Optimal Petroleum Fuels Blending Under Uncertainty
Technology #17503

Applications

In the refining industry, crude oil procurement is the largest expenditure and has an enormous impact on refinery profitability. This technology can be used by refineries to optimize crude purchases and refiner operations.

Problem Addressed

Crude oil and oil markets have many uncertainties associated with the quality of the crude oil and the demands in the market. However, crude oil is processed and blended to create final products such as gasoline with strict quality constraints. Therefore, optimizing crude purchases and refining processes is essential to maximizing profits. This technology finds the global optimal solution for purchasing and blending crude oil within the affiliated uncertainties.

Technology

This method reformulates the chance-constrained problem as a tractable problem by creating a two-stage stochastic programming formulation. The first stage is selecting the best crude oil combination among several candidates and their price amounts to maximize expected gross margin across all scenarios. In the second stage, the uncertainties are realized and the optimal operations of the plant are implemented such that the market demand and quality specifications are satisfied. In order to obtain the global optimal solution for this problem, the variable discretization, feasibility and optimality-based domain reduction techniques are integrated into the non-convex generalized Benders decomposition (NGDB) methodology. The enhanced NGBD approach is able to find and verify a global optimal solution within a couple of hours compared to state-of-the-art commercial software which takes several days.

Advantages

- Optimizes crude oil purchases and blending under uncertainty
- Produces global optimal solution in a couple of hours

Categories For This Invention:

Energy
Hydrocarbons
Oil Exploration

Intellectual Property:

Systems and methods for improving petroleum fuels production
Issued US Patent
Systems and methods for improving petroleum fuels production
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Inventors:
Paul Barton
Yu Yang
Phebe Vayanos

Publications:
Integrated Crude Selection and Refinery Optimization Under Uncertainty
AIChE Journal
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External Links:
Barton Lab
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