End to End Crude Slate Optimization

VALIDERE

Hosts

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Agenda

- Introduction

- The Crude Slate Optimization Opportunity

- 3 Takeaways Your Teams Can Apply Today

Meet VALIDERE

The first and only data intelligence platform that provides real-time visibility into the quality of oil & gas.

The industry's most advanced quality dataset and AI-powered insights **guide the highest margin marketing, trading, & commercial opportunities.**

Powering 50+ of North America's leading oil and gas companies.

- 5+ million barrels / day optimized by Validere
- Offices in Houston, Calgary & Toronto

A cross-disciplinary team of experts.

- Oil and gas industry experts
- Leading data scientists (Harvard and Yale PhDs)
- Commodities and trading experts

Crude Slate Optimization: The process of making near-term commercial decisions around maximizing profitability.

1 Feedstock selection

- Refinery feedstock purchasing
- Midstream blendstock sourcing
- Biofuel blending

2 Operational scheduling

- Refinery: Cut points, utilization rates
- Midstream: Tank blending, pipeline batching

3 Logistics scheduling

- Sourcing barrels
- Lining up trucks, pipeline batches

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- Midstream: Tank blending, pipeline batching

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The Crude Slate Optimization Problem

Difficult to solve due to **incomplete data** and **slow reaction times** to changing conditions.

TAKEAWAYS
To address crude slate problems & drive margins, efficiencies & ESG mandates

1 When sourcing feedstock / blendstock, **it pays to scan the broadest possible range of sources, even if you only have estimates**

2 Build operational feedback loops by leveraging the **full predictive power of information your already measure at your facility**

3 Build your processes so that you can **adapt to changing conditions in the field**

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Takeaway 1:
Broaden Your Search

TAKEAWAY 1

—

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APPLICATION

Building up a large database of possible sources of product with modelled/mined estimates on available volume and quality allows you to find the best opportunities faster.

IMPACT

We've seen an
- **average increase of 319%** vs. current slate
- **$2.65 per incremental barrel** added

The current approach to sourcing blendstock

1 Start with a list of available crudes from previous deals or a local database

2 Call contacts to get quality for current month and available volumes

3 Use a model to calculate what you need to buy to obtain the quality and volume you want

4 Negotiate & purchase

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Applying Takeaway 1:
Broaden Your Search

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1

Gather a database of **all possible lease and stream barrels you can buy**, gathering as much information as possible on quality and available volume

2

Use extensive data mining and predictions to fill in any gaps in your data (quality, logistical costs, available volume)

3

Use a model to calculate what your need to buy to blend the quality and volume you want, now considering your expanded universe of barrels

4

Confirm any mined/predicted data for the barrels your model told you to buy with the seller

5

Buy barrels from the sellers, and blend at your site

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Demo: Blend Builder

Optimizing throughput at a midstream terminal

CLIENT PROFILE

Results

Profile

Midstream and infrastructure company with refineries, condensate, and crude processing and marketing

Facility

Truck terminal with 400,000 bbls/month of throughput capacity at a gas and liquids processing plant

Leveraging Edge blend builder / optimize terminal, client was able to identify:

125,000 bbls

of incremental volume throughput

479%

increase in blend profit

$4.57

of additional profit per barrel of incremental volume

Optimizing throughput at a physical trading and logistics company

CLIENT PROFILE

Results

Profile

Physical trading and logistics company with a worldwide portfolio of facilities

Facility

Terminal with 250,000 bbls/month of throughput capacity at a gas and liquids processing plant

Leveraging Edge blend builder / optimize terminal, client was able to identify:

50,000 bbls

of incremental volume throughput

159%

increase in blend profit

$0.73

of additional profit per barrel of incremental volume

Applying Takeaway 2:
Use Your Data

Leverage the full predictive power of data your already measure at your facility

APPLICATION

Use existing field and lab data to
- Predict assay parameters that cannot be measured in real time
- Displace high-maintenance or unreliable analyzers
- Use real-time understanding of uncertainty and tolerances in operational decisions

CASE STUDY

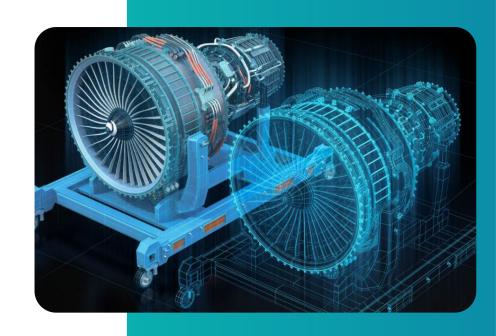Leveraging Virtual Analyzers, 50kbpd midstream terminal in trading hub was able to:

Reduce quality giveaway 64% due to accuracy increase and real-time uncertainty tracking

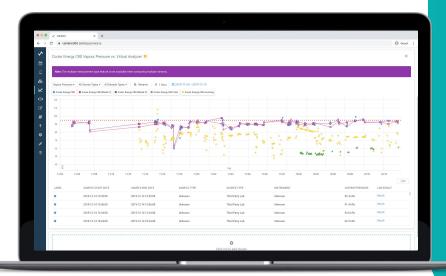**Increase profits by $0.30/bbl, >$5M/yr**

Save $1M-$3M on CAPEX

Virtual Analyzers

A digital twin to physical analyzers that offers **enhanced measurement** possibilities at **a fraction of the cost**.

