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Fero Labs

Industrial Use Case Playbook

Cutter Stock Additive Minimization

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Introduction

Welcome to the **Industrial Use Case Playbook**, crafted by Fero Labs for the forward-thinking professionals dedicated to enhancing factory production optimization.

Whether you're a Data Scientist, Process or Production Engineer, Quality or Plant Manager, this playbook is tailored to equip you with the strategies, insights, and tools necessary to drive transformative change within your organization.

In today's rapidly evolving industrial landscape, maximizing production efficiency and minimizing operational costs are imperative for maintaining competitiveness and sustainability.

Within each of our industrial playbooks, we present a curated collection of use cases designed to address the specific challenges faced by modern manufacturing facilities. Each use case is meticulously crafted to deliver tangible outcomes, ranging from increased productivity and quality to reduced waste and energy consumption to help achieve sustainability goals.

Featured within these pages is a use case which spotlights **Cutter Stock Additive Minimization for petroleum refineries.** This case exemplifies how to tackle complex production optimization challenges head-on, leveraging data-driven approaches to drive measurable improvements in operational efficiency and cost-effectiveness.

As you embark on this journey for operational excellence, we encourage you to approach each Fero Labs use case scenario with curiosity, a willingness to embrace innovation and change.

By harnessing the power of your production data, domain knowledge, and collaborative problem-solving, we believe that you can unlock the full potential of your factory's production capabilities.

Together, let's redefine what's possible in industrial manufacturing and pave the way for a future of unprecedented productivity and sustainability.

Welcome aboard,

Fero Labs

Industry Overview

In the realm of petroleum refining, where precision and efficiency are paramount, optimizing production processes is essential for maintaining competitiveness and ensuring product quality. Petroleum refineries play a pivotal role in transforming crude oil into valuable products, including gasoline, diesel, jet fuel, and petrochemicals, which serve as essential resources for various industries and daily life.

The global petroleum refining industry serves as a critical link in the energy supply chain, providing fuel and feedstock for transportation, manufacturing, and other economic activities. With increasing demands for cleaner fuels, higher quality products, and cost-effective operations, petroleum refineries face mounting pressure to optimize their processes while minimizing environmental impact.

However, the **complexity of petroleum refining** poses significant challenges for refinery operators, particularly in terms of **product quality control and process efficiency**. Cutter stock additives, used in the refining process to adjust the properties of finished products, play a crucial role in achieving desired specifications and meeting market demands.

One critical aspect of optimizing petroleum refining processes lies in **Cutter Stock Additive Minimization**. This approach involves minimizing the use of cutter stock additives while **maintaining product quality and meeting regulatory requirements**. By leveraging advanced process modeling, real-time monitoring, and data analytics, refinery operators can identify opportunities to optimize additive usage, reduce costs, and improve operational efficiency.

Cutter Stock Additive Minimization not only enhances product quality and process efficiency but also contributes to sustainability goals by reducing chemical usage and waste generation. By implementing optimized additive management practices, refineries can achieve higher levels of operational efficiency while reducing environmental impact and operating costs. At Fero Labs, we refer to this as Profitable Sustainability.

Industry Challenges

In Industry 4.0, the promise of digital transformation often gets stuck in **"pilot purgatory,"** with **70% of initiatives failing to progress beyond testing phases**. McKinsey's research highlights that the choice of use case significantly impacts this phenomenon.

Selecting use cases that lack strategic alignment, clear value propositions, or encounter technical barriers contributes to pilot initiatives' failure.

Pilot purgatory not only wastes resources but also risks eroding confidence in digital transformation efforts. To navigate this challenge, organizations must strategically select use cases closely aligned with their objectives, offering clear pathways to value creation and scalability.

In each **Fero Labs Use Case Playbook**, we explore industrial use cases designed to address modern manufacturing challenges. Leveraging advanced analytics, AI, and machine learning, these use cases aim to drive tangible improvements in operational performance, cost-effectiveness, and sustainability.

By focusing on strategic and transformative use cases, organizations can break free from pilot purgatory and unlock new opportunities for growth and innovation.

Use Case Description

Background

In petroleum refineries, residual fuel oils from crude distillation units, also referred to as heavy fuel oils (HFOs), are blended with various light oils to improve quality. These additives, known as cutter stock, encompass low viscosity oil and oil-derived products such as kerosene, olefins, diolefins, light cycle oils (LCOs), and diesel. The main objective of integrating these components into HFOs is to reduce its viscosity to target specifications, allowing the resulting fuel blend to be categorized, marketed, and sold as value-add fuel products.

Problem

The value of cutter stock is high and often more valuable than the resulting fuel oil, motivating plant operators to **minimize its use in the blending process** while still meeting desired viscosity specifications. This requires a delicate balance: insufficient addition of cutter stock can leave the HFOs overly viscous and unsuitable for sale, whereas adding an excessive amount of cutter stock can lead to major monetary losses.

