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Unlocking Hidden Profit: Boosting Refinery Margins Through Blend Optimization And Loss Control

Kevin Kim and Roy Smith

April 9, 2025

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Trindent Consulting

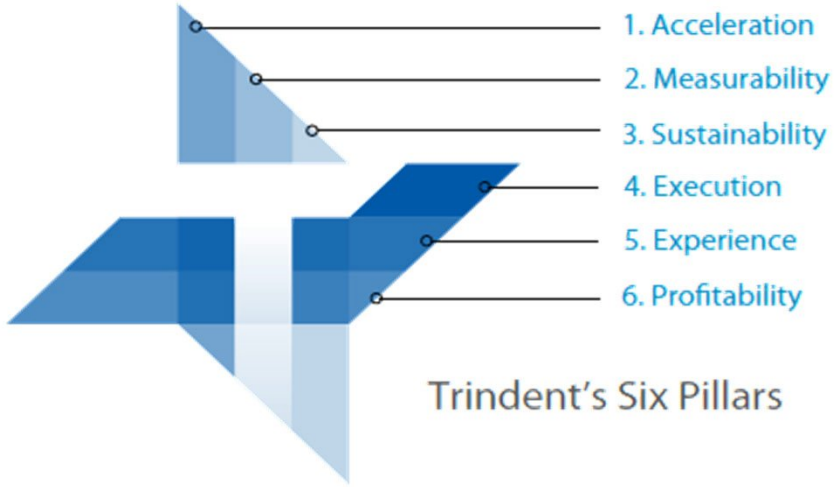
We Are An Implementation-Based Improvement Firm Specialized In Margin Improvement

Global management consulting firm specialized in **Downstream & Midstream**

We achieve **results in excess of 500% ROI** within the first year without capital expenditure or complex IT investments.

We audit and support the engagement following its completion to ensure that **success is sustained.**

Execution is everything



Trindent's Six Pillars

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Our Clients

Trindent Has Worked With The Largest Oil And Gas Companies Globally

bp · ExxonMobil · Chevron · Marathon · Co-op · Syncrude

SASREF · CHS · cenovus energy · Delek US · Suncor · Irving

SPRC · Big West Oil · Phillips 66 · Parkland · Valero · Flint Hills resources

MARATHON

SUPPLIER RECOGNITION AWARD
INNOVATIVE PARTNERSHIP

"I found your firm's approach to optimizing our operations to be refreshing and extremely powerful in how it generates bottom-line results. The operations team now has new tools and reports to view productivity, cost, speed, service, and quality in real time and the speed at which these tools were developed and rolled out was impressive."

A Fortune 500 Energy Company

2014 PROFIT 500 · 2015 PROFIT 500 · 2016 PROFIT 500 · 2017 PROFIT 500 · 2018 GROWTH 500 · 2019 GROWTH 500 · 2020 GROWTH LIST

THE GLOBE AND MAIL 2019 Canada's Top Growing Companies · THE GLOBE AND MAIL 2021 REPORT ON BUSINESS CANADA'S TOP GROWING COMPANIES

CONSULTING FASTEST GROWING FIRMS 2017 · 2018 · 2019 · 2020

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2 How We Execute

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How We Execute

A Trindent Improvement Program Involves Three Phases Of Interaction

Assessment

- Conduct **in-depth diagnostic evaluation** focusing on internal processes and process management capability
- Interface with area management, accounting, and operations to understand **key profit levers** and quantification approaches
- Perform **process observations** of day-to-day activities focused in **identifying profit improvement opportunities**
- Determine gaps in the process **management system information**
- Quantify **financial improvement opportunity**

Engagement

- Develop **key performance indicators** that link to the overall business direction and drive behaviors required to achieve the business goals
- Develop and implement **continuous improvement** models supported by root-cause analysis and defined escalation protocols
- Design and **implement solutions** to provide deep line of insight into performance and reduce value leakage
- Perform **management and field training** to improve knowledge of and adherence to best practice in value chain optimization

Audit

- An engagement **sustainability audit** recommended to be conducted approximately six months following engagement closure
- The purpose of the audit is to **ensure program sustainment**, enhance processes and tools, and understand improvement activities following engagement close

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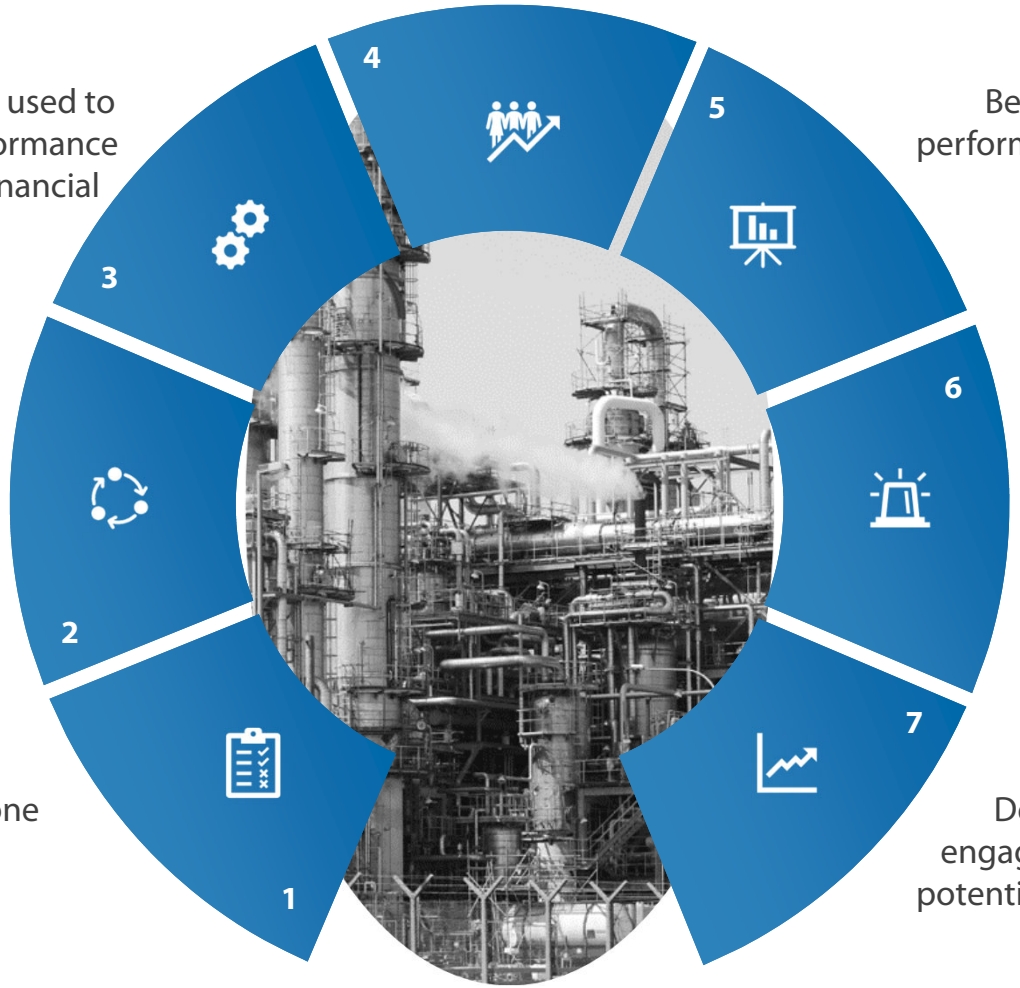
Assessment Benefits

Qualify And Quantify Sources Of Improvement And Potential Opportunity



1. Perform 30+ standalone studies to uncover opportunities for improvement
2. Analyze current value generation program through direct observation
3. Critique the tools used to manage key performance indicators and financial metrics
4. Determine the mindset/behaviors in place that drive performance
5. Benchmark your performance versus other refiners
6. Focus the improvement efforts on the critical issues
7. Determine the engagement payback potential (500% - 1500%)

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Case Study
Optimizing Blend Operations

