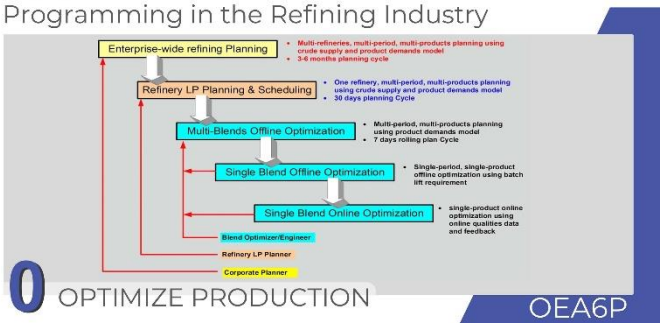
# Applications of Mathematical Programming in the Refining Industry

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| **Topic ID** | **OEA6T** |
| **Title** | **Applications of Mathematical Programming in the Refining Industry** |
| **Category** | **O-Optimize Production** |
| **eLearning Level** | **Basic** |

## Introduction

The mathematical equations may have Constraints decision variables as well as equalities/inequalities. Some common parameters concerning the model are market requirements, regulations concerning diesel fuel, and crude mix ratio. For refinery operations, these parameters influence profitability, export/import of final petroleum products, and refinery operations.

Performance of formulations and data accuracy are key factors for the efficiency of the mathematical model. First, the material flow path is traced by the model. Then different mathematical formulations are prepared for individual operations.

**This topic will discuss mathematical programming and its attributes, crude oil planning and scheduling, fuel blending optimization, etc.**

### Benefits of Mathematical Model

The production cost for finished petroleum products can be optimized with the help of a mathematical model. The model can also optimize the cost of transportation. Refiners always look for more sales realization resulting in enhanced profitability. Hence, they need to use the blended system efficiently.

### Base Mathematical Model

Initially, the refiner proposes a base model based on the refinery configuration. This model outlines the appropriate crude mix ratio. Production cost depends on different constraints, such as crude availability, price of crude, market demand, quality specs, etc.

### Superstructure Display

A refinery configuration may have a superstructure display. It will consist of all existing topology options, such as the option for heavy oil processing. Here, technology for RFCC (residual fuel catalytic cracking), VRHDS (residual vacuum hydrodesulfurization, ARDS (Atmospheric residual hydrodesulfurization), etc., will be considered. Based on the superstructure, a refiner can develop a MILP (mixed-integer linear program).

### Connecting Various Refineries

There may be a common pool consisting of finished and intermediate petroleum products. To enhance profitability, various refineries may share this common pool. A mathematical model linking all these refineries may be constructed to ensure optimum allocation.

### Instances of LP Applications

Fluctuation in demand influences the import/export of various chemical products, as well as inventory. For example, if there is a decrease in sulfur content in diesel fuel, then processing costs may increase. In such cases, the import of high-speed diesel (HSD) may become economically more viable for refiners. Similarly, if the crude ratio increases, then there is a reduction in heavy naphtha imports. In such cases, LP may guide the refiner regarding process scaling and ensuring profitability.

**Summary:** MP applications play a significant role in refinery operations. Their efficiency depends on precise input. Refiners need adequate training in this regard.

| Mode of eLearning | Available? |
|---|---|
| Free Course | No |
| Refresher Course | No |
| Pick N Choose (Custom Curriculum) | Yes |
| Advanced Level Course | Yes |
| Structured MCOR Curriculum | Yes |