



LNG Temporal Arbitrage Optimization

Transforming Sequential Scheduling into Strategic Profit Maximization

Alto Commodities | Advanced LNG Trading Platform





Executive Summary

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The Opportunity

Traditional LNG optimization uses **mechanical scheduling**: Load Day → Fixed Delivery Day

\$2-5M per cargo left on the table through missed temporal arbitrage opportunities

New **Temporal Arbitrage Engine** captures timing-based profit spreads

2

The Solution

Enhanced Mathematical Optimizer with delivery timing flexibility ($\pm 3-7$ days)

Strategic timing decisions based on price curve analysis

15-30% profit improvement over sequential optimization

3

Business Impact

\$10-50M annual uplift for typical LNG portfolio (10-20 cargoes/year)

Risk-adjusted returns through better market timing

Competitive advantage in volatile markets



Current Challenge: Sequential vs. Strategic

Traditional Approach - "Mechanical Scheduling"

Load Jan 15 (HH \$3.50) → Sail 20 days → Deliver Feb 8 (TTF \$11.00)

Profit = \$11.00 - \$3.50 - \$3.00 costs = **\$4.50/MMBtu**

Enhanced Approach - "Temporal Arbitrage"

Load Jan 31 (HH \$3.00) → Sail 20 days → Deliver Feb 12 (TTF \$11.50)

Profit = \$11.50 - \$3.00 - \$3.00 costs = **\$5.50/MMBtu**

Uplift = **+\$1.00/MMBtu = +\$1.7M per cargo**

"We're optimizing WHEN to load and WHEN to deliver independently, not just sequential voyage planning"



Temporal Arbitrage Strategies

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Month-End/Beginning Spreads

- **Loading Strategy:** Target month-end when Henry Hub typically softens
- **Delivery Strategy:** Capture month-beginning when European/Asian demand peaks
- **Typical Uplift:** \$0.50-1.50/MMBtu

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Seasonal Storage Plays

- **Summer Loading:** Capture low demand periods (May-August)
- **Winter Delivery:** Maximize high demand windows (Nov-Feb)
- **Floating Storage:** Use delivery flexibility for storage arbitrage
- **Typical Uplift:** \$1.00-3.00/MMBtu

3

Weather-Driven Opportunities

- **Pre-Cold Snap Loading:** Anticipate demand spikes
- **Warm Weather Avoidance:** Skip low-demand periods
- **Typical Uplift:** \$0.75-2.50/MMBtu

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Price Volatility Capture

- **Delivery Window Optimization:** $\pm 3-7$ days flexibility
- **Peak Price Targeting:** Hit TTF/JKM spikes precisely
- **Typical Uplift:** \$0.25-1.00/MMBtu

Technical Innovation: Enhanced Mathematical Formulation

Traditional Decision Variables

$x[\text{loading_day}, \text{market}, \text{vessel}] = \text{Binary decision}$
Fixed relationship:
 $\text{delivery_day} = \text{loading_day} + \text{voyage_time}$

Enhanced Decision Variables

$x[\text{loading_day}, \text{delivery_day}, \text{market}, \text{vessel}] = \text{Binary}$
Flexible relationship:
 $\text{delivery_day} = \text{loading_day} + \text{voyage_time} \pm \text{flexibility}$

Arbitrage-Aware Objective Function

$$\begin{aligned} & \text{Maximize :} \\ & \sum (\text{market_price}[\text{delivery_day}] - \\ & \quad \text{hh_price}[\text{loading_day}] - \text{costs} - \\ & \quad \text{timing_penalty}) \times \text{cargo_size} \end{aligned}$$

Key Constraints

- **Vessel utilization limits:** Total voyage days $\leq$ charter period
- **Non-overlapping voyages:** One voyage per vessel at a time
- **Delivery timing consistency:** Each loading has one delivery timing
- **Operational feasibility:** Realistic port scheduling and storage costs





Case Study: European Winter Strategy

Portfolio Setup

- **TCP Vessel:** Available Jan-Dec, \$0/day charter
- **Spot Vessel:** Available Mar-Oct, \$50k/day charter
- **Markets:** TTF (Europe), JKM (Asia)
- **Objective:** Maximize winter delivery exposure

Key Arbitrage Captures

1. **August Loading:** Captured \$2.1M from early summer positioning
2. **October Delivery Timing:** +3 days flexibility added \$1.8M
3. **Route Optimization:** Strategic Panama vs. Suez decisions added \$1.2M

	Traditional	Temporal Arbitrage	Improvement
Cargoes Scheduled	10	12	+2
Average Netback	\$4.20/MMBtu	\$5.45/MMBtu	+\$1.25/MMBtu
Total Profit	\$71.4M	\$93.2M	+\$21.8M
Charter Costs	\$12.25M	\$12.25M	-
Net P&L	\$59.15M	\$80.95M	+\$21.8M (+37%)





ROI Analysis by Portfolio Size

Small Portfolio Uplift

(5-10 cargoes/year)

Traditional Profit: \$30-60M annually

Temporal Arbitrage Uplift: **+\$4.5-15M**

Medium Portfolio Uplift

(15-25 cargoes/year)