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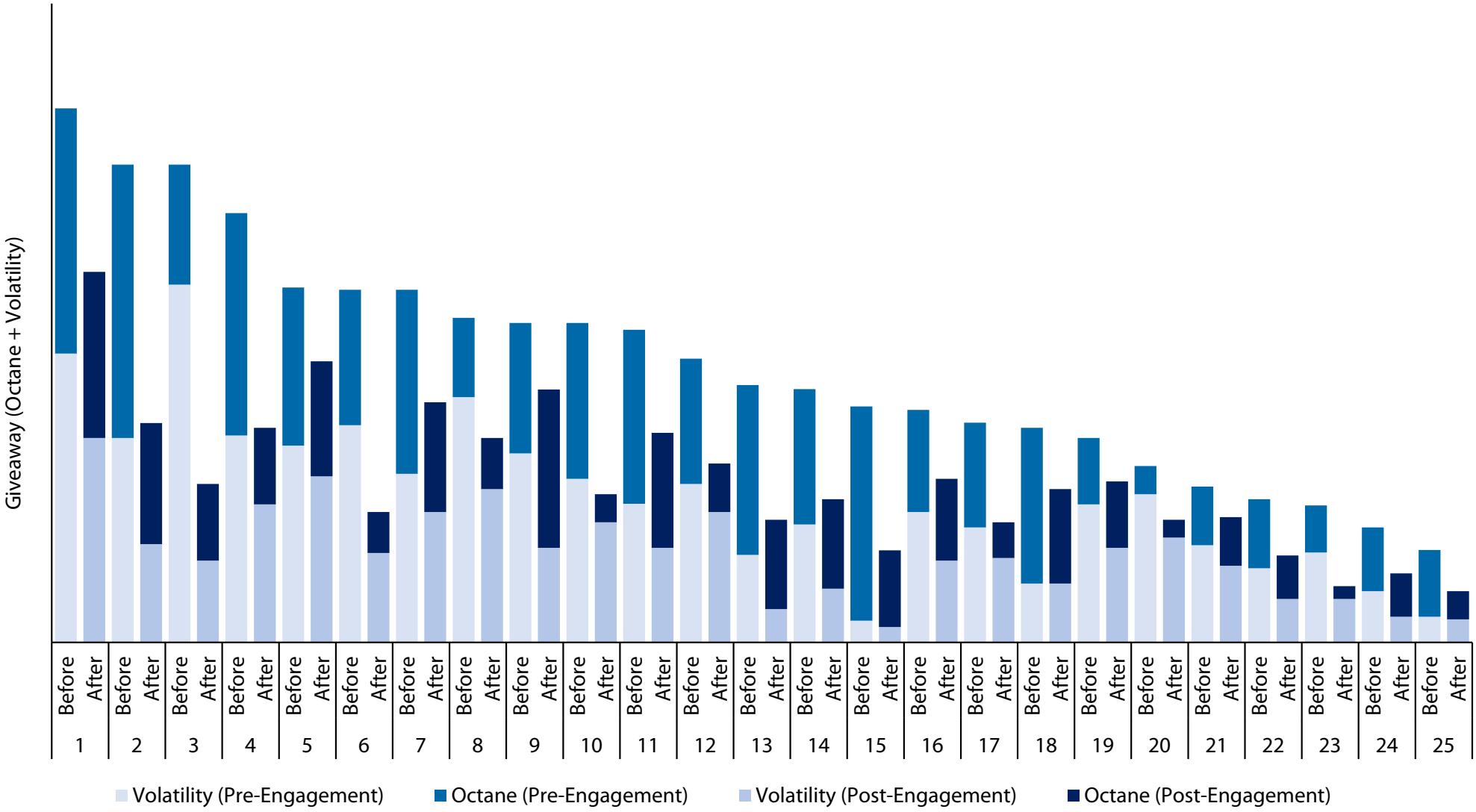
Gasoline Quality Giveaway Benchmark

Last 25 Engagements Resulting In 45% Product Quality Giveaway Reduction ($450,000,000 / Yr)



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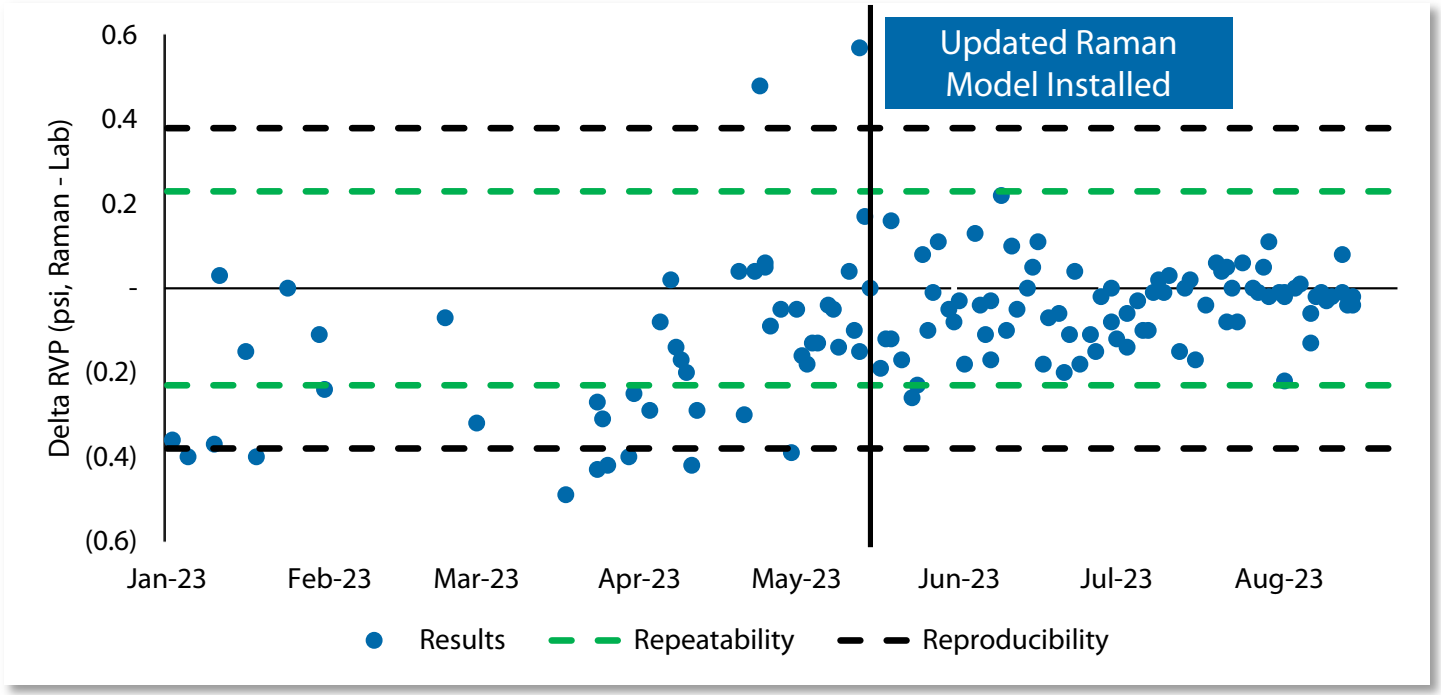
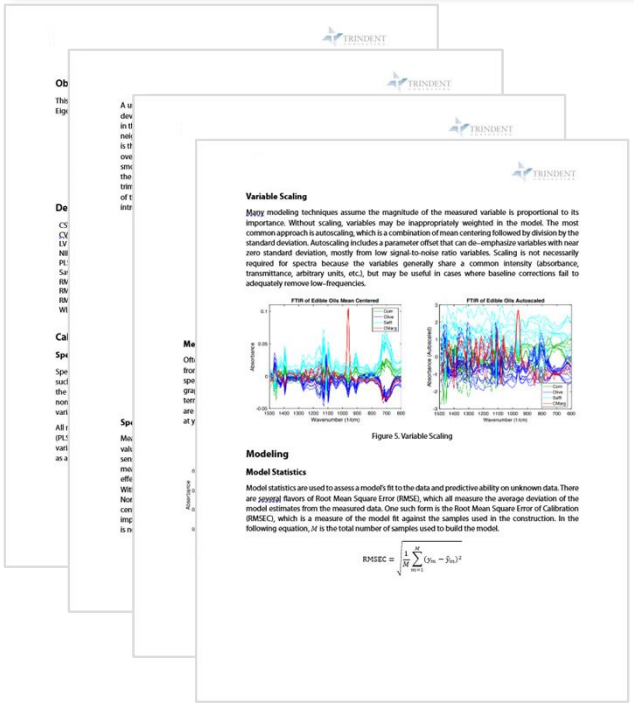
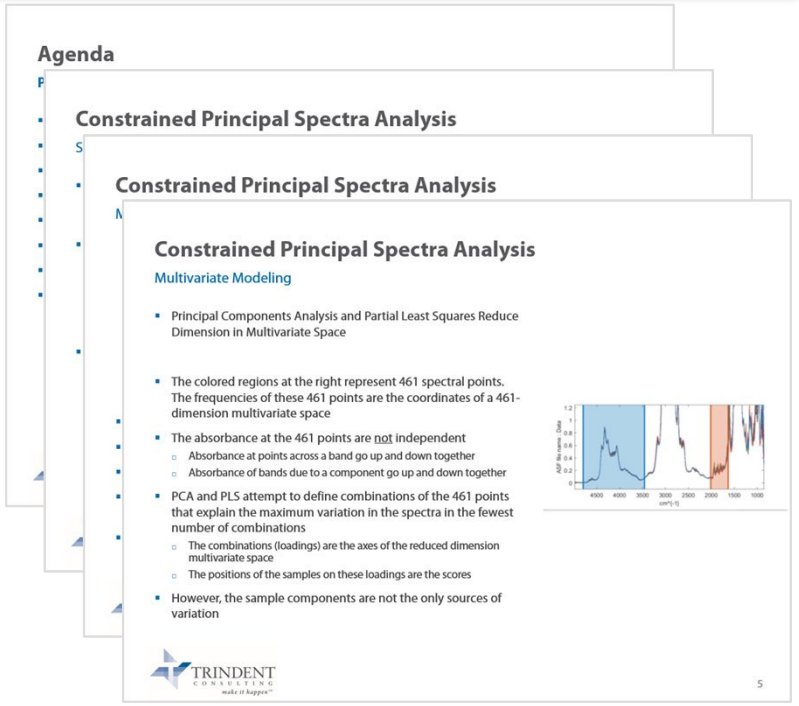
NIR Model Development & Training

Updated Model Was 100% Within Method Reproducibility, Allowing For Tighter Blend Control, While Enhancing Internal NIR Modeling, Biasing, And Maintenance Capabilities







