Executive Summary

This report summarizes the use of a linear programming model used to optimize refinery crude oil purchasing while meeting a specific uncertain demand. The model was optimized by maximizing the gross refinery margin (GRM). The model includes catalytic reforming units, naphtha pre-treating units, a kerosene treating unit, a hydrodesulfurization unit, and an isomerization unit.

This base of the model is an LP model which was developed to model the Bangchak Refinery. The model incorporates uncertainty into the demand of refinery products and the purchase price of six available types of crude oil (Oman, Tapis, Labuan, Seria Light, Phet, and Murban).

The LP model is made even better by accounting for refinery utility cost, hydrogen production, and refinery fuel gas production. These inclusions allow the model to reflect the cost of operating at certain conditions. The model also gives a more accurate representation of the GRM function since the cost of utilities has been taken into account.

When compared with commonly-used industrial software, the LP model in GAMS is able to test a variety of operating variables to find a gross refinery margin value near the global optimum. Industrial software operates on a successive linear programming principle, which depends on the starting point of the solver. This can lead to industrial software finding only a local optimum.

Compared to the model without utilities, the LP utility model gives a larger gross refinery margin. While the model takes utility cost into account, it is still able to optimize the use of each unit in the refinery, increasing the total throughput for each time period evaluated.

Using the basic linear Bangchak Refinery model in GAMS, it was shown that the results of a successive linear programming (SLP) method depend on the starting point selected. Different initial conditions resulted in different stream output values.