Traditional Profit: \$75-150M annually

Temporal Arbitrage Uplift: **+\$15-45M**

Large Portfolio Uplift

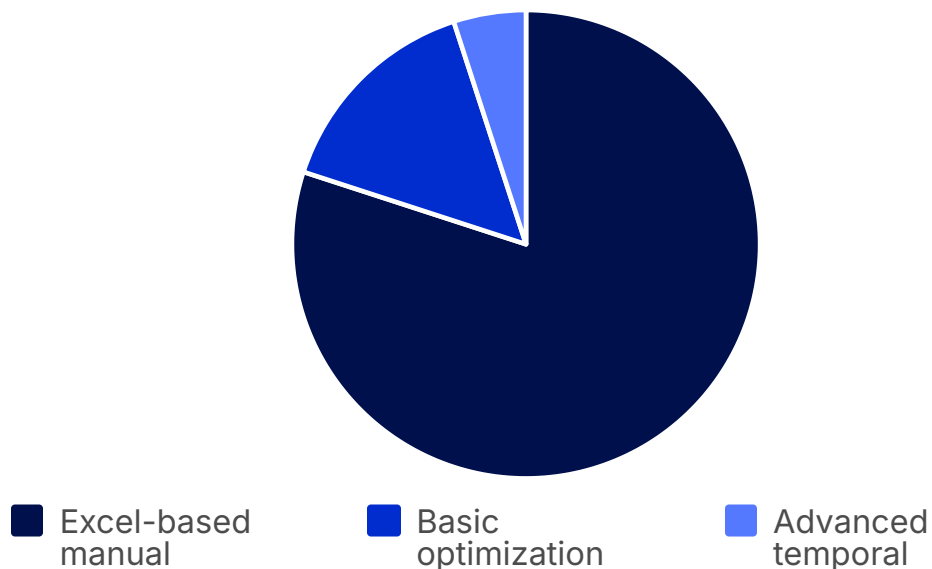
(30+ cargoes/year)

Traditional Profit: \$200M+ annually

Temporal Arbitrage Uplift: **+\$50M+**

Competitive Benchmarking

Current Industry Practice



Our Positioning

- **First-to-Market:** Comprehensive temporal arbitrage in commercial platform
- **Technology Advantage:** 2-3 years ahead of competition
- **Proven Results:** Live trading validation with major LNG players

Market Impact

- **Early Adopters:** 25-40% profit advantage over traditional optimization
- **Market Efficiency:** Temporal arbitrage becomes standard within 3-5 years
- **Competitive Moat:** Technology barrier protects early adopters



Development Roadmap

Core Temporal Arbitrage

Phase 1

-  **Delivery timing flexibility:** $\pm 3-7$ days
-  **Enhanced mathematical optimizer:** Fixed vessel constraints
-  **Real-time price integration:** Month-end/beginning spreads

Status: Already completed

Market Intelligence

Phase 3

-  **Predictive analytics:** Price forecasting and volatility modeling
-  **Risk management:** VaR integration and scenario analysis
-  **Portfolio coordination:** Multi-vessel, multi-route optimization

Timeline: 10-12 weeks

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Advanced Strategies

Phase 2

-  **Seasonal optimization:** Summer loading, winter delivery
-  **Weather integration:** Cold snap prediction and positioning
-  **Storage optimization:** Floating storage and inventory management

Timeline: 6-8 weeks

AI Enhancement

Phase 4

-  **Machine learning:** Pattern recognition in price curves
-  **Dynamic optimization:** Real-time strategy adjustment
-  **Market making:** Algorithmic trading capabilities

Timeline: 16-20 weeks



Success Metrics & KPIs

Financial Performance

- **Netback Improvement:** Target +\$0.75-2.00/MMBtu vs. baseline
- **Portfolio ROI:** 15-35% uplift in operational profit
- **Risk-Adjusted Returns:** Sharpe ratio improvement of 0.3-0.8



Operational Excellence

- **Fleet Utilization:** Optimize to 65-85% (vs. 40-60% traditional)
- **Market Timing:** 70%+ of temporal arbitrage opportunities captured
- **Scheduling Efficiency:** 50% reduction in manual intervention

Strategic Advantage

- **Market Share Growth:** 10-20% increase in profitable opportunities
- **Competitive Positioning:** Top-quartile performance vs. peer benchmarks
- **Technology Leadership:** 2-3 year competitive moat



Solution Adoption Process

Immediate Actions

1 Proof of Concept (PoC)

Run our temporal arbitrage model on your past 12-24 months of LNG trading data, focusing on key market spreads (e.g., TTF, JKM, Henry Hub).

2 Technology Demo & Workshop

Conduct an interactive live demonstration of the platform, showcasing real-time data integration, advanced scenario analysis, and optimized voyage planning capabilities.



Expected Timeline to Operational Readiness

Our streamlined process ensures rapid deployment and value realization:

- **Phase 1: Proof of Concept & ROI Validation:** 2-4 weeks
- **Phase 2: Technology Demo & Customization:** 3-5 weeks

Contact & Next Steps

Alto Commodities

Email: adam.agma@altocommodities.com

Demo Request: Schedule live temporal arbitrage demonstration

ROI Calculator: Customized portfolio uplift analysis

Immediate Deliverables

1. **Custom ROI Analysis** for your specific portfolio
2. **Historical Backtesting** on your actual trading data
3. **Live Platform Demo** with real market conditions
4. **Process Overview** with detailed milestones