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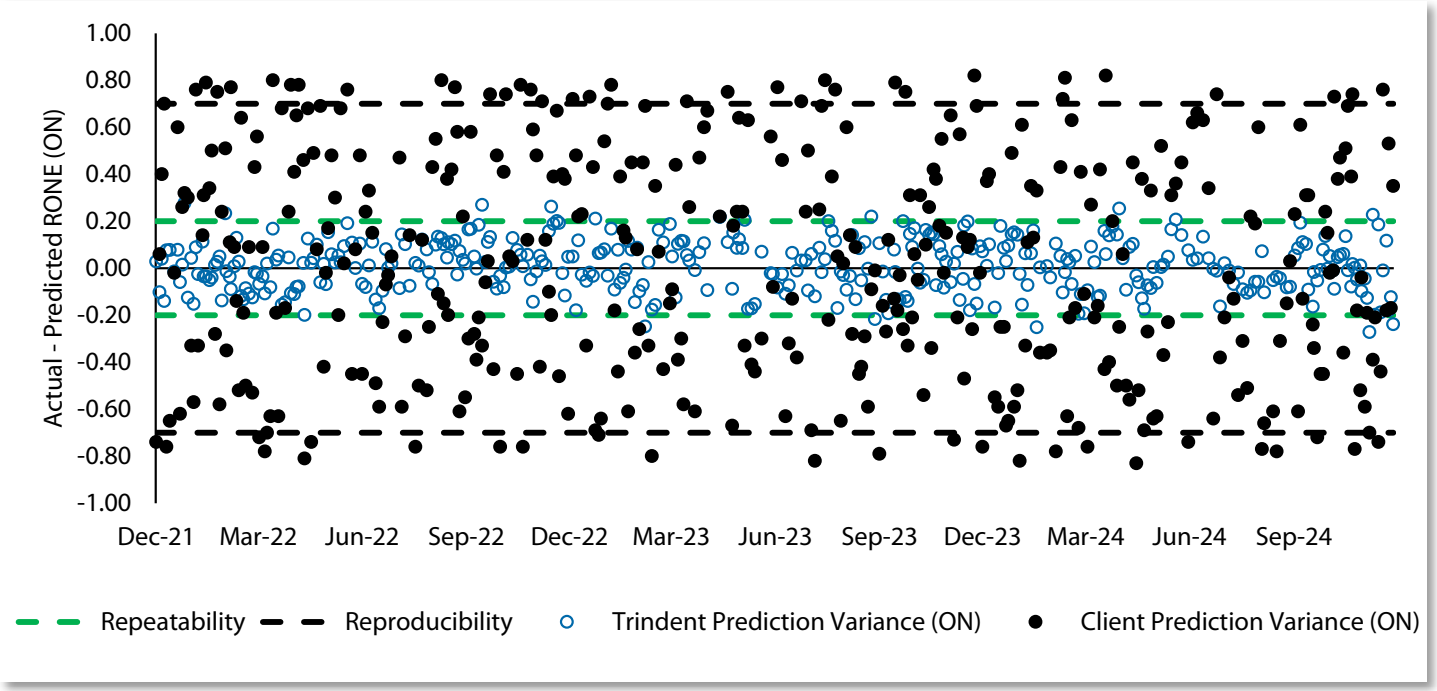
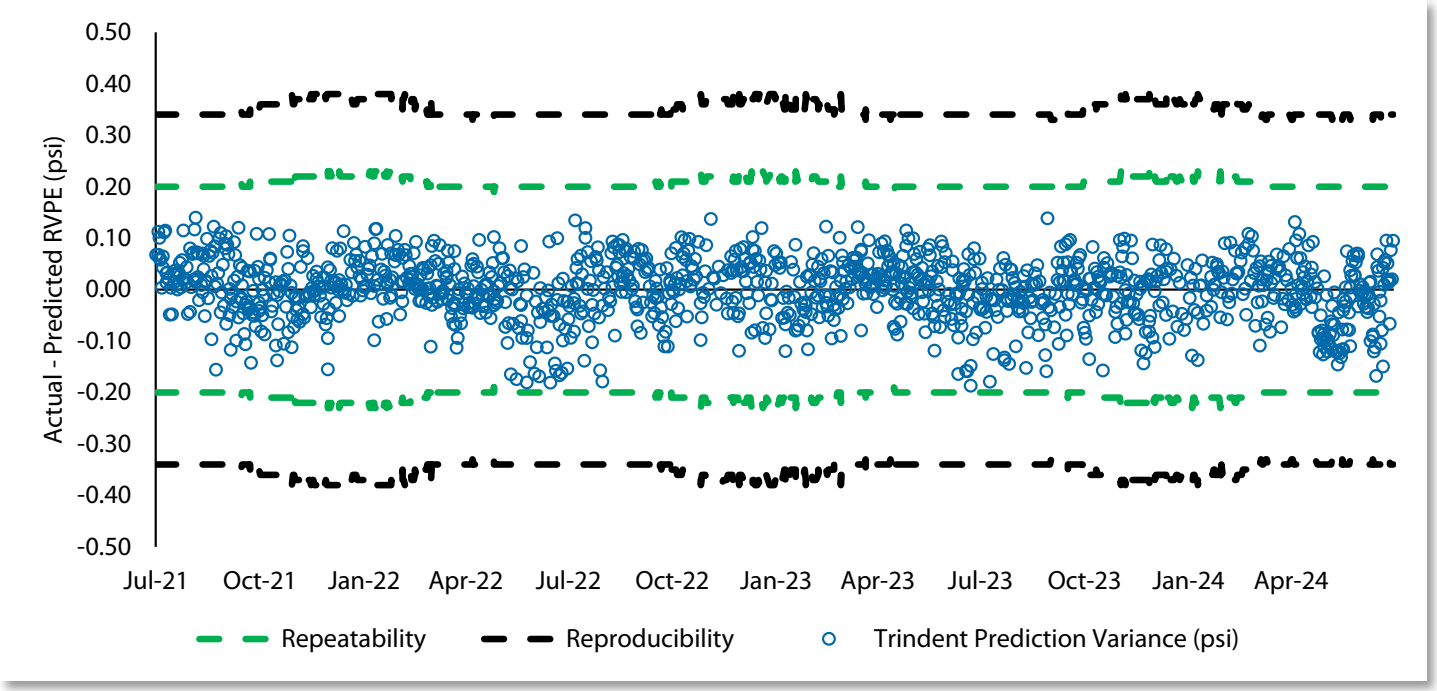
Post Ethanol Models

Updated Octane And Volatility Model Was 100% Within Method Reproducibility And Repeatability, Allowing For Buffer Reductions And Fewer Product Quality Incidents





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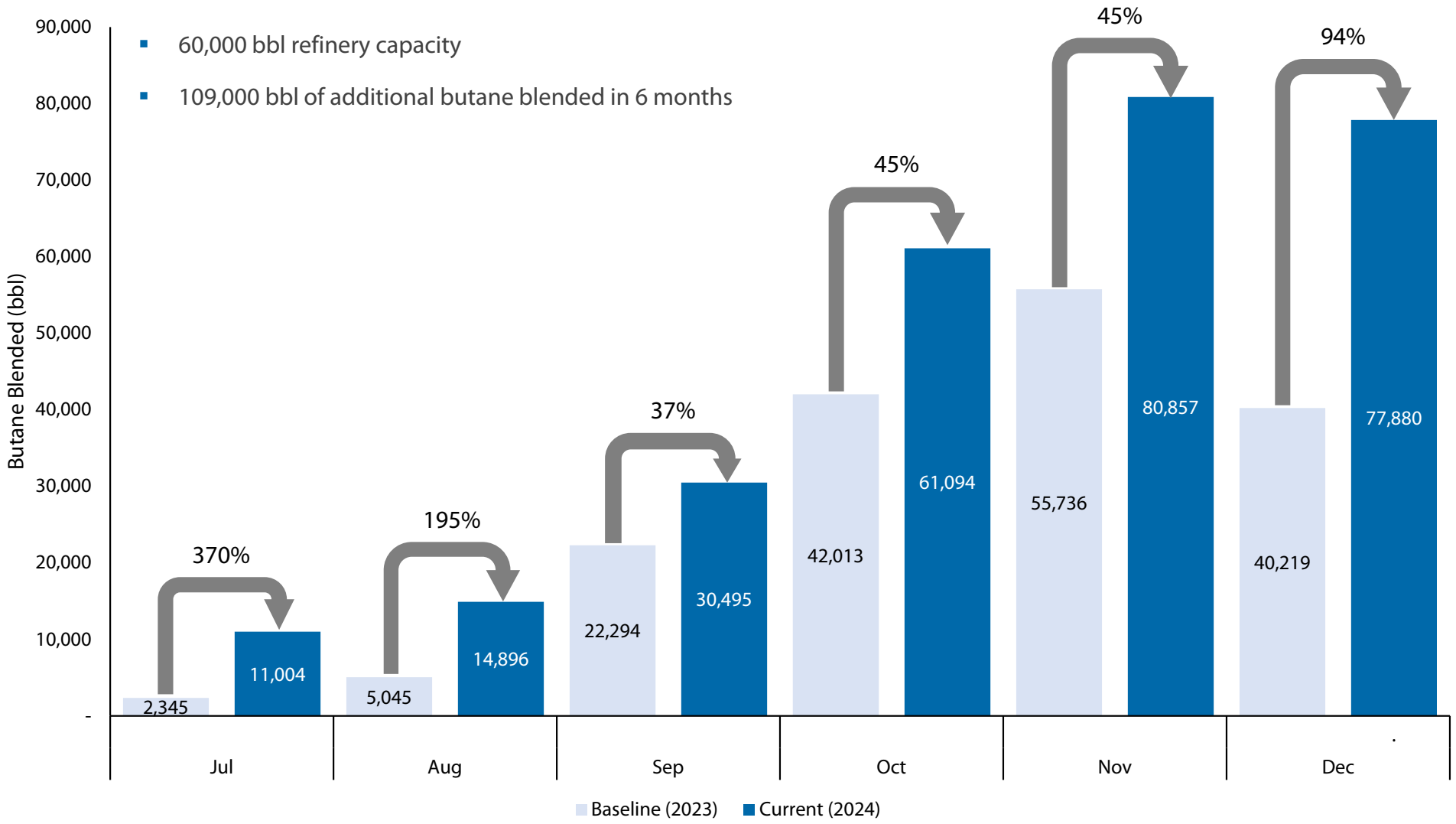
Butane Blending

