



CUSTOMER CASE STUDY

# How Cosmo Oil deployed process digital twin to enable real-time optimization and save \$2M/crude unit annually

Cosmo Oil Co., Ltd. - [www.cosmo-oil.co.jp](http://www.cosmo-oil.co.jp)  
 Industry - Oil & Gas

## Goals

- Cosmo oil needed the capacity to quickly adapt operations in real-time to improve production efficiency retaining safe and stable operations
- Using a digital twin to generate precise operating information to enable teams to improve performance and make informed decisions at an accelerated pace.
- To manage and optimize operations to respond to frequent crude feedstock switching and to target fluctuating prices and optimum operating points

## Challenges

- Need to remain competitive in a fiercely crowded market where other refineries were already deploying real time optimizations
- Team wanted to leverage real time optimizations based on auto-tuned, live data drawn from first-principle rigorous simulation technology.

- Need to optimize plant operations by factoring product prices, utility costs, and equipment constraints through closed-loop real-time optimization generating precise operating information, aligning operations with optimum targets.

## AVEVA solution

- AVEVA Engineering
- AVEVA Unified Supply Chain Management
- AVEVA Process Optimization in Refining

## Results

- Cosmo Oil achieved \$2.3M/year of benefits from its CDU process optimization through more efficient processes and yield improvement.
- Overall, the optimization initiative saw payback in less than one year.
- As a next step, the team is looking to use the real-time optimization process to improve energy efficiency and boost sustainability in their operations

## Summary

Cosmo Oil is the third largest refining company in Japan where it imports crude oil and supplies various petroleum products for the domestic and global market. The company operates three refineries in Japan (Chiba, Yokkaichi and Sakai) with a total CDU capacity of 363,000 BPD.

Cosmo Oil needed to keep pace with other refiners in Japan's highly competitive market and improve operations through real-time process optimization to make the best operational decisions when processing a high variety of crudes.

The company launched a multiyear optimization project to transform its operations and selected AVEVA to develop a Process Digital Twin. The solution enables Cosmo Oil to optimize operations in real time with closed-loop process control and auto-tuning that factors economics and plant configuration to maximize margins.

Cosmo Oil deployed real-time optimization (RTO) on four crude units at two refineries and saw a payback from investment in less than one year with annual savings of more than \$2M per year for each unit.

## Competition, margin drive roadmap for operational improvement

Cosmo Oil operates in a highly-competitive domestic refining market, the result of industry consolidation and a shrinking domestic market. In addition, market shocks introduce further complexity to the business and increase pressure to make optimal decisions.

Several oil majors in Asia had previously deployed real-time optimization (RTO) solutions to gain a competitive edge. To keep pace with competitors, Cosmo Oil wanted the ability to quickly adapt operations in real time to push operational limits while maintaining safe and stable operating conditions.

The company faced several challenges in its daily operations:

- Frequent crude feedstock switching due to changing prices and availability leading to frequent changes in optimum operating points.

- Optimal operating points were based on results from past test runs and did not represent real-time operating conditions, risking loss of margin due to suboptimal operating control.
- Manual operations opened the potential to lose margin through manual error.

Longer term, the company wanted to implement optimization technology to surpass competitors' capabilities. Towards the short- and long-term goals, Cosmo Oil launched a three-year Crude Distillation Unit Real-Time Optimization System Implementation Project to deploy real-time process optimization to its refining operations.

## Digital twin: the foundation for real-time optimization

In considering available optimization solutions, Cosmo Oil was aware that other refiners in Japan had specifically deployed AVEVA which was regarded as the leading real-time optimization solution in the market.

Cosmo Oil had previous experience with AVEVA Engineering (Process Simulation) and AVEVA Unified Supply Chain Management. Based on the strong history and relationship with AVEVA and broad use of AVEVA Process Optimization in refining, the team selected AVEVA over other software solutions.

AVEVA Process Optimization delivers the ability to generate precise operating information to improve performance and enable operators to make informed decisions at an expedited rate. Whereas advanced process control (APC) is widely used to reduce process variability and optimize plant operation close to constraints, AVEVA Process Optimization incorporates economic conditions into the optimization to maximize profits. As a result, companies deploying AVEVA Process Optimization historically see improvements of \$0.05 to \$0.25/bbl.

