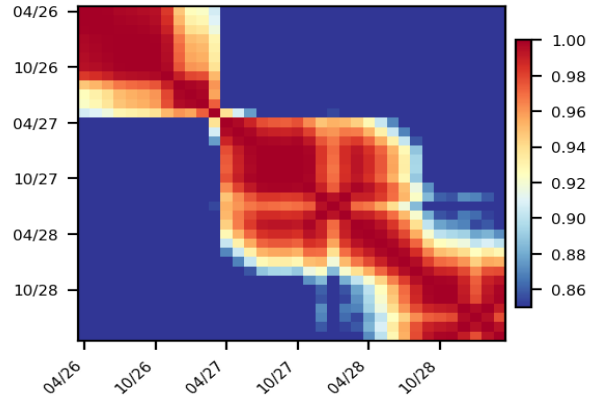
# Calibration & Volatility

Left: Samuelson volatility term structure — PCA-derived total vol per tenor vs. fitted  $\sigma(\text{TMM}) = \sigma_{\text{long}} + (\sigma_{\text{short}} - \sigma_{\text{long}}) \cdot \exp(-\lambda \cdot \text{TMM})$ . Right: forward-forward correlation matrix showing decorrelation at longer tenors.

**Samuelson Vol Term Structure (R<sup>2</sup>=0.978)**



**Forward Correlation Matrix**



## Cash-to-Prompt (C2P) Analysis

The **cash-to-prompt spread** is the difference between the daily physical gas price at the delivery location and the prompt-month futures price. This spread is a key driver of storage value for physical operators — it represents the premium (or discount) for having gas available today versus next month.

Post-2010, seasonal calendar spreads have narrowed significantly. As a result, the majority of storage value now comes from **daily cash-vs-futures trading optionality** rather than buy-summer/sell-winter strategies. This C2P optionality is a competitive advantage for physical operators over financial traders who only access the futures market.

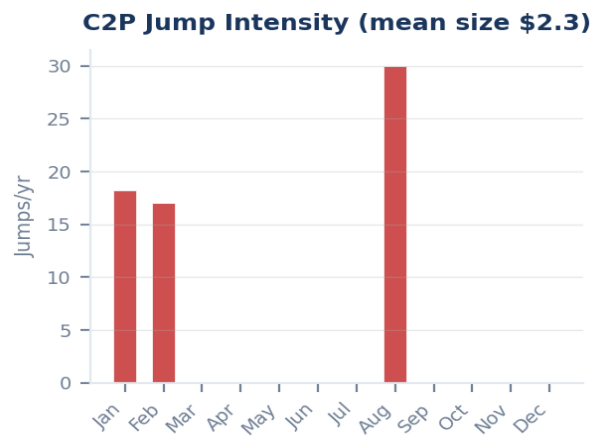
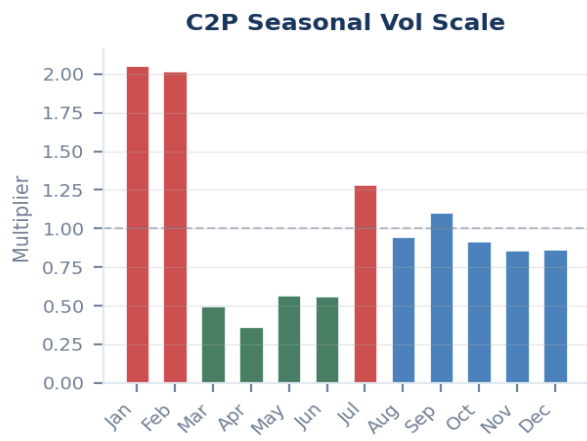
Metric	Value
Location premium (Station 85 vs HH)	+\$0.181/MMBtu average
Normal daily range	±\$0.589/MMBtu around the mean
Mean reversion half-life	17 trading days (~1 weeks)
Data source	Station 85 daily cash prices (Jan 2020–Mar 2026)
Observations	2,270 daily prices across 6+ years
Price spikes detected	3 months with spike activity
Average spike magnitude	\$2.26/MMBtu