65% Increase In Butane Blending And 3% Reduction In Blend Cost



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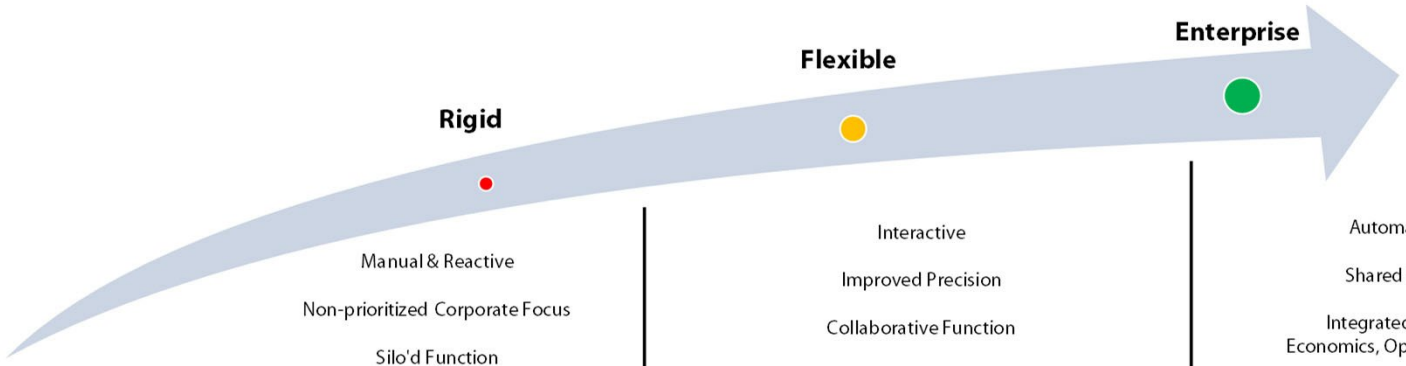
Product Blending Maturity Assessment

Industry Best Performers Achieve 4.0 To Sustainably Mitigate Product Giveaway



		Rigid	Flexible	Enterprise
		Manual & Reactive Non-prioritized Corporate Focus Silo'd Function	Interactive Improved Precision Collaborative Function	Automated & Proactive Shared Corporate Vision Integrated Function (Supply, Economics, Operations, & Distribution)
Process & Behaviors	Execution Performance	High variability; limited set of standardized procedures	Some variability; low adoption of standardized procedures	Minimal variability; standard procedures
	Sampling & Testing Practices	Weekly frequency; no mid blend testing	2-3 times per week; inconsistent mid blend	Daily frequency; basis for blend/recipe adjustments
	Target Setting	Not consistently set or reviewed	Set and communicated; lack of standardization; inconsistent tracking	Tailored to product type; revised, communicated, and tracked regularly
	Blend Results Review Process	Unclear or misused procedures	Procedures used; recurring feedback loop is not used	Documented, followed, tracked, and root cause analysis performed
Systems	Equipment Reliability	Infrequent calibrations; additional PM opportunities	Site level calibrations; adherence to PM program	Round Robin calibrations; comprehensive PM program
	Blend Prediction	Limited capability	Used to adjust recipes; accuracy not tracked; model updated regularly	Used to adjust recipes; accuracy tracked; model updated frequently
	LP Model Performance	Limited updates to inputs and settings; output not aligned with blend scheduling	All inputs updated quarterly; LP outputs drive blend scheduling decisions	All inputs updated monthly; non-linear modeling; integrated with plant-wide model
	Process Automation	Manual management of all blend processes	Some blend control processes automated (inline analyzers, etc.)	Full Blend Property Controller, blend process monitoring and control fully automated
	Blending Method	Batch Blending, off-line control and certification	Batch blending with mix of on-line and off-line control and certification	In-line blending with on-line control and certification
	Assessment Score	0	1.0	5

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Gasoline Quality Giveaway Reduction – 450 KBBL/D Refinery

30 Week Process, 707% ROI, Without Capital Expenditure

- **Results Delivered**
  - $23,359,000 annual savings (Nov-23 to Oct-24), 707% ROI
    - $0.29 improvement pbbl gasoline
    - Cash flow positive in Week 9
  - 30% giveaway reduction (0.84 to 0.59 ON & psi)
    - Q4 to Q2 improvement against Trindent benchmark
  - 75% reduction in Product Quality incidents (4 to 1)

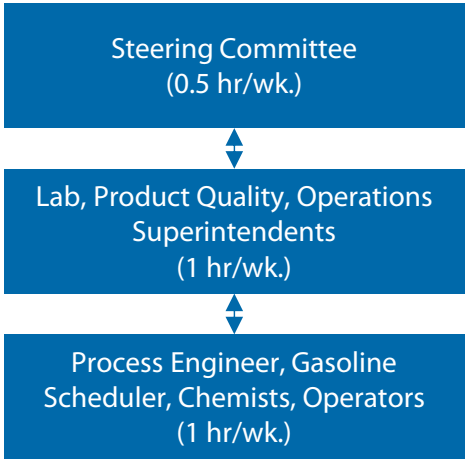
- **6 Month Post-Engagement Audit Findings (Nov-24)**
  - 100% of process changes sustained or improved
  - 93% of system changes sustained or improved with clear plan to address regressed backcasting tool
  - Additional $4,000,000 opportunity identified with 4 recommended next steps
  - Positive behavioral changes pursuing continuous improvement activities (e.g., online analyzer program, post-ethanol modeling)

"It is good to have representation from various groups because it is easy to have siloes and not see the totality of benefits from your work."

"The current process is far superior to the one I inherited coming into this role."

"Thank you for making the complicated, simple."

- **Actual Engagement Resourcing**



Improvement completed with an average commitment of 0.9 hr/wk. per stakeholder

- **Refinery #2 And #3 Approach**
  - Estimated opportunity [1]
    - Refinery #2: $16,400,000 - $23,000,000
    - Refinery #3: $4,500,000 - $6,300,000
  - 3-week diagnostic assessment per site, accurately quantifying and prioritizing financial improvement opportunities with charters to address the gaps
  - Minimal resource requirement (30-minute interview with key stakeholders, process observations, and two 60-minute summary meetings for diagnostic assessment)
  - Shorter project duration than Project #1 due to integration into client environment and blending applications

[1] Assuming $0.25-0.35 improvement pbbl of gasoline, 90% utilization, and yield estimate variation between different Refineries; validated during 3 week diagnostic assessment.

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Case Study
Reducing Hydrocarbon Loss

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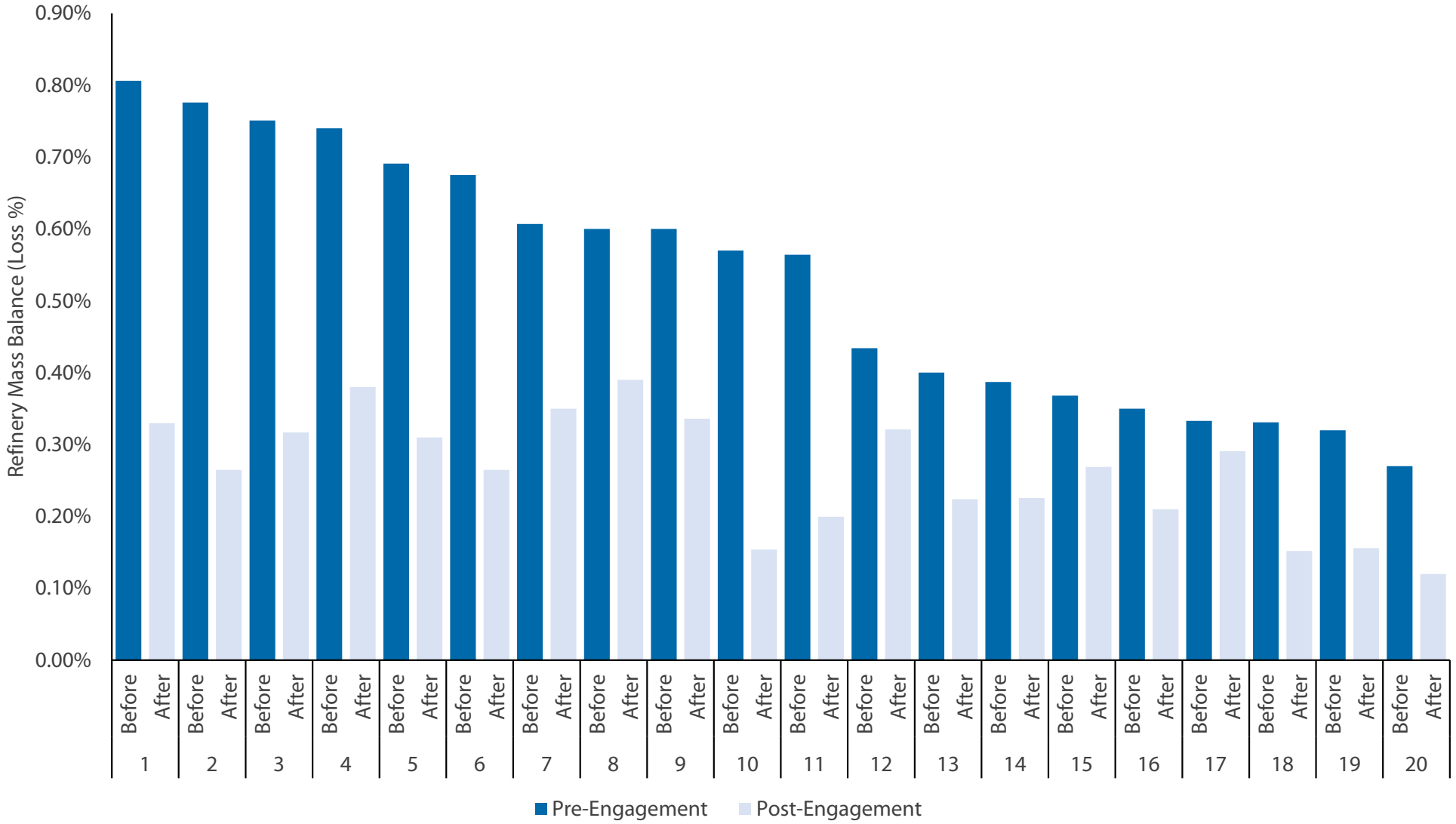
Refinery Mass Balance

