

Optimization and Scheduling



Challenge

In today's market, it is more important than ever to reduce costs, improve savings, and streamline operations. Many pipeline companies have embarked on optimization initiatives to this end. It can be difficult, however, to achieve optimal financial performance from one's assets without optimization and scheduling technology.

- Large systems of interconnecting pipelines provide powerful flexibility and transport capacity. However, the size, operational scope, and flexibility of the pipeline assets also pose many tactical and strategic challenges.
- The ability to move crude oil and refined products from one point to another as efficiently and economically as possible is crucial for a pipeline company. Scheduling pipelines efficiently is an essential component to this process.
- Operational deal sheets depicting incremental costs of new contract volumes are a powerful tool that can be used to determine whether to accept new contract volumes and what price to quote. This data, however, can be complicated to produce due to convoluted power contracts.
- Empowering operators and schedulers with the data and knowledge of how to run the pipeline most efficiently can quickly and significantly affect the company's bottom line. Unfortunately, creating this dataset manually can be an onerous process.

Traditionally, pipeline operators and schedulers have optimized their operations using experience and spreadsheets, and they have enjoyed a good margin of success. However, as experienced operators and schedulers leave the workforce, companies are forced to depend on the decisions of novice employees. With the lack of standard methods to accurately determine how efficiently the operator is using pipeline resources to move products, the need for software that optimizes performance and standardizes its assessment becomes more and more prevalent. Optimization and efficiency initiatives frequently lead companies in search of software solutions that can provide the following functions:

- An entire network overview for managing entire pipeline and terminal network
- Optimization of network capacity and asset utilization
- Quick validation of ability and cost of a nomination
- Capitalization on possible fungible swaps
- Analysis of transport alternatives
- Effective use of alternate sources
- Comprehensive pipeline and terminal scheduling
- Nominations management
- Automated reconciliation between scheduled and actual operations
- Better operational and financial evaluations of new or modified assets
- Lowered operating costs through reduced DRA and power consumption
- Improved understanding of the incremental cost of new transportation volumes
- Analysis and understanding of complex power billings

In today's challenging economic times, every company is searching for significant ways to improve their bottom line. Optimization and scheduling technology can help achieve optimal financial performance from a pipeline company's assets.

Solution

The Liquids Management suite provides a comprehensive optimization and scheduling solution have been uniquely developed to deal with the specific challenges incurred by pipeline operators. Our tools are utilized for optimizing, planning, scheduling, and managing the transportation and storage capability of our customers. To meet these needs, our suite includes TransportPlanner®, PipelineScheduler®, TerminalScheduler®, and PipelineOptimizer® as seen in Figure 1 below.

TransportPlanner is a comprehensive software system for planning and managing complex transportation networks for pipelines as well as other modes of bulk transport. It collects and processes crucial transport requirements needed to execute effective annual, monthly, and daily strategic planning. Batched or stream operations are supported as well as fungible and non-fungible considerations. Routing connections, unidirectional and bidirectional flow, cost of transport, as well as capacity limitations are among the many elements used by the optimization algorithms to automatically select the best routing plan through the network.