## Rolling C2P Execution Diagnostics

Metric	2-Year	5-Year
Reported gas days with executed flow	360	930
Reported gas days with deferred flow	554	1,324
Reported gas days with forced catch-up	345	883
Executed path decisions	300	832
Deferred path decisions	513	1,292
Forced path decisions	297	823
Average executed spread	+\$1.689/MMBtu	+\$1.605/MMBtu
Average deferred spread	+\$1.567/MMBtu	+\$1.681/MMBtu
Total C2P P&L contribution	\$5,802,424	\$14,541,391

Gas-day activity counts come from rolling `c2pWindowResults`; aggregate path decisions, spreads, and P&L; come from `c2pExecutionSummary` when present.

## C2P Seasonal Patterns

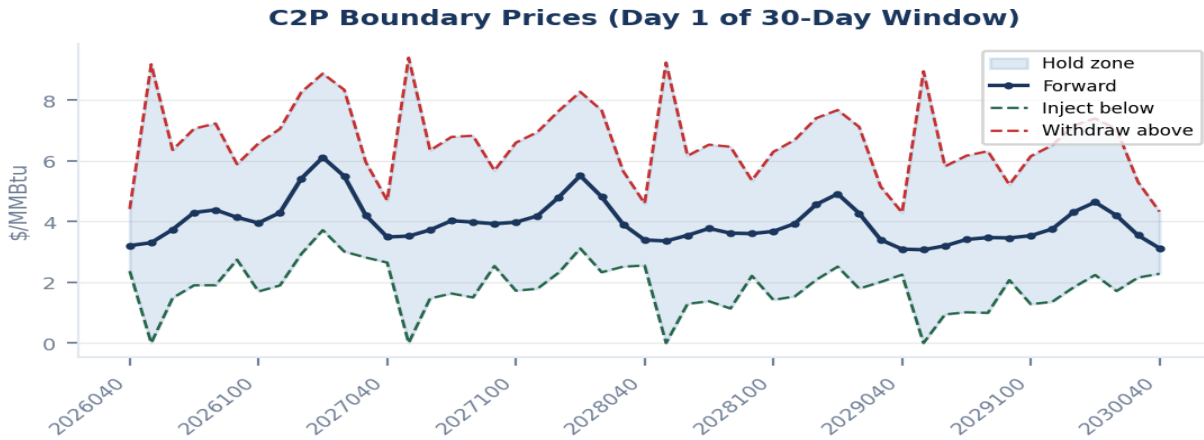


Left: seasonal vol multiplier (peak Jan: 2.05x). Right: monthly jump intensity showing concentration in winter/summer.

