SIMTO®

M-Blend® for Crude Blending

Refineries must have a low-cost crude mix that can be processed in the existing processing units and make high yields of high-value products. SIMTO M-Blend helps the crude scheduler deal with the complex constraints in specifications, inventory, logistics, and production schedules. SIMTO M-Blend is easy to use and flexible to help the refinery respond quickly to variations in crude oil supply and quality.

Opportunity and Impact

- Refineries take advantage of spot purchases on opportunity crudes for increasing margins.
- Crude scheduling has a big impact on crude unit throughput and downstream unit operations.
- Crude feed quality fluctuation is a major disturbance for refinery operation.

Benefits

SIMTO® M-Blend for Crude Scheduling is an integrated crude blend optimization and scheduling system. It provides several tools for the crude scheduler/blender including: Blend Evaluator, Single Blend Optimizer, Multi-Blend Optimizer, and Virtual Blends for rapid blend analysis and predictions. Benefits from using M-Blend for Crude Scheduling are:

- Improving crude mix consistency for varying crude diets,
- Stabilizing crude feed qualities to reduce disruptions,
- Predicting blend properties using linear and non-linear correlations,
- Minimizing the cost of multiple blends over multiple periods,
- Controlling critical properties for maximizing throughput within process constraints,
- Adapting quickly and forecasting impact of slate changes,
- Seamless integration with crude assay systems.

Have More Control

Controlling critical properties that limit the amount of crude processed are essential for improving throughput and consistency. For example, sulfur and vacuum residue contents have maximum targets due to the capacities of the sulfur recovery and coking units. A crude mix with a high total acid number may be incompatible with the metallurgy of the processing units. Hydrogen availability and hydrocracking capability may determine how heavy a crude mix can be processed.

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Solving Crude Blending Issues

Best Practices

Current Issues

- Unstable crude diet
- Difficult and slow to evaluate opportunity crudes
- Substantial variation in crude feed qualities
- Large crude "Quality Giveaway"
- Higher demand for crude tankage and segregation

Use Multi-Blend Crude Optimizer

- Optimized crude blend recipes
- Meet crude unit feed specs for stable diet
- Recommend buys/sells
- Minimize give-away
- Generate refinery crude schedule including optimized blends

Achieve Best Practices using SIMTO M-Blend

The objective of crude scheduling objective is to ensure that the right crude mix is processed. M-Blend (Multi-Period Blend Optimization) is a comprehensive, flexible, and versatile solution for blending crudes.

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- Stabilizing crude feed qualities and utilize more economical crudes by optimizing the crude slate to meet quality targets set by the planning system.
- Minimize the total cost of crude of multiple blends over multiple periods in the schedule horizon, while honoring constraints in specifications, inventory, logistics, and production schedules.
- Avoid problems of optimizing a single blend at the risk of inventory shortage and unit shutdown or slowdown for subsequent blends of the crude mix.
- Managing inventory economically by accurately predicting demands of crude oil components. Inventory control is important with the tight supply of crude oil.
- Predicting blend properties accurately with versatile blending methods including linear blending, bonuses, formulas, interactions, and dynamic libraries. The library blending method can handle complex correlations of oil compatibility models to predict asphaltene insolubility to prevent oil separation and heater fouling.
- Blending the crude mix consistently for stable operation and consistent product quality.
- Increasing refinery flexibility with the ability to blend crude oils outside experience and to adapt quickly to changes in crude supply and quality.

Comprehensive Solution

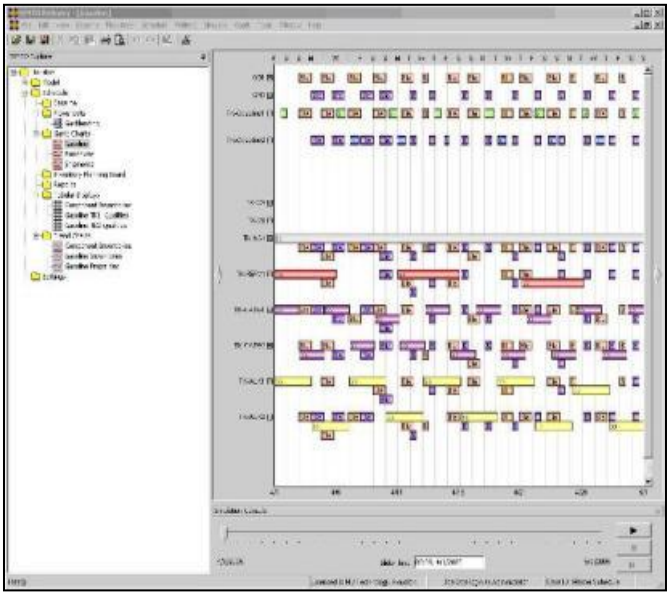
SIMTO M-Blend solves the blend optimization problems involving multiple crudes and multiple periods in today's supply-chain environment. This optimizer finds the optimal recipes that meet the specifications of individual blends across the schedule horizon, while minimizing the cost and quality giveaway and honoring the constraints of materials, logistics, and receipts.

The material specifications and constraints come from the manufacturing process, planning system, or ERP system. Material utilization is optimized within the available quantities. Compositions of materials may have minimum or maximum limits. Materials for the same services can be grouped into pools (e.g. sweet vs. sour) that may also have minimum and maximum limits.