Last 20 Engagements Achieving 50% Mass Loss Reduction



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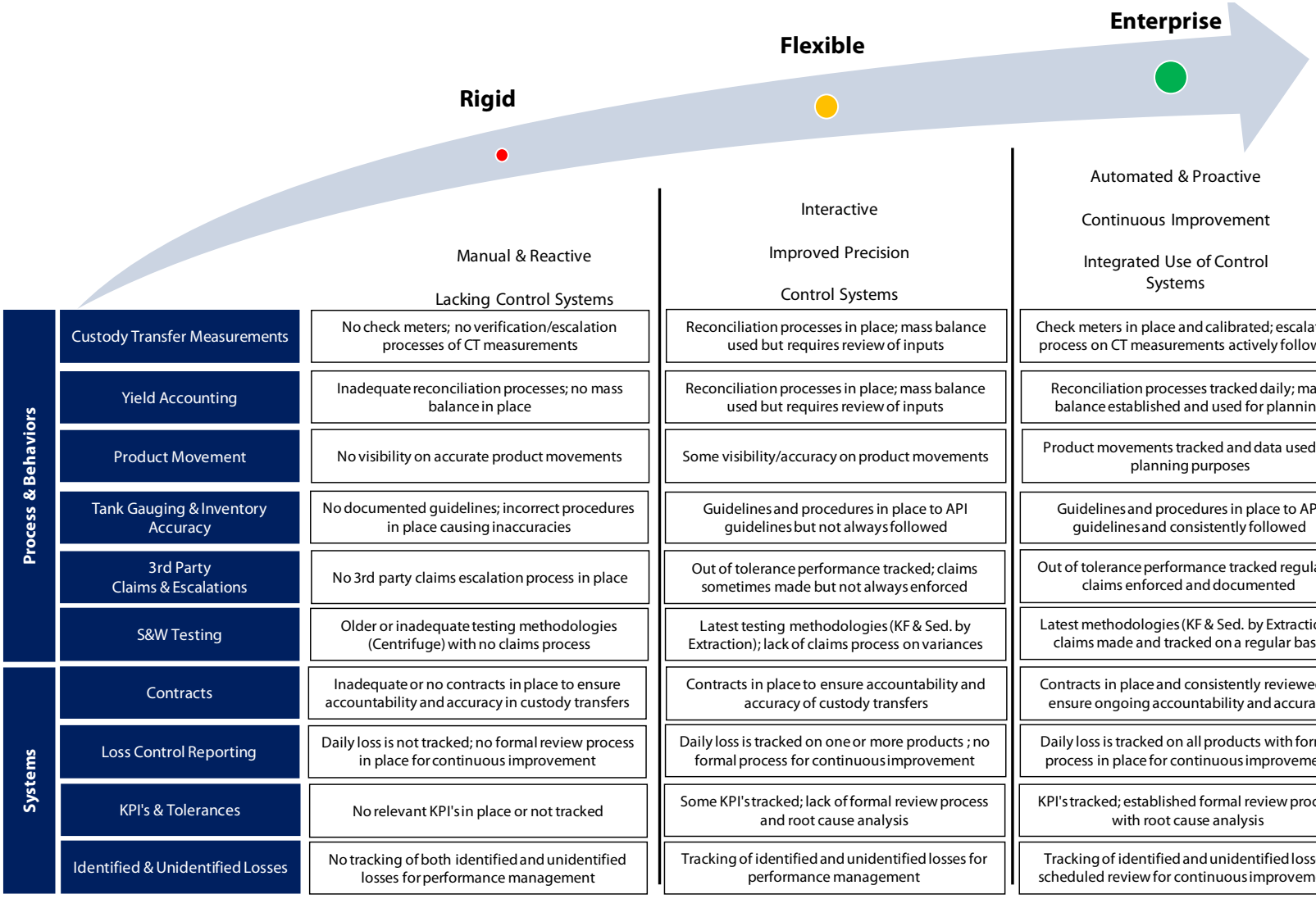
Hydrocarbon Loss Control Maturity Assessment

Maturity Of Loss Control Program Is An Indicator Of Financial Improvement Opportunities



		Manual & Reactive Lacking Control Systems	Interactive Improved Precision Control Systems	Automated & Proactive Continuous Improvement Integrated Use of Control Systems
Process & Behaviors	Custody Transfer Measurements	No check meters; no verification/escalation processes of CT measurements	Reconciliation processes in place; mass balance used but requires review of inputs	Check meters in place and calibrated; escalation process on CT measurements actively followed
	Yield Accounting	Inadequate reconciliation processes; no mass balance in place	Reconciliation processes in place; mass balance used but requires review of inputs	Reconciliation processes tracked daily; mass balance established and used for planning
	Product Movement	No visibility on accurate product movements	Some visibility/accuracy on product movements	Product movements tracked and data used for planning purposes
	Tank Gauging & Inventory Accuracy	No documented guidelines; incorrect procedures in place causing inaccuracies	Guidelines and procedures in place to API guidelines but not always followed	Guidelines and procedures in place to API guidelines and consistently followed
	3rd Party Claims & Escalations	No 3rd party claims escalation process in place	Out of tolerance performance tracked; claims sometimes made but not always enforced	Out of tolerance performance tracked regularly; claims enforced and documented
	S&W Testing	Older or inadequate testing methodologies (Centrifuge) with no claims process	Latest testing methodologies (KF & Sed. by Extraction); lack of claims process on variances	Latest methodologies (KF & Sed. by Extraction); claims made and tracked on a regular basis
Systems	Contracts	Inadequate or no contracts in place to ensure accountability and accuracy in custody transfers	Contracts in place to ensure accountability and accuracy of custody transfers	Contracts in place and consistently reviewed to ensure ongoing accountability and accuracy
	Loss Control Reporting	Daily loss is not tracked; no formal review process in place for continuous improvement	Daily loss is tracked on one or more products ; no formal process for continuous improvement	Daily loss is tracked on all products with formal process in place for continuous improvement
	KPI's & Tolerances	No relevant KPI's in place or not tracked	Some KPI's tracked; lack of formal review process and root cause analysis	KPI's tracked; established formal review process with root cause analysis
	Identified & Unidentified Losses	No tracking of both identified and unidentified losses for performance management	Tracking of identified and unidentified losses for performance management	Tracking of identified and unidentified losses; scheduled review for continuous improvement