Expand the functionality of your existing measurement assets without costly new hardware installation, maintenance, fouling, and malfunction.

What does it do?

Predict properties of a commodity (e.g. vapour pressure, viscosity, distillation curve) based on existing knowledge of a facility

What is it used for?

Fill in data gaps where other options aren't feasible for practical or economic reasons or where physical analyzers don't exist.

How does it work?

Maps facility molecules and applies known relationships and physical properties to track unknowns and fill data gaps using statistics, historical test results, and machine learning.

New measurement possibilities

Virtual Analyzers currently predict:

VP
VAPOUR PRESSURE

S
SULPHUR CONTENT

C4-
C4- CONTENT

D
DENSITY

V
VISCOSITY

FP
FLASH POINT

DP
DISTILLATION PROFILE

CC
CRUDE COMPATIBILITY (P-VALUE)

H2S
H2S CONTENT

Can also predict:

TAN - Total Acid Number

W - Wax Content

MCR - Micro Carbon Residue

ETOH - Ethanol

O - Other

▢ Not possible with traditional analyzers

Reducing quality giveaway at hub terminal

CLIENT PROFILE

Results

Profile

Global midstream and logistics company with a portfolio of crude, condensate, NGL, and natural gas processing facilities

Facility

Crude terminal with 50,000 bpd of throughput capacity delivering at trading hub across multiple possible grades

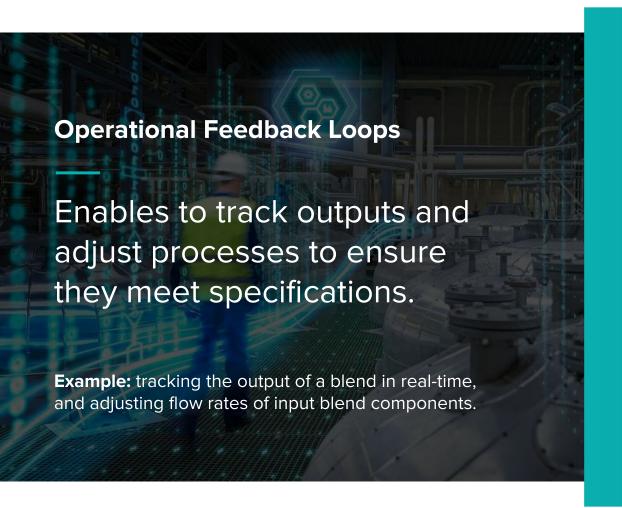Leveraging Virtual Analyzers, client was able to:

53% reduced quality giveaway
due to virtual analyzer accuracy increase
+ **11% reduction in quality giveaway** with no increase in off-spec risk from real-time uncertainty tracking

$0.30/bbl, >$5M/yr profit increase

$1M-$3M CAPEX saved

Operational Feedback Loops

Enables to track outputs and adjust processes to ensure they meet specifications.

Example: tracking the output of a blend in real-time, and adjusting flow rates of input blend components.

1 **Profit Optimization**

2 **Risk Management**

3 **EHS / ESG**

Applying Takeaway 3:
Optimize in Real Time

Build processes to quickly adapt to changing conditions.

APPLICATION

Even the best plans and models run into operational realities. Operational and commercial teams need to be able to quickly communicate, adjust plans, and reoptimize.

IMPACT

A greater understanding of the how operational changes and constraints affect commercial decisions. The ability to adjust to changing conditions and create new optimized plans on the fly.

Reacting to facts on the ground

Facts on the ground are often **different from paper blend plans**

Large impact

- Off-spec shipments
- Missed/late shipments
- Refinery unit down

Smaller Impact

but still important

- Linefill
- Tank heel
- Batch interface

Barriers that slow reaction time

1 **Unavailable operations-level data**
- No operational feedback loops in place
- If feedback loop is in place, it is only accessible by operations

2 **Slow optimization**
- Slow data gathering
- Manual adjustments of models

Applying Takeaway 3

Optimize in Real Time

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Operational Feedback Loop ➜ Commercial Feedback Loop

Operational feedback loops must be communicated to commercial teams

Benefits

————

1 **Calculate impact of real-time quality changes on blend plans**

2 **Make on-the-fly commercial decisions to improve blends**

Demo: Operational Optimizer

Tracking heel quality in fuel oil blends on a refinery sales stream

CLIENT PROFILE

Results

Profile

Mid sized refining and petrochemical company with several mid-sized refineries and petrochemical plants

Facility

Refinery and petrochemical plant 15,000 bpd of LSFO production

Leveraging real-time quality tracking and operational optimization, client was able to:

Reduce uncertainty by 5x
in sulphur content and viscosity prediction

Increased speed of blend process
in sulphur content and viscosity prediction

$1.2M/yr opportunity for additional profit

TAKEAWAYS
To address crude slate problems & drive margins, efficiencies & ESG mandates

1 When sourcing crude from the market, **it pays to emphasize completeness over accuracy**

2 There is a wealth of information available if you can **leverage the full predictive power of information you already have**

3 Reality can't always be planned for, so **your team needs to react quickly.**

Thank You

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