Problem Summary

Predict final fuel oil viscosity and minimize the quantity of cutter stock required to save costs.

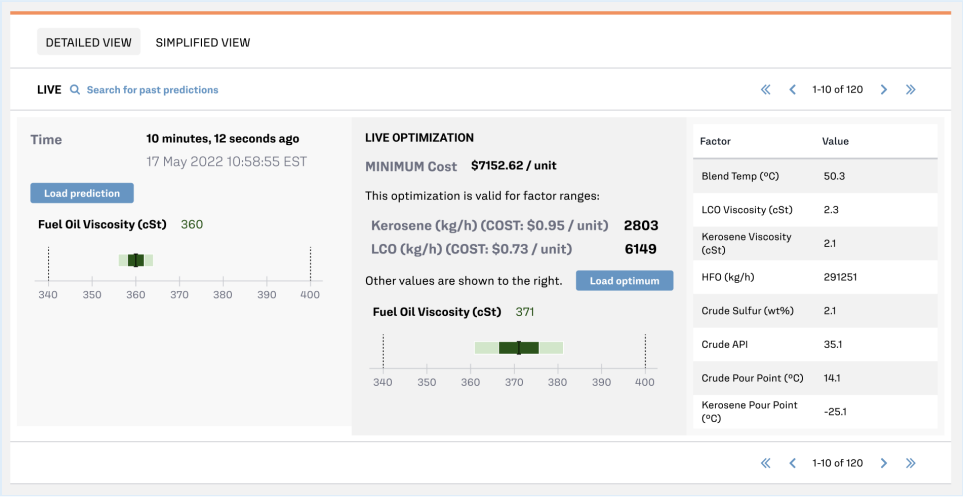
To ensure the viscosity of the final blend meets required specifications, **plant operators** periodically sample the fuel oil blend during production and measure its viscosity. In general, the lack of access to KPI data for prolonged periods forces operators to rely heavily on their expertise and judgement during the blending process. This approach, although beneficial for repurposing and enhancing HFOs, can lead to **overuse of cutter stock by up to 15%** if the process operator believes that fuel oil specifications are not being met.

Fero Labs Solution

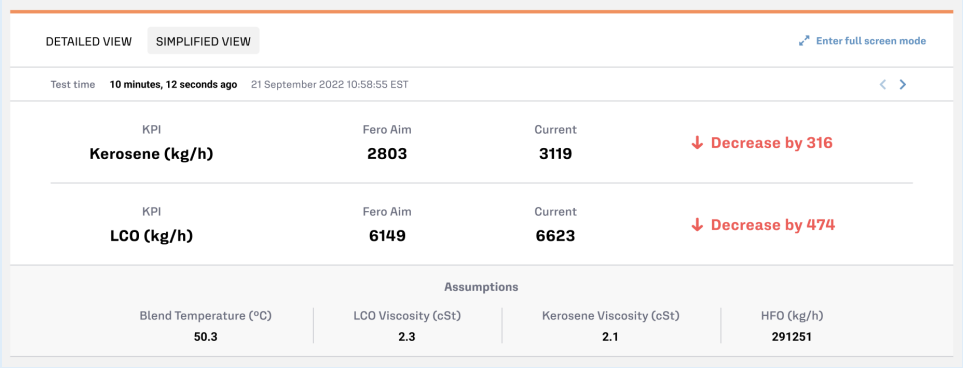
A well configured Fero Labs analysis can be used accurately predict final fuel oil blend viscosity and learn the important factors that impact it. Based on the predictions of final viscosity and the properties of the cutter stock (kerosene and LCO), Fero can then optimize to achieve viscosity within spec while minimizing the amount of total cutter stock needed. The result of Fero's optimization is clear recommendations to make process changes in order to achieve viscosity goals.

A Live Fero Analysis for this use case presents two screens:

- Detailed View: for **production and quality engineers** to monitor production and take action at any moment. In this example we see that Fero predicts final fuel oil viscosity based on current conditions and amount of kerosene and LCOs. If the viscosity is predicted to be well within spec (as seen below), Fero will recommend reducing the amount of each cutter stock in the process while constraining the total wt% of cutter stock. These changes will minimize total cost of cutter stock while keeping viscosity in specifications.



- Simplified View: for **plant operators** with critical information clearly presented to prompt them to make changes to the process to achieve the desired viscosity while minimizing the cost of cutter stock usage.



Process & Business Outcomes

In-process optimization and commensurate cost minimization

When deployed, Fero considers the varying feed stock characterizations and process conditions throughout the crude distillation process to make predictions for blend viscosity. Operators receive real-time, cost-efficient recommendations for adjusting the process parameters to minimize the cost of cutter stock while maintaining the fuel oil blend viscosity within specification. These recommendations also take into account time lags in measurements made at different stages of production. Optimizing viscosity by just 1 centistoke is projected to reduce cutter stock usage by up to **15%**, resulting in significant cost savings.

