Bunker Refueling Software Optimization Success Story

LQM partnered with Profit Point to optimize its BOptimum™ bunker refueling recommendation software system.

Benefits

Manages the trade-off between basic refueling goals, bunker variables, operational issues and market situational constraints and assists with purchase optimization and compliance.

Background

LQM Petroleum Services, Inc. (www.lqm.com) is one of the largest international marine fuel oil brokers in the world, with core competencies in marine fuel oil brokerage, futures markets and outsourced bunker procurement solutions. With its deep expertise in marine refueling, LQM recognized that marine operators lacked a comprehensive refueling and inventory management system.

Marine refueling decisions are dynamic and complex problems that may include several port stops, cargo loading and unloading, fluctuating pricing from port to port and a variety of required business rules. BOptimum™ (www.boptimum.com) is the first comprehensive commercial bunker refueling and on board inventory management system in the marine industry built to assist with bunker refueling which are complex problems in a dynamic environment. BOptimum™ is capable of showing a quick ROI to its customers by reducing fuel bills with a robust recommendation system.

According to Preet Hooda, the BOptimum Product Manager, "With Profit Point's software optimization, BOptimum saves 1- 2 % of fuel bills for vessels in marine commerce and that at current prices of over $ 500/mt is of high value to ship owners whose fuel budget is 30 – 60 % of their daily operating freight revenue and one of their highest Voyage operating expenses."

Our Solution

A Linear Programming optimization model built in the Mosel language and uses the Xpress-MP optimization engine.

Decision Variables:
The model's decision variables are the quantities of the different fuel-types purchased and loaded into each of tanks on the vessel, ports and prices.

Objective Function:
The objective function seeks to minimize the sum total of the fuel prices and barging costs associated with the purchase quantities. Barging costs applied are of a discontinuous nature depending on the quantity, and consist both a fixed and variable component. Mathematically, if P represents fuel prices and B barging costs:

$$\textbf{Minimize} = \sum_{i,j,k} (Q_{ijk} * P_{ijk}) + \sum_{j} ((\sum_{i,k} Q_{i,k}) * B_{j})$$

Constraints:
The following constraints apply to EACH port on the voyage and EACH fuel type:

- Minimum and Maximum arrival amount.
- Minimum and Maximum departure amount.
- Maximum refueling quantity: this is a function of the available refueling time and pumping rate in a port.
- Minimum refueling quantity: this amount typically stems from any contractual arrangements and is only applied if the model opts to refuel in a particular port.

The following constraints pertain to each of the ship's tanks:

- Maximum tank capacity.
- Allowable Co-mingling percent: this is the maximum amount of 'old' fuel allowed in a given tank when the model decides to purchase/load at a given port.
- Inventory or quantity balance; meaning that the amount of fuel at the end of a port-pair must be equal to the inventory at the starting port of this pair plus purchases, minus consumption.

The final constraint requires that the vessel have a total amount of fuel on board to complete each port-pair of the voyage and finish the entire trip.

The optimization model minimized bunker expenditures for a marine vessel with several fuel tanks which contain one of 3 types of fuel through an analysis of the key variables involved in the bunker decision: price, port, inventory draw down, supply availability, etc. The solution is then used by BOptimum to produce a Bunker Purchasing plan. The Bunker Purchasing plan is a list of all ports along the vessel's voyage with the amount of bunker to be purchased at each port.

Learn more about Profit Point's custom optimization software development services.

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