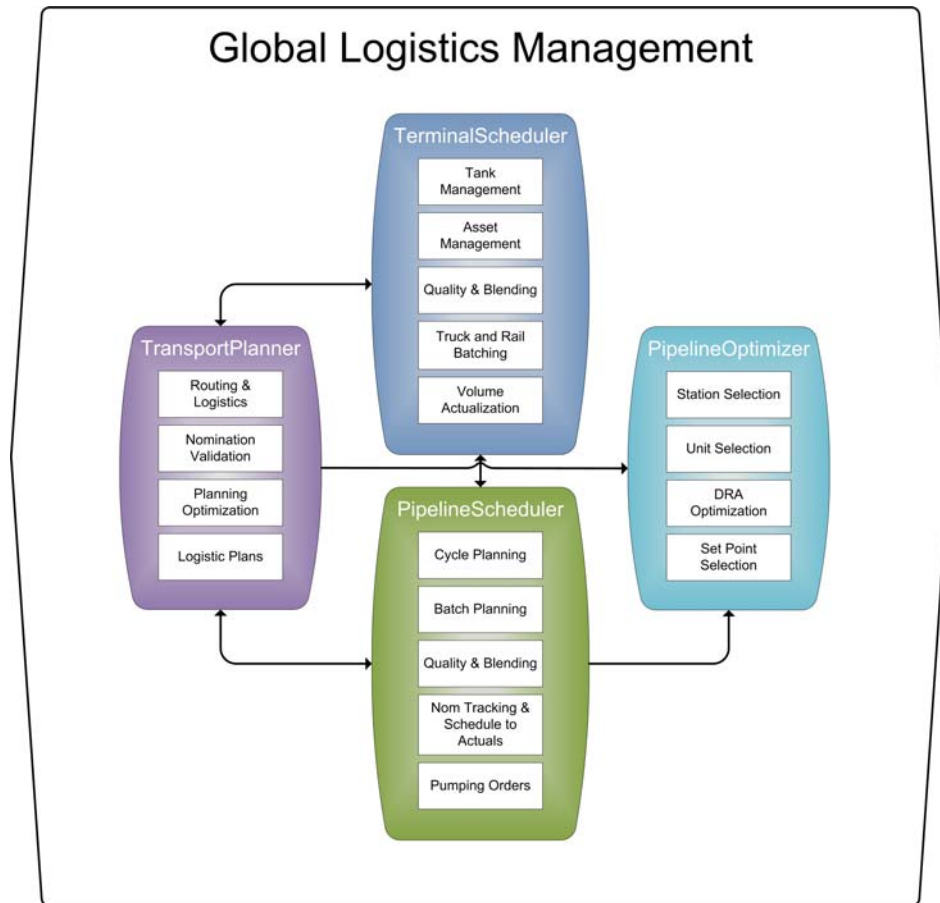


Figure 1. Liquids Management Global Logistics Solution

PipelineScheduler and TerminalScheduler are field-proven pipeline and terminal scheduling platforms that provides the perfect environment to support advanced requirements related to scheduling, pipeline operations, facility planning, and support of the commercial business environment. These applications are designed to support the entire scheduling workflow, from initial nominations or tank lifting forecast to generating the pumping schedule for operations as shown in Figure 2 below.

These scheduling applications represent an easy-to-use liquids scheduling system that addresses the challenges of moving vast amounts of crude oil and refined products through the world’s terminals and pipelines. The system provides schedulers the tools and information necessary to plan efficiently, and ensure timely delivery of products, including product movements on liquids pipelines and in terminals. It organizes and consolidates information crucial to support daily commercial and operational decisions. By interfacing with other critical systems with the pipeline and/or terminal company the liquid scheduling system can become a key element of the enterprise.