# Hedging & Operational Strategy

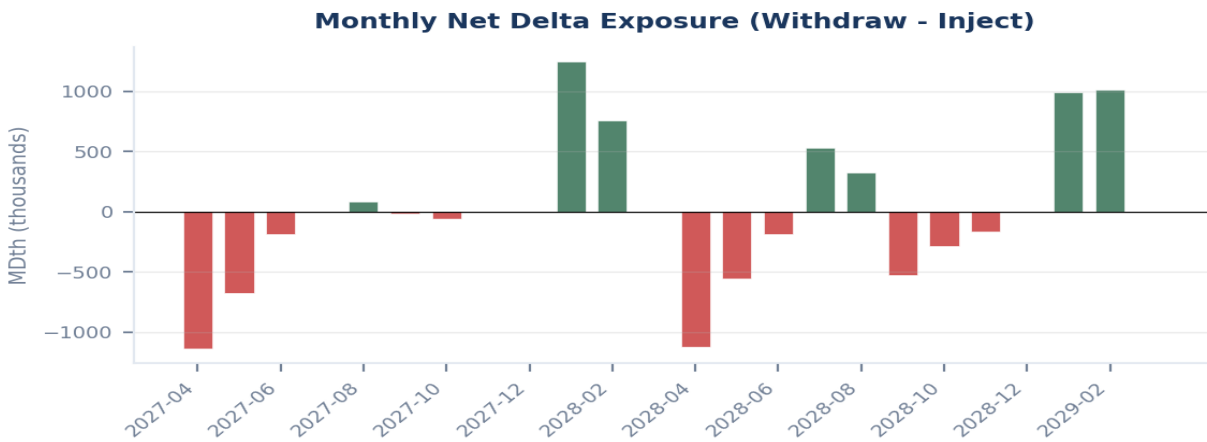
## Daily Boundary Prices

Inject when cash falls below the green boundary (cheap gas). Withdraw when cash rises above the red boundary (expensive gas). Hold when cash is in the shaded zone. These thresholds are computed from the C2P calibration and adjust seasonally — wider in winter (high vol), narrower in summer.



## Monthly Net Delta Exposure

Net physical position by month from the optimal rolling schedule. Green bars = net withdrawal (long gas, sell forward to hedge). Red bars = net injection (short gas, buy forward to hedge). The trading desk hedges these monthly positions on forwards while retaining daily timing flexibility.



## Recommended Operating Approach

**Hedge the months, trade the days.** Monthly forward hedges settle against the monthly index — they do not constrain daily injection/withdrawal decisions. The trading desk locks in seasonal spreads with monthly forwards (protecting revenue and managing cost), then optimizes daily nominations against the cash market using the boundary prices above. All three value layers — intrinsic, calendar extrinsic, and C2P timing — are captured simultaneously.

Timeframe	Action	Value Captured
At deal signing	Hedge seasonal spread on monthly forwards (sell winter, buy summer)	\$6.2M / 2yr

Timeframe	Action	Value Captured
Monthly	Roll and rebalance monthly hedges as curve reshapes	Calendar extrinsic (+\$2.5M)
Daily	Use boundary prices to time inject/withdraw nominations	C2P timing (+\$5.8M)

# Sensitivity Analysis

## Net Value at Different Reservation Fee Levels

Rate (\$/Dth/mo)	2-Yr PV Fee	2-Yr Net	5-Yr PV Fee	5-Yr Net
\$0.10	\$4,558,780	\$9,926,698	\$10,598,141	\$23,300,302
\$0.15	\$6,838,170	\$7,647,308	\$15,897,212	\$18,001,231
\$0.18	\$8,205,803	\$6,279,674	\$19,076,654	\$14,821,789
\$0.20	\$9,117,559	\$5,367,918	\$21,196,283	\$12,702,160
\$0.25	\$11,396,949	\$3,088,528	\$26,495,353	\$7,403,090
\$0.30	\$13,676,339	\$809,138	\$31,794,424	\$2,104,019
\$0.32 *	\$14,588,095	(\$102,618)	\$33,914,052	(\$15,609)
\$0.35	\$15,955,729	(\$1,470,251)	\$37,093,494	(\$3,195,051)
\$0.40	\$18,235,119	(\$3,749,641)	\$42,392,565	(\$8,494,122)

\* Offered rate. Green = positive net value.

## Value Capture Framework: Hedge the Months, Trade the Days

Component	2-Year	5-Year	How to Capture	Risk Profile
Intrinsic (seasonal spread)	\$6,209,235	\$14,795,150	Monthly forward hedges	Locked — no market risk
Calendar Extrinsic	\$2,473,819	\$4,561,902	Rolling rebalance of monthly hedges	Gas — only adjust when profitable
<b>C2P (daily timing)</b>	<b>\$5,802,424</b>	<b>\$14,541,391</b>	<b>Active daily trading desk</b>	<b>Requires execution capability</b>
<b>Total</b>	<b>\$14,485,477</b>	<b>\$33,898,443</b>		

**Key point:** Monthly forward hedges do not constrain daily operational flexibility. Forwards settle against the monthly index — the trading desk still chooses which days within each month to inject or withdraw. All three value layers are accessible simultaneously: hedge the seasonal spread with monthly forwards, rebalance as curves move, and trade the daily cash market for timing value.

