LyondellBasell

LyondellBasell Optimizes Refinery Middle Distillates Production Across Multiple Units with Aspen GDOT™

aspentech | Case Study

2% | **Increase in ULSD production** from naphtha/gas oil

Reduced quality variability in Kero and Diesel finished products

> "Aspen GDOT optimized the refinery middle distillate production across multiple units and tanks, enhancing existing tools and reducing product quality variability."

– Robert Confair, Process Control Engineer

LyondellBasell

CHALLENGES

- Units not coordinated in real time and relied on delayed process feedback, impacting product quality variability.
- Off-spec product quality variations intermittently resulted from lagging manual operational changes.

SOLUTION

LyondellBasell implemented Aspen GDOT to address these challenges:

- Coordinating economic strategies and targets across multiple units.
- Identifying limits sooner and automatically adjusting other units to compensate.
- Making consistently scaled move sizes to reduce over and under corrections.
- Predicting tank properties and rundown lines using tank quality Inferentials (TQI).

BENEFITS

Aspen GDOT significantly improved product throughput and quality by coordinating strategies and targets across multiple units, resulting in:

- Tighter control on ULSD sulfur with no off-spec tanks completion.
- Improved control of flash and freeze points on kerosene products.
- Low maintenance requirements.
- Significant reduction in operational moves.
- Success that led to the scoping of additional Aspen GDOT projects onsite.

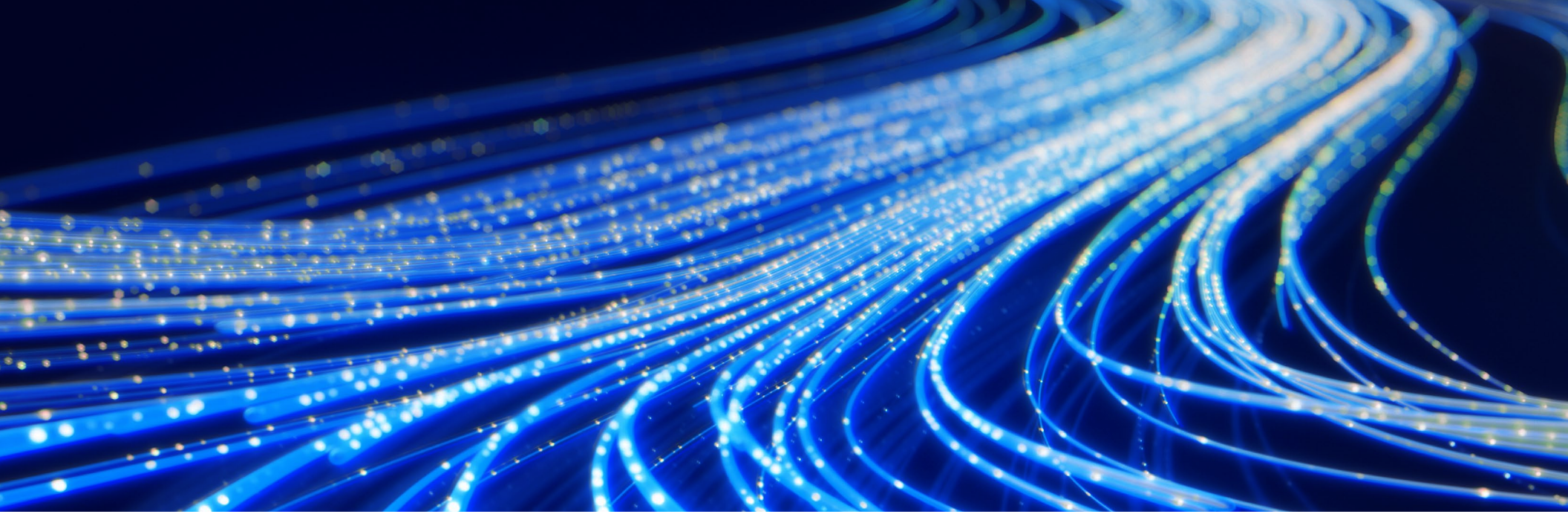
Overview

LyondellBasell Industries is a leading multinational chemical company incorporated in the Netherlands, with U.S. operations headquartered in Houston, Texas, and additional offices in London, UK. The company operated one of the largest refineries in the United States, located just off Houston's ship channel, with a rated capacity to transform 268,000 barrels per day of crude oil into clean fuels, lubricants, chemical intermediates, coke and other products.