Assessment Score 0.0 5.0

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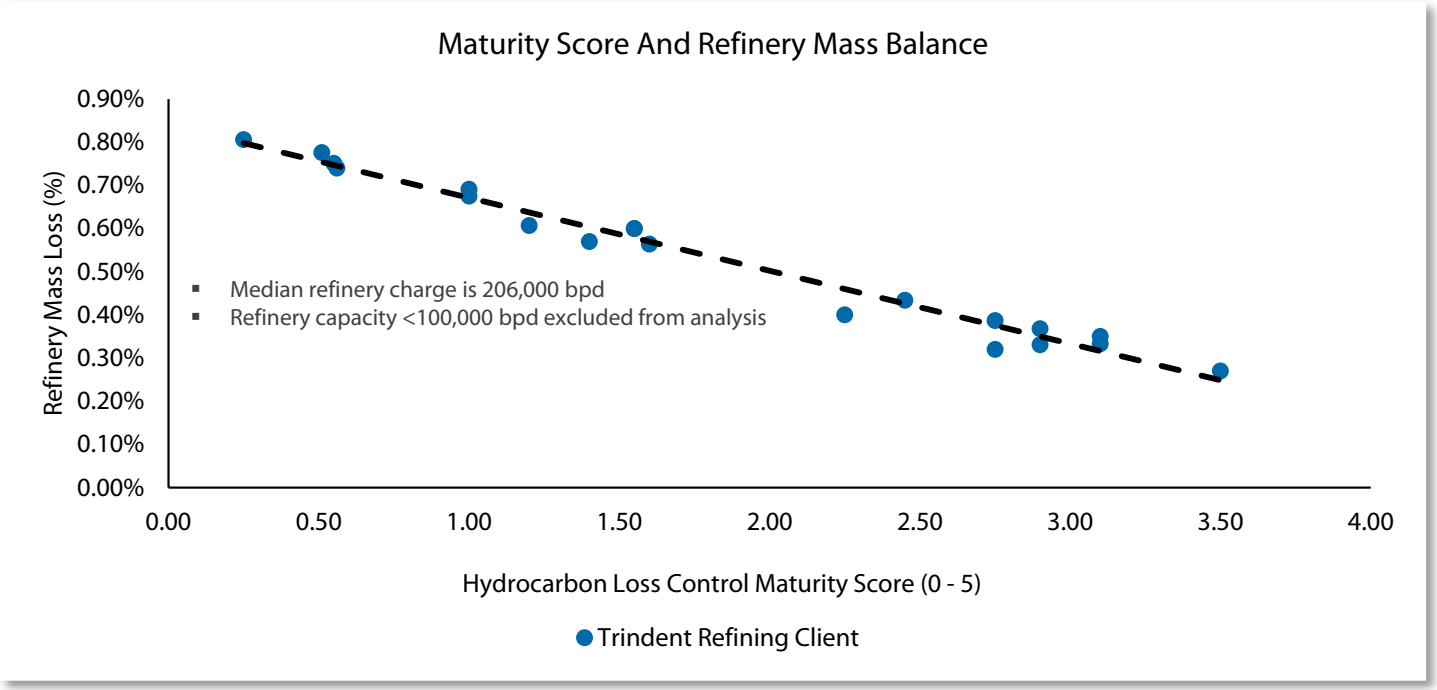
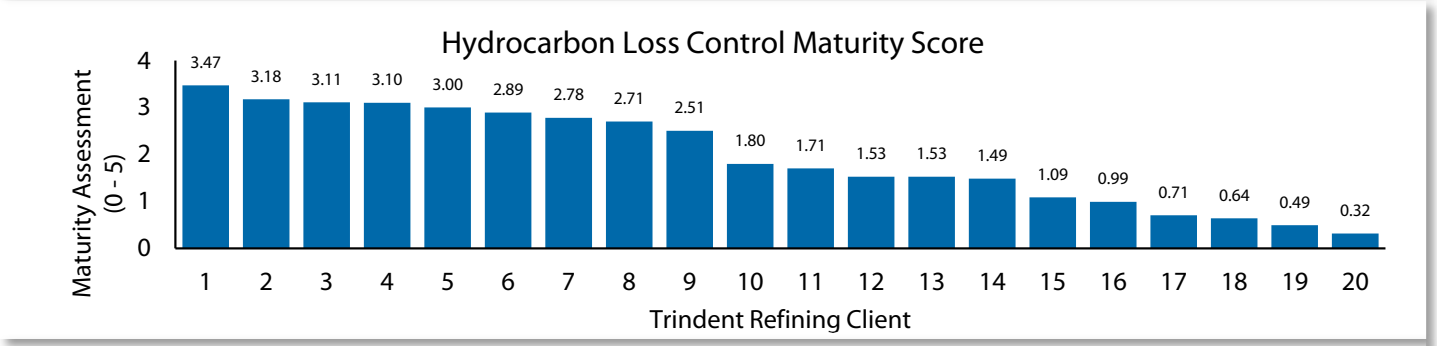
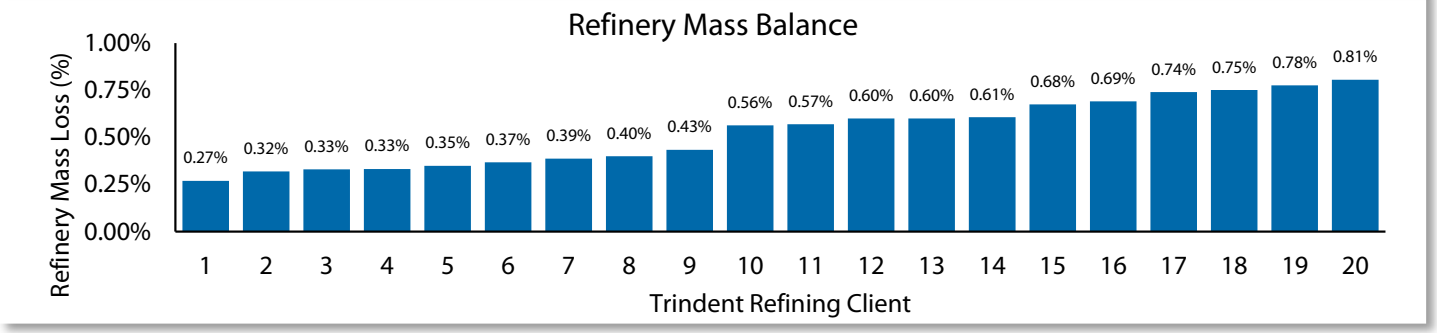
Maturity Score And Refinery Mass Balance

Program Maturity Score Is Indicative Of Refinery Mass Gain/Loss Performance, Where Q1 Performers Achieve <0.15% Loss Post Trident Engagement







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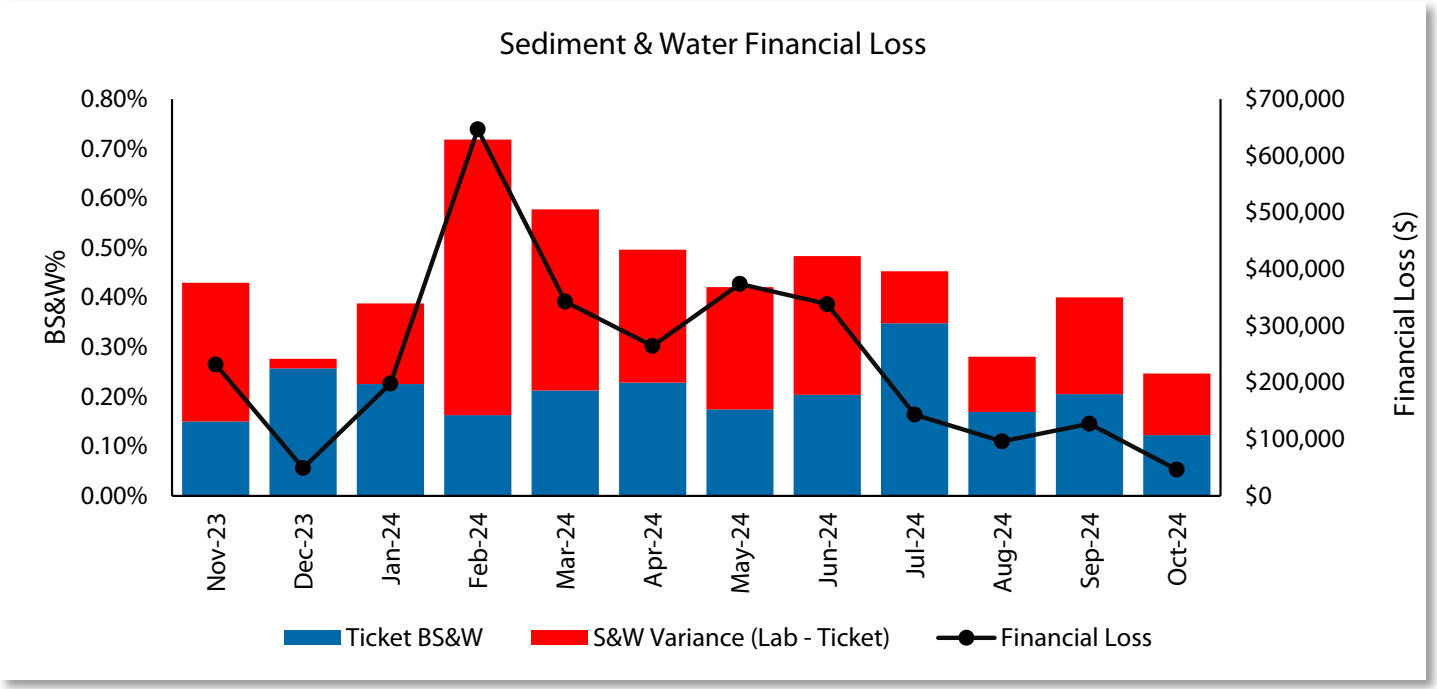
Sediment & Water Losses

BS&W Analysis To Determine Accuracy Of Ticket Information And The Financial Impact Of Inaccurate Analysis



Crude	Average Ticket BS&W %	Average Lab BS&W %	% Under Reported	Price ($/bbl)	Opportunity ($)
Crude 1	0.203%	0.473%	57.1%	$64.32	$1,033,000
Crude 2	0.211%	0.430%	50.9%	$64.32	$2,858,000
Crude 3	0.198%	0.313%	36.7%	$65.94	$1,554,000
Crude 4	0.201%	0.515%	61.0%	$67.18	$1,009,000
Crude 5	0.052%	0.095%	45.3%	$86.79	$209,000
Crude 6	0.248%	0.440%	43.6%	$61.66	$4,459,000
Total	0.202%	0.379%	46.7%	$66.41	**$11,122,000**