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“AVEVA has a vision for process optimization and a roadmap to take companies from process control to real-time optimization to AI-infused solutions, all oriented around their notion of the Process Digital Twin.”

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**Mr. Masayuki Yamamoto**

Assistant Manager, Operation Group, Refining & Technology Dept.  
Cosmo Oil Co., Ltd.

## Implementation of closed-loop process control and auto-tuning

Beginning with a crude distillation unit (CDU) at Cosmo Oil's Sakai refinery, the AVEVA team built a real-time optimization model to test and validate, and apply to other units. The result was a Process Digital Twin, a rigorous digital representation of the process, that connected to the plant via advanced process control to optimize operations in alignment with their production plan. The solution:

- Provides real time optimization based on auto-tuned, real time, and first principle rigorous simulation technology.
- Optimizes plant operations by factoring product prices, utility costs, and equipment constraints.
- Enables closed-loop real-time optimization of the CDU by generating precise operating information, aligning operations with optimum targets.
- Incorporates current economic and process conditions including dew point gap.
- Downloads information to advanced process to adapt operations.

In addition to the technology deployment, AVEVA carried out several standard training sessions and model workshops for operators and engineers – a process that built further trust across the project team, aligned deployment with specific customer needs, and laid a foundation for future collaboration.

Mr. Masayuki Yamamoto of Cosmo oil said, "Importantly, at the ground level, AVEVA engineers are very easy to work with and understand the clear next step in a project. The team helped us solve project issues along the way and coordinated resource to make the CDU project highly successful."

After the success of the initial CDU project, Cosmo Oil conducted feasibility studies to evaluate benefits of expanding AVEVA Process Optimization to other process units at Sakai as well as at the Yokkaichi and Ciba refineries. In total, the company completed deployment of real-time optimization on four units - two CDU and two fluid catalytic cracker (FCC) units - by the first half of 2020.

## One year ROI and \$2M annual savings per unit

Cosmo Oil's Process Digital Twin with AVEVA Process Optimization is transforming the company's way of operating by providing process insights rather than simply measurement. The Digital Twin gathers plant data every few hours, reconciles the data, and optimizes plant operation automatically with:

- Auto-tuning to match to actual plant behaviour
- Real-time execution and communication with the plant
- Rigorous process simulation model for the accurate replication of actual plant behaviour

### Additional application and insight from the Process Digital Twin include:

- Faulty instrumentation identification to improve the accuracy of instrumentation
- Mass balance to measure performance
- Energy balance for energy management
- Process equipment performance monitoring
- Operation trouble shooting and engineering case study
- Planning model update to improve accuracy

In initial calculations, Cosmo Oil achieved \$2.3M/year of benefits from its CDU process optimization from yield improvement. Overall, the optimization initiative saw payback in less than one year.

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"AVEVA solutions are regarded as the gold standard for real-time process optimization. Our experience with AVEVA's team on the initial CDU deployment confirmed their expertise and that AVEVA was the right partner to work with to transform our operations."

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**Mr. Masayuki Yamamoto**

Assistant Manager, Operation Group, Refining & Technology Dept.  
Cosmo Oil Co., Ltd.



## Future Deployments

By implementing a Process Digital Twin, Cosmo Oil took an important step to transform its operations and gain new insight. With optimization projects completed at Sakai and Yokkaichi, Cosmo Oil will plan to implement RTO at their Chiba Refinery. Moving forward, the company has potential to identify further optimization gains by optimizing energy use and equipment performance.

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“We need AVEVA’s help for the future, for maintenance of RTO as well as the next evolution of the project. The key to optimization is to keep using it to maintain optimal performance. There is no doubt that digital transformation of our operations will be a journey – and AVEVA will be our long-term partner to achieve our vision.”

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**Mr. Masayuki Yamamoto**

Assistant Manager, Operation Group, Refining & Technology Dept.  
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To learn more, please contact your AVEVA representative or visit us online at [aveva.com](https://www.aveva.com)