Operational Barriers in Middle Distillates Production

Producing middle distillates including jet fuel and ultra-low sulfur diesel (ULSD) requires optimizing operating conditions and blending streams from multiple sources, each with constraints that change over time due to factors like feed composition, equipment limitations, and catalyst activity. Before implementing Aspen GDOT, each contributing unit's advanced process control (APC) operated independently, targeting local specifications such as sulfur levels, flash points, and other quality parameters based on estimates and delayed feedback from adjacent units, rundown lines and tank quality samples/Inferentials.

Operators used this feedback to manually adjust APC limits, tank lineups and other targets. This approach demanded significant communication, coordination and manual effort, often leading to over/under corrections, off-spec tank completions and lower production of clean diesel and kerosene fuels.



Reducing Product Quality Variability Through Dynamic Optimization

Aspen GDOT enabled the site to reduce product quality variability by dynamically coordinating multiple units within the middle distillate envelope. Aspen GDOT identified process constraints and limits sooner, automatically adjusting other units through scaled moves to achieve global economic optimization.

Aspen GDOT enhanced, rather than replaced, existing DMC3 and inferential applications, improving production planning/scheduling workflows. By interfacing with these applications and enhanced workflows, it facilitated the implementation of global economic objectives with minute-by-minute process feedback similar to APC. Aspen GDOT combined non-linear models with APC dynamic models, utilizing process feedback to auto-calibrate through dynamic Data Reconciliation (DR). This technology uses process control models and historic data to ensure the accuracy and consistency of across the process optimization scope. This approach optimized control moves, achieving higher unit control, increasing throughput and providing tighter control on product flash and freeze points.

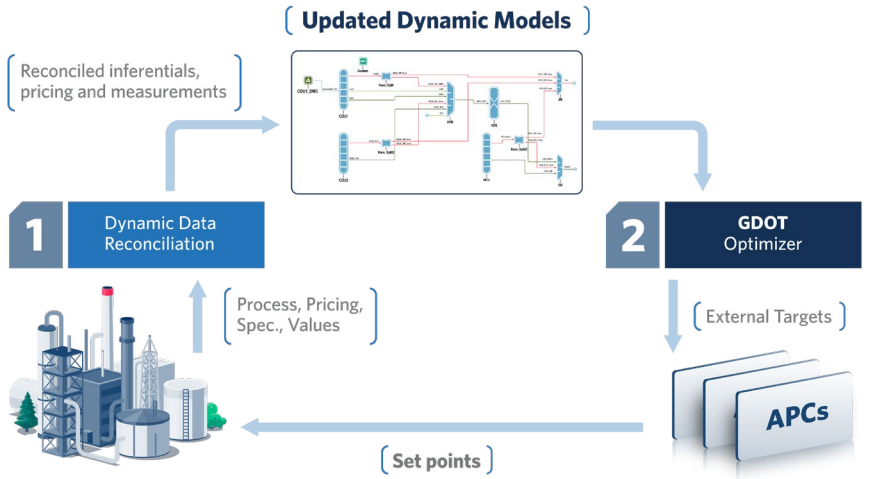


Figure 1: Visual representation of Dynamic Data Reconciliation in Aspen GDOT

Leveraging existing Tank Quality Inferentials (TQI) Models in Aspen Inferential Qualities™ (IQ), Aspen GDOT efficiently corrected potentially off-spec conditions before tank completion. Adjustments considered tank heels and controlled rundown qualities to ensure the blended tank finished closer to ULSD sulfur limits, reducing off-spec production. Aspen GDOT predicted rundown targets and tank properties for five diesel tanks with five specifications each, and three jet tanks with four grades and three specifications each.

A closer evaluation of site operations led to the elimination of redundant Inferentials, implementing only two IQ applications—one for jet and one for diesel—requiring just sixteen inferentials. These prediction models enabled GDOT to correct off-spec conditions prior to tank completion. Additionally, Aspen GDOT handled multiple tank lineups and lab sample inputs with no manual intervention.