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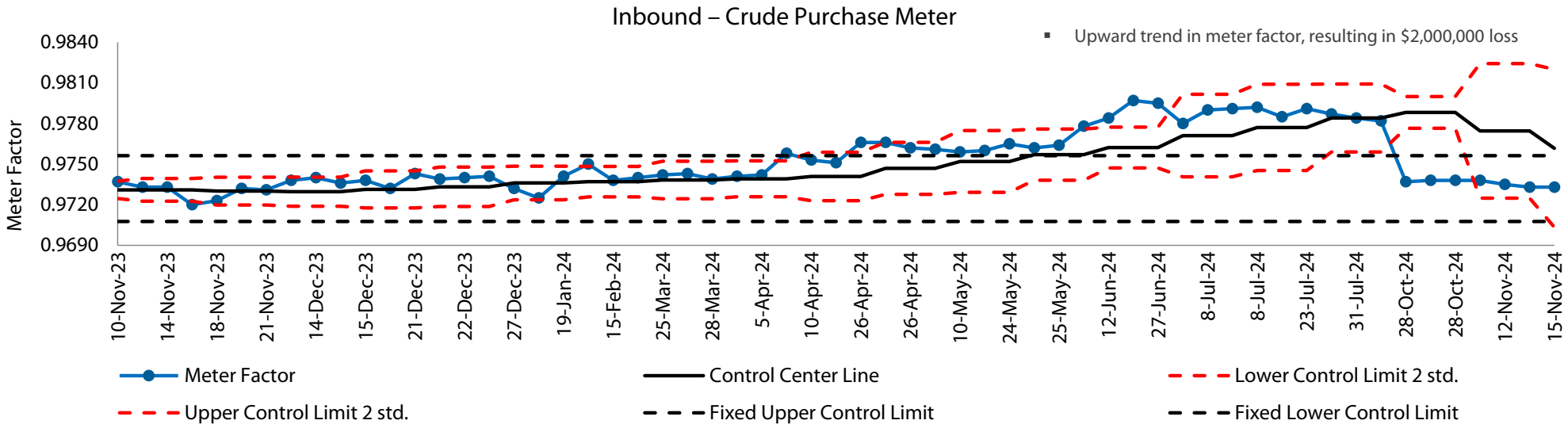
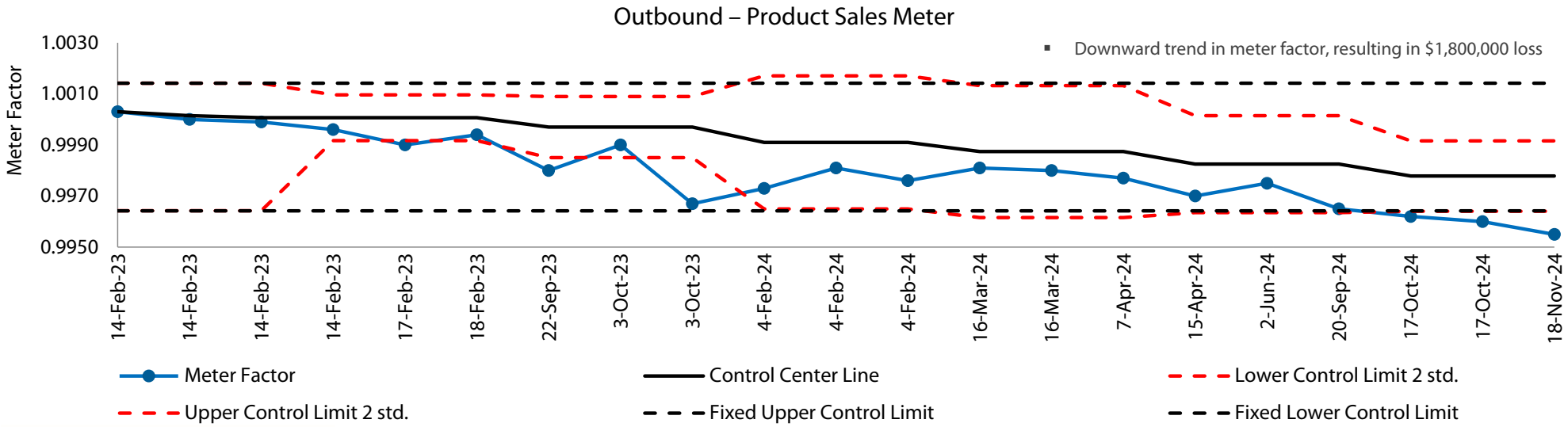
Meter Factor Control Charts

Custody Meter Oversight Is Critical To Mitigate Financial Losses





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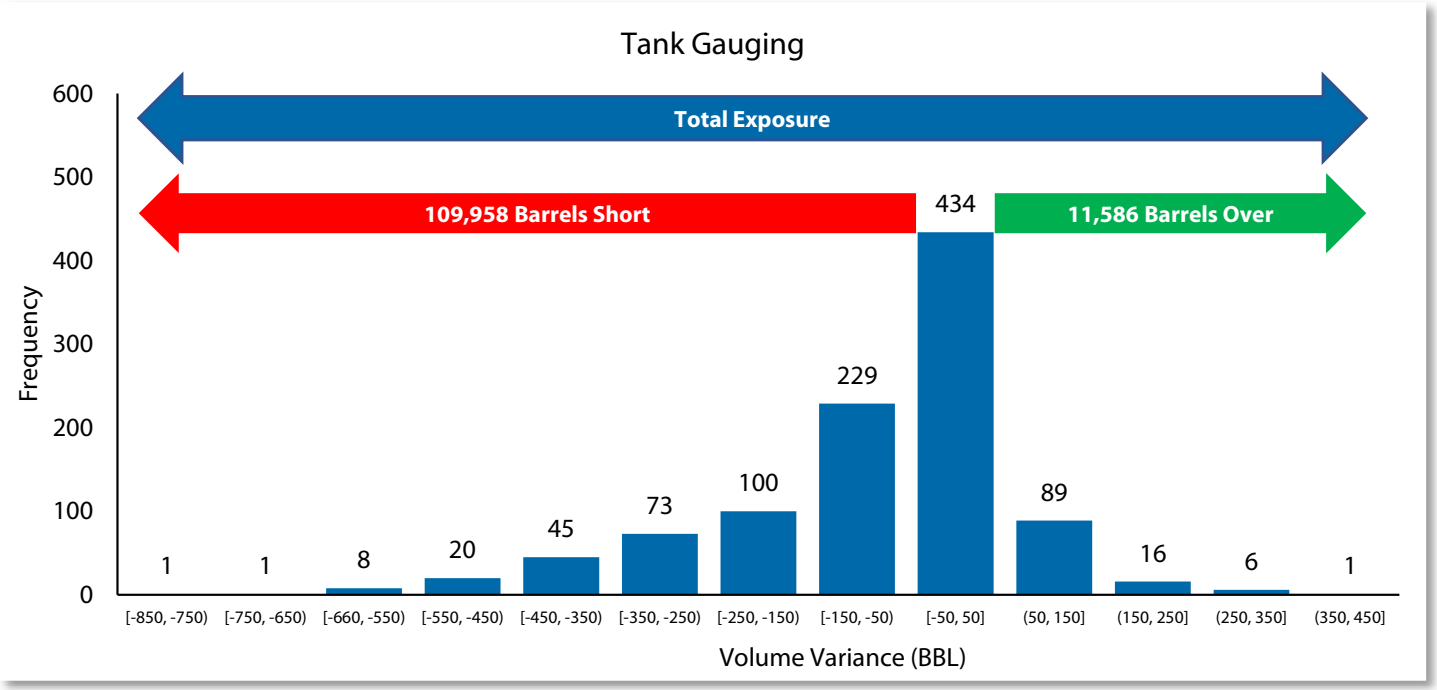
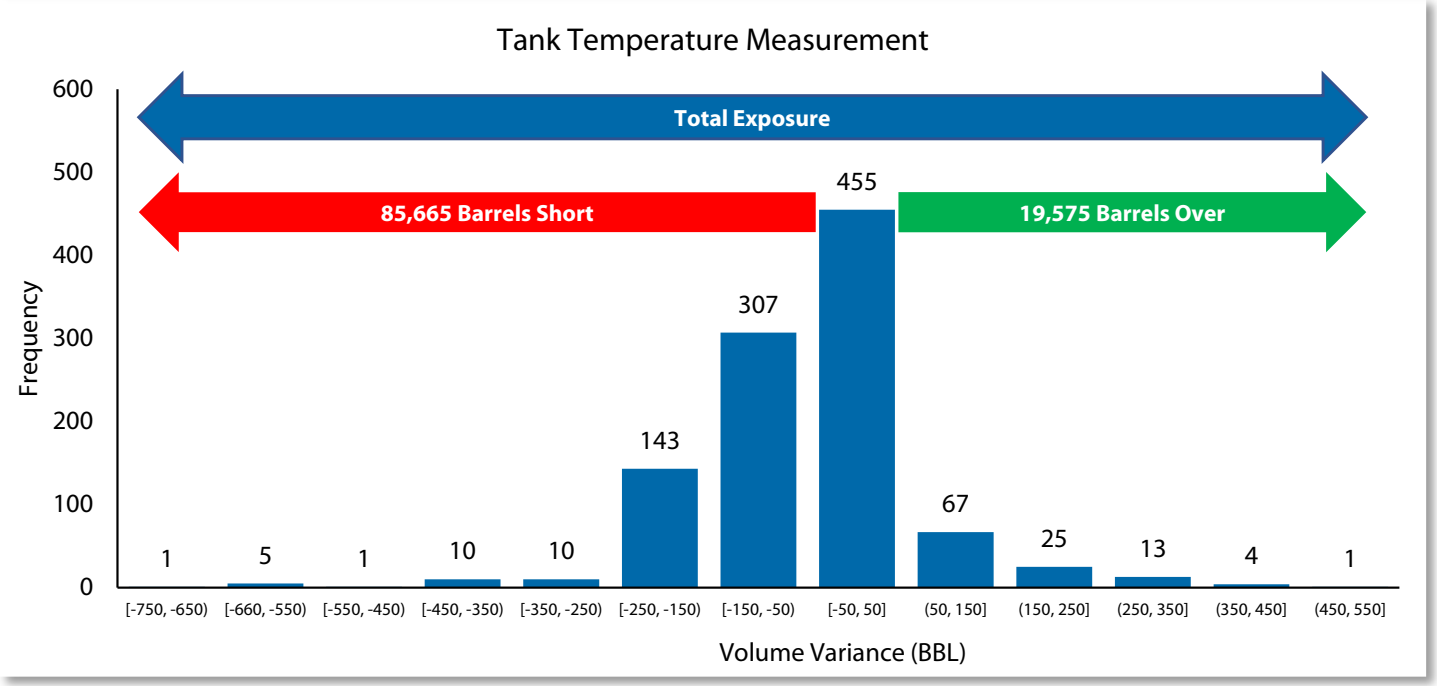
Volume Variance Analysis

Impact To Financial And Refinery Optimization Due To Inaccurate Tank Level And Temperature Measurement Processes