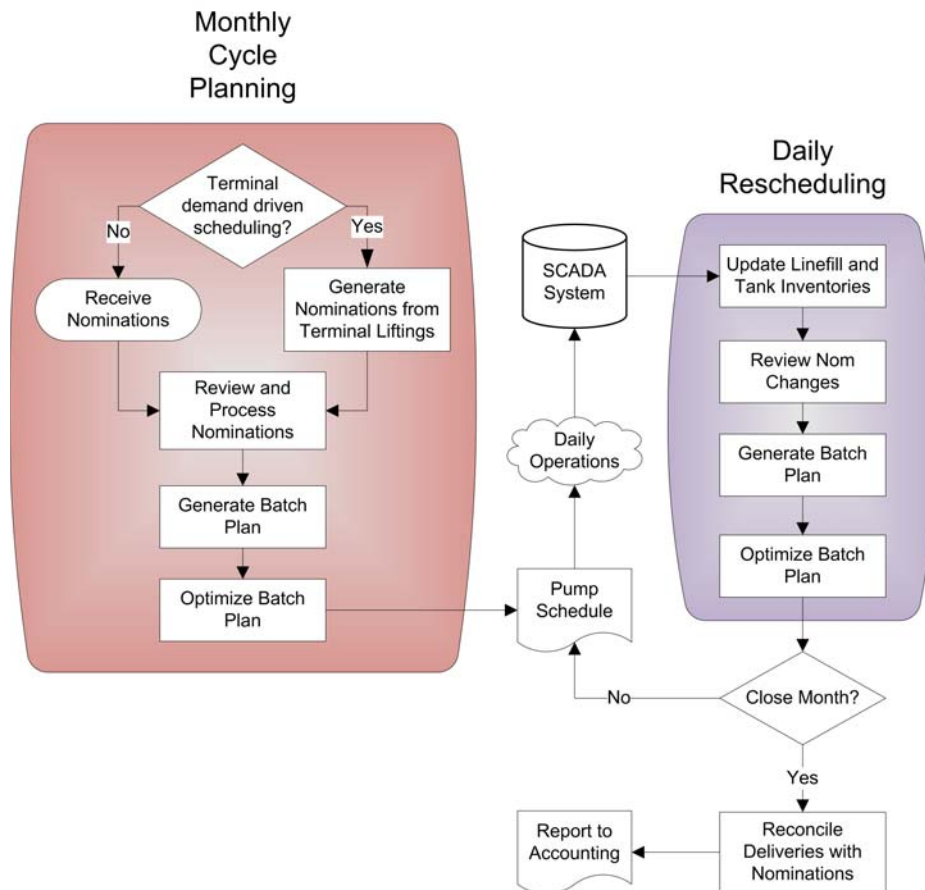


Figure 2. PipelineScheduler and TerminalScheduler Workflow

PipelineOptimizer is an analysis-focused solution platform which provides a hydraulic simulation of the pipeline and its operations. This system combines a pipeline hydraulic simulator, batch scheduling system, and power contract model, all overlaid with multiple optimization drivers. This design produces a uniquely distinctive solution with tremendous potential to meet a client pipeline’s optimization needs. Its full-featured batch scheduling allows PipelineOptimizer to address most, if not all, of the real-world scheduling scenarios that a company might employ. The considerable speed of its underlying hydraulic simulator and the power of its parametric study tool allow PipelineOptimizer to act as a powerful and timely companion to the pipeline engineer, analyst, or operator.

Key Capabilities: TransportPlanner

Some of the core functions of the TransportPlanner solution include:

Feature/Function	Description
Determine Network Capacity	Given a slate of committed movements, TransportPlanner can ascertain in seconds the amount of remaining capacity in the system
Quickly Validate Ability and Cost of a Nomination	New nominations can be posed to the system which will verify if the volumes can be transported and provide an estimated cost of that transport
Capitalize on Possible Fungible Swaps	For fungible products, TransportPlanner will identify potential swaps, satisfying a faraway source with a closer one, reducing the time and cost of a transport
Analyze Transport Alternatives	Alternative modes of transport, such as rail or barge, can be posed to the system to determine the expansion of the network capability the new transport pathway provides
Terminal Stock Management	In addition to tracking the inventory in each terminal, TransportPlanner can be instructed to plan movements from terminals with an excess to terminals in deficit; terminal inventories can directly satisfy movement requests and support floating physical shipper positions in the network
Effectively Use Alternate Sources	Many systems have alternative sources of flow at which additional volumes can be purchased or sold when needed; through its optimization algorithms, TransportPlanner can determine when to cost effectively use such alternatives
Consolidate and Reconcile Multiple Operational Groups	TransportPlanner provides an executive overview of the comprehensive transport network which may include multiple independently scheduled and operated subsystems or pipelines; it can take in the operational schedules of the several groups and make an analysis and assessment of the synchronization and compatibility of each schedule relative to each other

Table 1. TransportPlanner Functions

TransportPlanner Quick Facts

- Carefully-tuned optimization algorithms balance varying network costs to find optimal logistics pattern for pipeline network
- Selected by NATO for order-to-cash and scheduling needs

Key Capabilities: PipelineScheduler and TerminalScheduler

Some of the core functions of the PipelineScheduler and TerminalScheduler solutions include:

Feature/Function	Description
Nominations Management	Nominations will be imported from Synthesis®; cycle plans and batch plans can then be generated based on nominated values or terminal requirements
Visual Representation of Asset	Visual of representation of the pipeline is simulated using the schematic; pipes, tanks junctions and other details of the asset are visually represented in the schematic
Tank and Terminal Management	All tanks and terminals are visually represented in the schematic; tanks can be represented as individual tanks or a tank pools where set of tanks with a similar product are considered as one tank
Blending and Blend Recipes	Blending of products in tanks and in the pipeline is simulated; additionally, blending recipes can be configured by the scheduler
Event Simulation and Management	Simulations are executed and can be viewed along time lapse of the schedule; each event in the schedule can be viewed and referenced back to schematic
Automated reconciliation of scheduled to actual operations	Automated reconciliation is supported with daily comparisons of actual vs scheduled volumes
Efficient, centralized information distribution	Report and email distribution of output data is available to send data to appropriate individuals and applications; additionally, we support export of schedules and other output data in a number of different formats
Batch origination and pumping at mid-line locations	Batch origination and pumping at mid-line locations are supported in PipelineScheduler; this is visually verified represented in the schematic
Full line or “in passing” stripping and injections	Schedulers can strip or inject a portion or full line volumes from a pipe; this is visually verified represented in the schematic
Fixed rate or percentage flow rates	Rates can be configured at a pipe, product and batch or stream level
Safety head and tail batch volumes	Safety head and tail volumes (or bypass volumes) can be configured to minimize transmix
Rules-based Routing	Rule-based routing allows scheduler to standardize the path for injection and delivery; Multiple routes are supported and utilized on one asset
Pipeline Analysis	Identification of bottlenecks and constraints; schedules can be generated for user-defined variable time periods; it provides comprehensive, accurate, model-based pipeline scheduling; time-based and event-based triggers allow for close modelling of the actual operations on the pipeline
Multi-product Support	PipelineScheduler supports a wide variety of fluids; user-defined qualities may be created and product blending may be tracked in mixed batches and tanks
Data Interfaces	PipelineScheduler supports a number of data interfaces which includes services to import/export nominations, line fill, tank levels, pumping schedules, and batch plan
Advanced Database and Reporting	A relational database provides optimal data storage and extensive reporting capabilities, including financial reporting and reports on crude mix composition
Unified Visual Interface	PipelineScheduler uses a client-server architecture that allows users to view the entire pipeline and planned operations through one console; additionally, it also provides a web-based interface for data collection and reporting