Tankage considerations include tank services for compatibility was well as min/max limits. The proper materials follow the correct switching sequences, do not overflow or underflow, and are transferred within pumping capabilities. The blending schedule has to account for varying qualities and quantities of materials because units have finite production rates and some units may be out of operation.

Flexible Approach

While the optimization problem is complex and sometimes infeasible, M-Blend provides user controlled flexibility. SIMTO M-Blend accommodates flexible objectives and constraints. While searching for the optimal recipes, the optimizer may enforce or relax the requirements to meet specifications, depending on the user-assigned penalty factors for those specifications.



The optimizer may try to meet the exact specifications for the user-specified, immediate future of the schedule and loosen the specification limits for the distant future. The blends in the immediate future are for near-term deliveries, and the blends in the distant future are for production planning and inventory management.

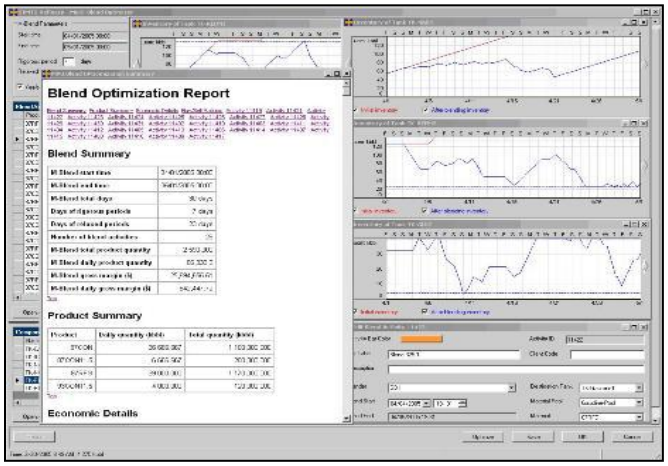
Users also have the ability to enforce or relax constraints on the heel or minimum discharge rate of component tanks. When flexibility fails to produce optimal results, the optimizer specifies the volumes of materials required to break the infeasible problem. This information helps the plant to manage inventory and to identify bottlenecks in the manufacturing process.

User-Friendly Interface

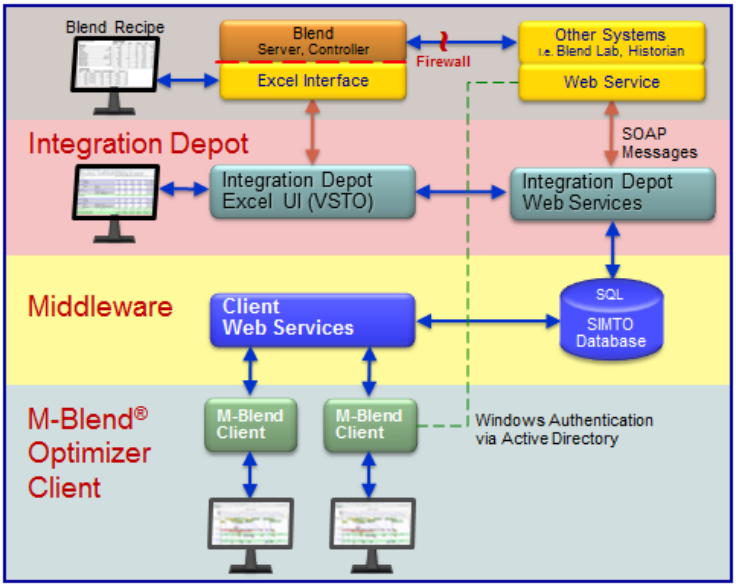
SIMTO M-Blend's powerful optimization algorithm and complex problem configuration are made user-friendly through SIMTO visualization technology, blend knowledge base, and data integration.

The user schedules blending activities by drawing bars on a Gantt chart and defining the

details of each blend on a window-based form. The user may make any changes in qualities, quantities, or constraints of materials and tanks on similarly user-friendly forms. After the changes, the user has instant feedback of the optimal recipes and their effects on product qualities and tank inventories in tabular displays and trend charts that improve comprehension and decision making.



The user is free from handling routine matters when M-Blend provides automatic data transfer for nomination and shipment information, laboratory data interface for component and product characterizations, and recipe transmittal to advanced blend process control systems (BPC).



A blend knowledge base is available to manage product specifications and blending methods and to ensure data accuracy during the configuration of blending activities.

Easy Integration

SIMTO M-Blend stores information of blending activities in an SQL Server database for ease of access and integrity of data. M-Blend can be used stand-alone or integrated with SIMTO Scheduling system. Crude supply schedule, processing unit schedule, dock schedule, and shipment schedule work seamlessly with blending schedule. All systems communicate among one another through SIMTO Web Services. SIMTO Integration Depot serves as an interface between the SIMTO Product Family and other systems.

M-Blend integrates with Assay Management Systems, Blend Property Controllers, Process Historian Systems, Production Planning Systems, Excel, and other plant applications.

Like all other SIMTO products, M-Blend is an enterprise solution with a multi-tier architecture allowing multi-user and multi-site operation and is smoothly integrated with corporation network security systems.

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About M3

M3 Technology is the premier supplier of supply chain management solutions focused on enterprise planning, advanced asset scheduling and optimization solutions for the petroleum, petrochemical & LNG industries. M3's solutions capture economic opportunities and reduce the cost of managing complex facilities at the plant level, regional operating level and global enterprise level.