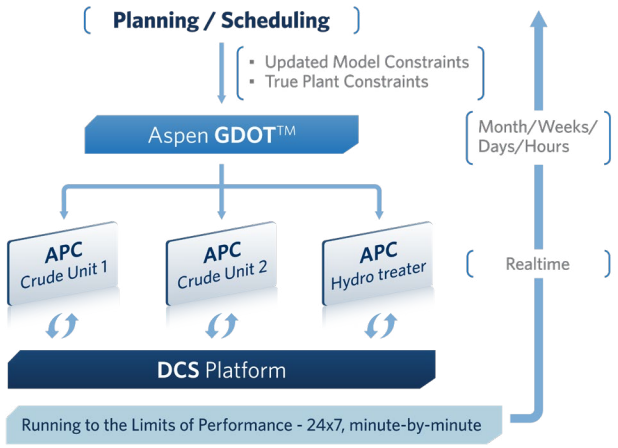


Figure 2: GDOT solution architecture.

GDOT implementation leveraged existing applications interfaces in Aspen Watch Performance Monitor™, Aspen IP.21®, Aspen Inferential Qualities™ (IQ) and Aspen DMC3, minimizing implementation costs and required minimal operations training. This approach simplified/reduced data collection, consolidated TQI, facilitated the addition of process variables tags and allowed DMC3 model updates without impacting history collection.

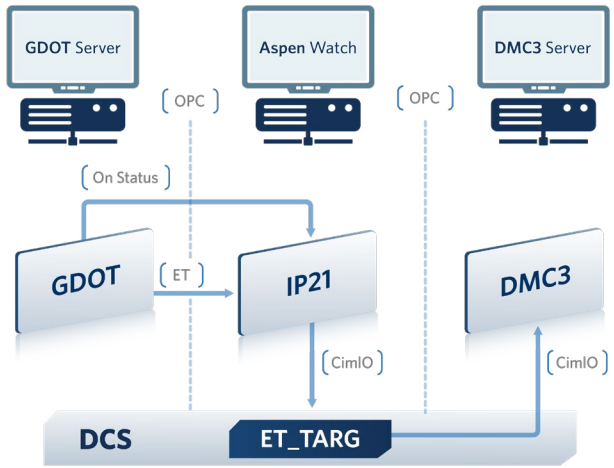


Figure 3: Aspen GDOT communication interfaces summary.

Transformative Production Outcomes

The implementation of Aspen GDOT at LyondellBasell's Houston Refinery led to significant improvements in middle distillate production, including:

- 2% Increase in ULSD Production: From naphtha and gas oil.
- Reduced Product Variability: By coordinating strategies and targets across multiple units.
- Enhanced Control of Product Specifications: Achieved tighter control over flash and freeze points for kerosene products and sulfur levels in ULSD.
- Operational Efficiency: Significant reduction in the number of moves made by operators and superintendents, freeing up time for other tasks.
- Enhanced Coordination: Key information from Aspen GDOT was shared across the plant, ensuring everyone was aligned on constraints and limitations.
- Low Maintenance Costs: Leveraged existing tools and infrastructure, reducing the need for upgrades and minimizing training requirements.
- No Off-Spec Tanks: Post-commissioning, LyondellBasell saw immediate benefits with no off-spec tanks and all tanks running closer to spec, resulting in smoother and more consistent operations

The implementation of Aspen GDOT at LyondellBasell's Houston Refinery significantly enhanced middle distillate production by improving product quality, increasing ULSD output and streamlining operations. The coordinated strategies and dynamic adjustments facilitated by Aspen GDOT led to tighter control over product specifications and reduced operational variability. The project not only delivered immediate economic benefits but also optimized the refinery's overall performance, demonstrating the value of dynamic process control in complex industrial environments.

About Aspen Technology

Aspen Technology, now part of Emerson, is a global software leader helping industries at the forefront of the world's dual challenge meet the increasing demand for resources from a rapidly growing population in a profitable and sustainable manner. AspenTech solutions address complex environments where it is critical to optimize the asset design, operation and maintenance lifecycle Through our unique combination of deep domain expertise and innovation, customers in asset-intensive industries can run their assets safer, greener, longer and faster to improve their operational excellence.

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