2 DEFINITION OF REFINERY CONFIGURATIONS

The preliminary refinery configuration study began with an initial optimization effort in which four different refinery configurations were evaluated. HQCEC had identified four refinery configurations in its proposal volume for consideration. SERESCO has accepted the four schemes which were evaluated as part of the initial optimization effort to identify a preferred refinery configuration for the refinery.

The refinery configurations primarily represented high conversion refineries maximizing diesel and gasoline production in line with the product goals. The configurations differed primarily in the bottom of the barrel processing option used in each configuration.

All of the configurations included the following process units：

- Atmospheric Distillation Unit
- Vacuum Distillation Unit
- Gas Plant
- Hydro-treating for (naphtha, and diesel fractions) or distillate Wild hydro-cracking for enhancing diesel cetane number and producing Jet-A1
- Catalytic Reforming units
- Isomerization Units (C_5 / C_6)
- Hydrogen Generation (via gas or Saturated LPG or possible naphtha)
- Sulfur Recovery Complex Unit

In addition to the process units, all of the configurations include the required utility systems required to support the facility (e.g. power supply, steam generation, cooling water system, BFW system, condensate recovery, compressed air /N_2 system etc.).

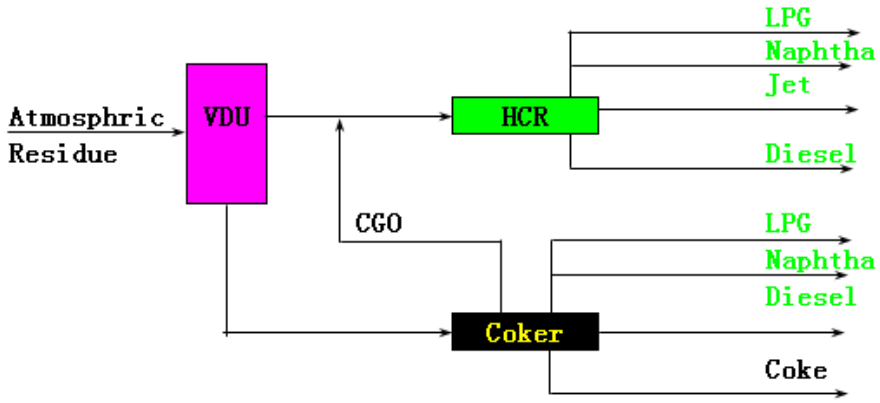
A summary of the options considered in the optimization effort as follows:

2.1 Case A –COKER + HCU

The Case A configuration includes the combination of a delayed coker and hydrocracker as the primary bottom of the barrel processing option. The Coker products are subsequently sent to downstream hydro-treaters. A hydro-cracker unit is capable of operating in full conversion modes and capable of operating in max diesel or max gasoline modes. The gas oil from the coker can be fed to the hydrocracker or used as a fuel oil component.

A simplified sketch for this case is shown in Figure 2.1.

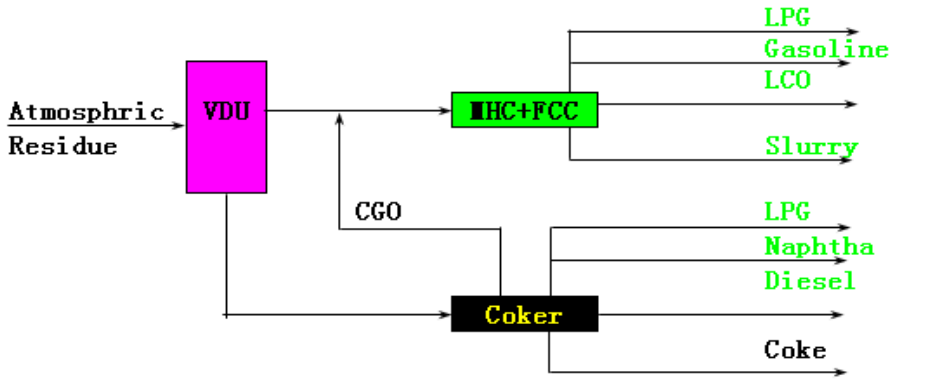
Figure 2.1 Case A Schematic (COKER + HCU)



2.2 Case B –COKER + MHC + FCC

The Case B configuration is a combination of a delayed coker and mild hydrocracker, followed by a FCC unit. The coker products are subsequently sent to downstream VGO MHC while the unconverted hydrocracker bottom is processed in the FCC and distillate MHC (wild hydro-cracking). A hydrocracker is capable of operating in mild conversion. The FCC is provided with the option of operating in a maximum gasoline mode or in a maximum LPG operating mode. FCC feed sulfur specified to eliminate the need for a wet gas scrubber unit and FCC naphtha hydro-treating unit. (This specification was subsequently modified in the second phase of configuration optimization). A simplified sketch for this case is shown in Figure 2.2.