Table 2. PipelineScheduler and TerminalScheduler Functions

PipelineScheduler and TerminalScheduler Quick Facts

- Manages both pipelines and terminals efficiently and easily for customers across the world
- Integrates with both TransportPlanner and PipelineOptimizer seamlessly

Key Capabilities: PipelineOptimizer

Some of the core functions of the PipelineOptimizer solution include:

Feature/Function	Description
Capacity Optimization	Model and study capacity of the pipeline
Cost Optimization	Find optimal pump combinations based on power contracts, power or fuel consumed, or cost of power or fuel to meet capacity flow rate or user-defined target flow rate
DRA Analysis and Optimization	Use of DRA rules, including amount of type of DRA injected at each station. Optimization provides suggested DRA injection rules, optimized and balanced with power costs of stations
Comprehensive library of modeling components	Includes pipes, stations, pumps, pump drivers, supplies/deliveries, junctions, heaters, resistance devices, and tanks. Model temperature effects including energy loss through pipe walls
User-adjustable tuning parameters	Used to facilitate matching of historical data with PipelineOptimizer results
Detailed modeling of liquid batch operations	Rule-based routing of batches based on origin, destination, and product, including multiple operations at the same location for a single batch
Controls	Extensive set of controls triggered by a specific time or event, including line shutdown controls
Bottleneck analysis	Automatic bottleneck analysis, which records the bottleneck for each step as well as what fraction of the run each bottleneck condition is active
Engineering reports	Wide assortment of engineering reports, including but not limited to Pump Combination Usage Report, Pump Detail Report, and Station Detail Report
Cost reports	Monthly reports showing electric bill for each station, providing analysis and understanding of complex power billing
Simulate hydraulic scenarios	Balance usage of line assets over time to work around line or unit outages; simulate new or upgraded system assets easily; determine costs of incremental volumes; study and assess costs under different running scenarios

Table 3. PipelineOptimizer Functions

PipelineOptimizer Quick Facts

- Typical savings include 2-3% reduction in DRA, 2-3% reduction in power consumption
- Significant reduction in both power consumption and DRA usage are possible, resulting in thousands of dollars of potential savings per year

Results

By selecting TransportPlanner, PipelineScheduler, TerminalScheduler, and PipelineOptimizer, customers have a fully integrated optimization and scheduling suite of products that help cut costs, increase throughput, and maintain a high level of efficiency. Customers are able to view their entire network in one easy-to-use dashboard, and then dive into individual pipelines and terminals to schedule movements. Once a schedule is completed, pipeline companies optimize the operations to move the nominations in order to minimize operational costs. When additional nominations are proposed, customers can perform logistics optimization to determine if there is capacity for the movement and its optimal route to take. With this suite of products, customers are able to easily and quickly visualize their pipeline and terminal network, add assets to their models, and view and understand optimization and simulation results, all from a single user interface. These results lead companies to meet or exceed their optimization and efficiency initiatives in short order.

Benefits Realized

Optimize Logistics

The ability to produce operating plans to maximize nominations while operating the pipeline cost-efficiently is priceless in today's economy. TransportPlanner gives pipeline companies the peace of mind that their network is being planned optimally and efficiently.

Improve Operational Efficiency

Providing schedulers the tools and information necessary to plan efficiently ensures timely delivery of products, including product movements on liquids pipelines and in terminals. PipelineScheduler and TerminalScheduler equip a company with the information they need to plan and schedule quickly and skillfully.

Optimize Operational Costs

Using PipelineOptimizer to reduce electric and DRA usage can easily save a pipeline company thousands of dollars per year on a single pipeline. By using the tool on a large network, these savings can be drastic and greatly improve the company's bottom line.

About Emerson Energy Solutions – Oil and Gas

Emerson Energy Solutions – Oil and Gas is a leading global supplier of supply chain management software and pipeline management software for the oil & gas industry. Founded in 1976, Emerson Energy Solutions – Oil and Gas serves more than 250 customers in 45 countries. Emerson Energy Solutions – Oil and Gas is committed to providing integrated solutions to address the unique challenges of the oil & gas industry and provide our customers with world class solutions that drive real business value with tangible results to the bottom line.



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