**Breakeven:** 2-Year: \$0.32/Dth/mo | 5-Year: \$0.32/Dth/mo.

## Key Risks

Risk	Impact	Mitigation
Forward curve flattening	Intrinsic declines with narrower spreads	Lock in calendar spreads early
Volatility decline	Extrinsic drops ~40–50%	Strong intrinsic base provides buffer
Execution risk	Actual capture may be 60–80% of model	Evening + intraday nomination flexibility
Basis risk	Z4 cash may decouple from Henry Hub	Location-specific cash data used in model
Weather extremes	Cash spikes can exceed \$4–7/MMBtu	Spike scenarios included in simulation

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*DISCLAIMER: This analysis is for informational purposes only and does not constitute a recommendation to enter into any transaction. Values are model-based estimates that may differ from actual market outcomes. Valor Analytics makes no representation regarding the accuracy or completeness of this analysis.*

## Appendix A: 2-Year Optimal Schedule (2027–2029)

LP-optimal injection/withdrawal schedule on delivered forward curve. Discount rate: 5.0%.

Month	Avg Price	Injection	Withdrawal	End Inventory	PV Cashflow
2027-04	\$3.49	1,215,140	—	1,215,140	\$-4,272,663
2027-05	\$3.52	784,860	—	2,000,000	\$-2,770,834
2027-06	\$3.73	—	—	2,000,000	\$0
2027-07	\$4.03	—	2,000,000	0	\$7,864,396
2027-08	\$3.98	—	—	-0	\$0
2027-09	\$3.93	1,215,140	—	1,215,140	\$-4,702,996
2027-10	\$3.98	784,860	—	2,000,000	\$-3,064,760
2027-11	\$4.19	—	—	2,000,000	\$0
2027-12	\$4.80	—	—	2,000,000	\$0
2028-01	\$5.51	—	2,000,000	0	\$10,508,065
2028-02	\$4.81	—	—	0	\$0
2028-03	\$3.91	—	—	0	\$0
2028-04	\$3.39	1,203,157	—	1,203,157	\$-3,911,939
2028-05	\$3.36	796,843	—	2,000,000	\$-2,554,862
2028-06	\$3.55	—	—	2,000,000	\$0
2028-07	\$3.77	—	2,000,000	0	\$7,002,835
2028-08	\$3.62	892,773	—	892,773	\$-3,040,052
2028-09	\$3.60	889,686	—	1,782,460	\$-3,006,037
2028-10	\$3.68	217,540	—	2,000,000	\$-745,710
2028-11	\$3.93	—	—	2,000,000	\$0
2028-12	\$4.56	—	—	2,000,000	\$0
2029-01	\$4.91	—	2,000,000	0	\$8,903,791
2029-02	\$4.27	—	—	0	\$0
2029-03	\$3.40	—	—	0	\$0

**2-Year Intrinsic NPV: \$6,209,235**

## Appendix B: 5-Year Optimal Schedule (2027–2032)

### Year 2027

Month	Avg Price	Injection	Withdrawal	End Inventory	PV Cashflow
2027-04	\$3.49	1,215,140	—	1,215,140	\$-4,272,663
2027-05	\$3.52	784,860	—	2,000,000	\$-2,770,834
2027-06	\$3.73	—	—	2,000,000	\$0
2027-07	\$4.03	—	2,000,000	-0	\$7,864,396
2027-08	\$3.98	—	—	0	\$0
2027-09	\$3.93	1,215,140	—	1,215,140	\$-4,702,996
2027-10	\$3.98	784,860	—	2,000,000	\$-3,064,760
2027-11	\$4.19	—	—	2,000,000	\$0
2027-12	\$4.80	—	—	2,000,000	\$0

Year 2027 PV: (\$6,946,857)