Figure 2.2 Case B Schematic (COKER + MHC/ FCC)

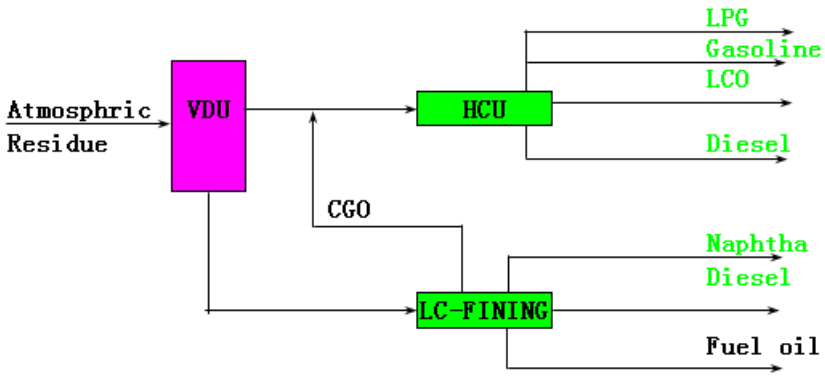


2.3 Case C –LC-FINING + HCU

The Case C configuration includes the combination of vacuum residue hydro-cracking (LC –fining) and VGO hydrocracker as the primary bottom of the barrel processing

option. LC –fining unit, instead of delayed coker, avoids solid coke product with low value and directly produces fuel oil. A hydrocracker is capable of operating in full conversion modes and capable of operating in max. diesel or max. gasoline operating modes. A simplified sketch for this case is shown in Figure 2.3.

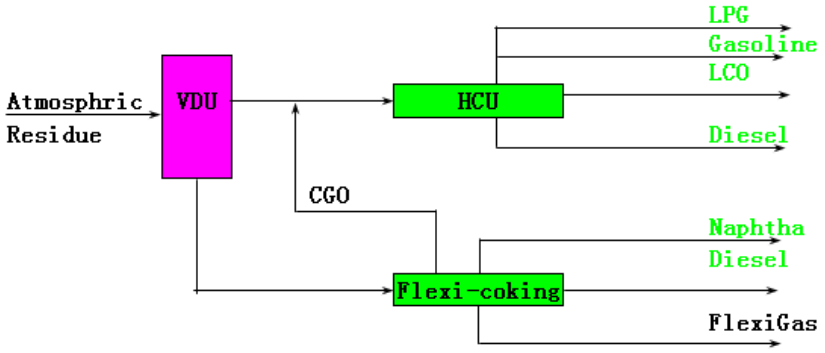
Figure 2.3 Case C Schematic (LC-FINING + HCU)



2.4 Case D –Flexi-coking + HCU

The Case D configuration includes the combination of flexi-coking and VGO hydrocracker as the primary option for bottom of the barrel processing option. Flexi-coking unit, with low heat value gas instead of a delayed coker, can avoid solid coke product with low value and sale difficulty. A hydrocracker is capable of operating in full conversion modes and is capable of operating in max. diesel or max. gasoline operating modes. A simplified sketch for this case is shown in Figure 2.4.

Figure 2.4 Case D Schematic (Flexi-coking + HCU)



2.5 Other Possible Configuration Cases

In processing technology, both HCU and FCC can process VGO feed. But HCU and FCC have different target products. Normally, HCU process will produce more

middle distillates, such as Jet and diesel with high quality. FCC process will produce more LPG and gasoline, and FCC feed with higher sulfur content must be pre-treated to reduce SOx and NOx emission. According to the market report, high quality Jet and diesel fuels are needed in Costa Rica, so HQCEC arranges LC-fining +HCU and flexi-coking +HCU. No LC-fining+MHC/FCC or flexi-coking +MHC/FCC is introduced in detail within this report because of higher gasoline production.