Reduced lab measurement frequency

By adopting Fero as a virtual soft sensor, refineries gain access to estimates for fuel blend viscosities at regular intervals, reducing dependence on laboratory measurements. This approach can alleviate bottlenecks caused by laboratory-dependent measurements and decrease the total annual lab measurements by as much as **20%**, enhancing visibility into production.

Reduced HFO accumulation and minimize environmental footprint

Adjusting the amount of cutter stock added enables operators to reduce the volume of HFOs requiring further processing or rework, alleviating the operational challenge of managing excess HFOs and mitigating issues related to storage, waste, and environmental concerns. Minimizing HFOs accumulation through real-time optimization supports more **sustainable operations,** reducing the refinery's **environmental footprint**.

Fero Labs Adoption Timeline

Refineries and plants with specialized teams can collaborate to set up and deploy Fero. Below is a timeline highlighting typical steps. With Fero's easy-to-use, no-code interface, this can be achieved in a matter of weeks, not months or years.

Time	Process & Quality Engineers	Data Scientists / IT	Operators	Management
Week 1	Pull data	Pull data		
Week 1	Upload to Fero			
Week 1	Configure Fero	Configure Fero		
Week 2	Corroborate results	Receive example report showing accuracy		
Week 2	Set up Fero Optimization	Set up Fero Optimization		Receive example report showing savings
Week 3	Live data connection	Live data connection		
Week 3	Live Optimization screen (Detailed view)		Live Optimization screen (Simplified view)	
Going forward	Monitor deployment		Follow Fero Optimization recommendations	Receive regular reports showing savings
Going forward	Run "what-if" scenario simulations, spot check production, run root cause analyses		Follow Fero Optimization recommendations	Receive regular reports showing savings

Use Case Data Requirements

The Fero Labs Platform has convenient integrations into common process information management systems, such as Aveva PI System, AspenTech, Wonderware, and SQL databases, as well as laboratory information management systems, such as SAP, Oracle, and other ERP systems. Initial data exploration can be done either through direct integration into these services, or data file uploads in Excel and CSV data formats.

The data requirements for this use case typically involve the following sources:

Crude Oil Characterization Data

- Source: typically LIMS or ERP (e.g., SAP)
- Content: API gravity, sulfur, pour point, CCR, asphaltenes, saturates, viscosities, etc.
- Index: Indexed by datetime

Cutter Stock Characterization Data

- Source: typically LIMS or ERP (e.g., SAP)
- Content: viscosity, temperature, density, pour point, sulfur, etc.
- Index: Indexed by datetime

Fuel Oil Blend Characterization Data

- Source: typically LIMS or ERP (e.g., SAP)
- Content: viscosity, temperature, pour point, sulfur content, etc.
- Index: Indexed by datetime

Crude Distillation Unit & Vacuum Distillation Unit Process Data

- Source: typically PIMS
- Content: crude flow rates, residue/HFO flow rates, light and heavy naphtha flow rates, kerosenes, light and heavy distillate flow rates, exchanger duties, supply temperatures, etc.
- Index: Indexed by datetime

Blender Process Data

- Source: typically PIMS
- Content: feed flow, kerosenes, LCO, temperature, etc.
- Index: Indexed by datetime

Activating This Use Case

Consider our **Industrial Use Case Playbooks** as inspiration and tactical ideas for your team to align on to maximize the efficiencies of your plant. Each Playbook has a matching **Use Case Blueprint** which provides detailed steps to activate each use case within the Fero Labs platform.

If you're curious to see these in action please book a use case demo with our team!

Together, let us continue to push the boundaries of what's possible, driving towards a future where industrial manufacturing is not just efficient and sustainable but truly transformative in its impact on society and the world at large.

Thank you for joining us on this journey, and we look forward to continuing to partner with you in your pursuit of excellence.

Sincerely,

Fero Labs

About Fero Labs

Fero Labs helps factories work better together by bridging the gap between the disconnected goldmine of production data and industrial knowledge inside every plant.

The Fero Labs Profitable Sustainability Platform collects data and knowledge, and augments it with powerful Fero ML so factories can make more confident changes that drive profit and sustainability.

Harnessing Fero Labs, a factory creates an augmented workflow which allows for better use of raw and recycled materials, production time, and energy utilization. Teams can work 90× faster, using Fero's AI powered simulated predictions or live optimizations. They can run root cause analyses in minutes, and make continuous process improvements that drive Profitable Sustainability.

Fero Lab's white-box explainable ML makes decisions clearer by showing the context and confidence levels behind every prediction and recommendation. This expands a plant's production knowledge and drives better production results for manufacturers, all while minimizing emissions. Together we'll build a sustainable tomorrow.