### Year 2028

Month	Avg Price	Injection	Withdrawal	End Inventory	PV Cashflow
2028-01	\$5.51	—	2,000,000	0	\$10,508,065
2028-02	\$4.81	—	—	0	\$0
2028-03	\$3.91	—	—	0	\$0
2028-04	\$3.39	1,203,157	—	1,203,157	\$-3,911,939
2028-05	\$3.36	796,843	—	2,000,000	\$-2,554,862
2028-06	\$3.55	—	—	2,000,000	\$0
2028-07	\$3.77	—	2,000,000	0	\$7,002,835
2028-08	\$3.62	892,773	—	892,773	\$-3,040,052
2028-09	\$3.60	889,686	—	1,782,460	\$-3,006,037
2028-10	\$3.68	217,540	—	2,000,000	\$-745,710
2028-11	\$3.93	—	—	2,000,000	\$0
2028-12	\$4.56	—	—	2,000,000	\$0

Year 2028 PV: \$4,252,301

### Year 2029

Month	Avg Price	Injection	Withdrawal	End Inventory	PV Cashflow
2029-01	\$4.91	—	2,000,000	0	\$8,903,791
2029-02	\$4.27	—	—	0	\$0
2029-03	\$3.40	—	—	0	\$0
2029-04	\$3.09	1,203,157	—	1,203,157	\$-3,392,343
2029-05	\$3.07	796,843	—	2,000,000	\$-2,223,085
2029-06	\$3.20	—	—	2,000,000	\$0
2029-07	\$3.41	—	—	2,000,000	\$0
2029-08	\$3.47	—	—	2,000,000	\$0
2029-09	\$3.46	—	—	2,000,000	\$0

2029-10	\$3.53	—	—	2,000,000	\$0
2029-11	\$3.76	—	—	2,000,000	\$0
2029-12	\$4.32	—	—	2,000,000	\$0

Year 2029 PV: \$3,288,362

## Appendix B: 5-Year Optimal Schedule (continued)

### Year 2030

Month	Avg Price	Injection	Withdrawal	End Inventory	PV Cashflow
2030-01	\$4.64	—	2,000,000	0	\$7,993,352
2030-02	\$4.20	—	—	0	\$0
2030-03	\$3.55	—	—	0	\$0
2030-04	\$3.12	1,215,140	—	1,215,140	\$-3,290,509
2030-05	\$3.31	784,860	—	2,000,000	\$-2,245,620
2030-06	\$3.55	—	—	2,000,000	\$0
2030-07	\$3.88	—	2,000,000	-0	\$6,512,950
2030-08	\$3.87	—	—	0	\$0
2030-09	\$3.78	1,203,157	—	1,203,157	\$-3,860,013
2030-10	\$3.79	796,843	—	2,000,000	\$-2,548,663
2030-11	\$4.04	—	—	2,000,000	\$0
2030-12	\$4.78	—	—	2,000,000	\$0

Year 2030 PV: \$2,561,497

### Year 2031

Month	Avg Price	Injection	Withdrawal	End Inventory	PV Cashflow
2031-01	\$5.30	—	2,000,000	0	\$8,684,672
2031-02	\$4.69	—	—	0	\$0
2031-03	\$3.77	—	—	0	\$0
2031-04	\$3.26	1,215,140	—	1,215,140	\$-3,269,030
2031-05	\$3.31	784,860	—	2,000,000	\$-2,136,100
2031-06	\$3.55	—	—	2,000,000	\$0
2031-07	\$3.88	—	2,000,000	0	\$6,195,310
2031-08	\$3.87	—	—	0	\$0
2031-09	\$3.78	1,203,157	—	1,203,157	\$-3,671,758
2031-10	\$3.79	796,843	—	2,000,000	\$-2,424,363
2031-11	\$4.04	—	—	2,000,000	\$0
2031-12	\$4.78	—	—	2,000,000	\$0

Year 2031 PV: \$3,378,730

### Year 2032

Month	Avg Price	Injection	Withdrawal	End Inventory	PV Cashflow
2032-01	\$5.30	—	2,000,000	0	\$8,261,115
2032-02	\$4.69	—	—	0	\$0
2032-03	\$3.77	—	—	0	\$0

Year 2032 PV: \$8,261,115

**5-Year Intrinsic NPV: \$14,795,150**