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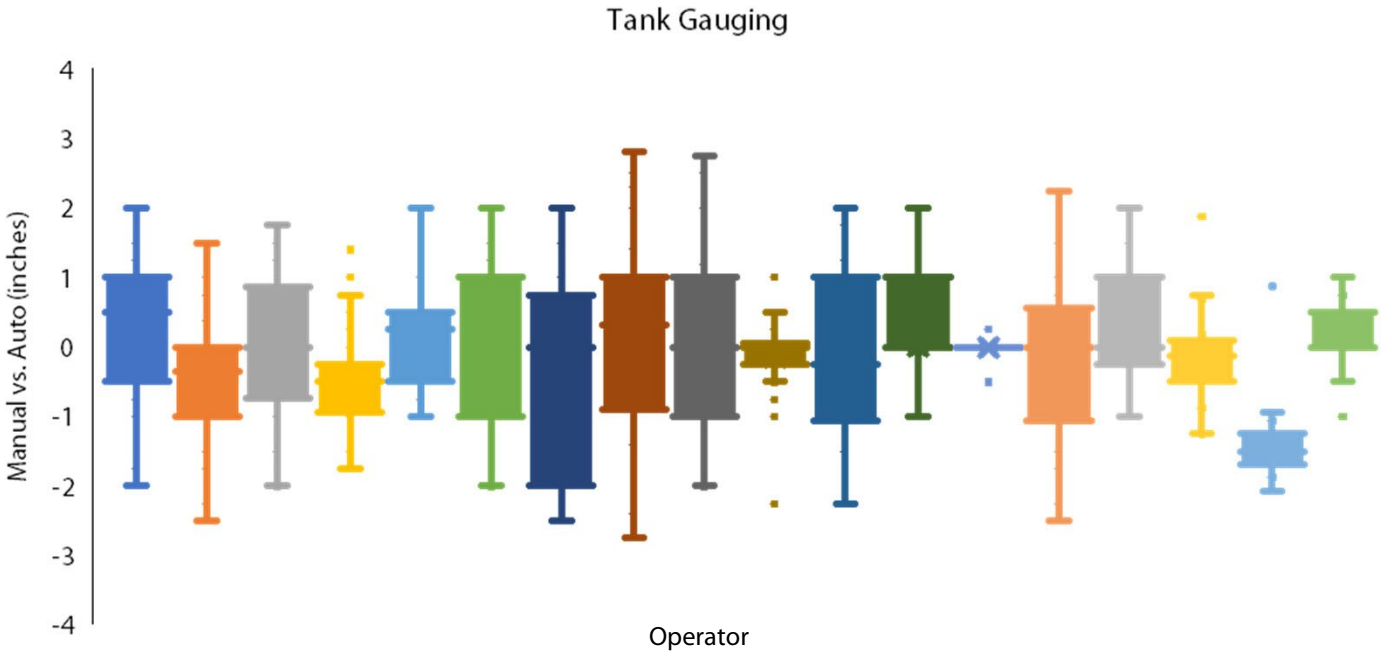
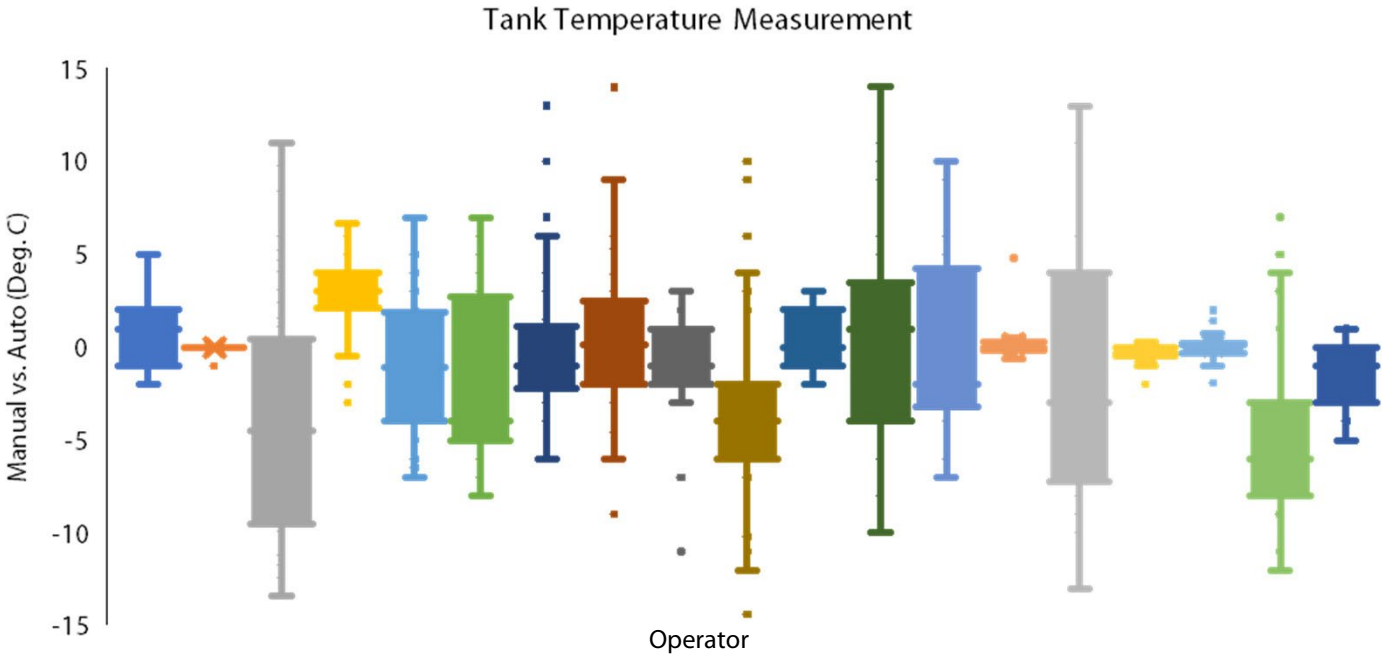
Operator Variability

Performance Variance Among Operators Is Assessed To Determine Root Causes And Impact On Hydrocarbon Losses





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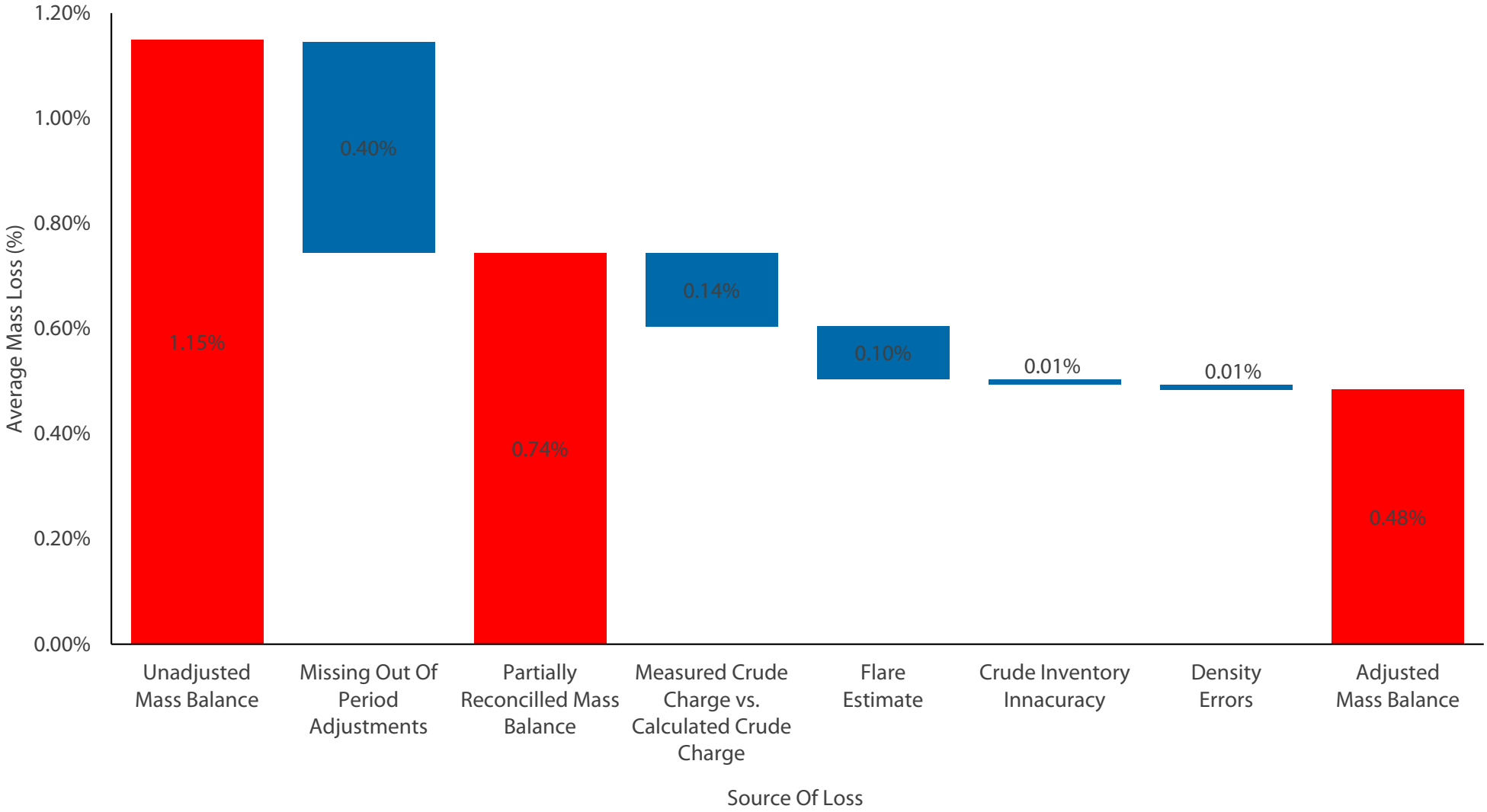
Adjusted 2023 Refinery Mass Balance

Adjusted Mass Loss Of 0.48% Worth $52,280,000



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5 Questions

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