

Abstract
Process Economics Program Report 228
REFINERY RESIDUE UPGRADING
(February 2000)

Refinery residue is the hydrocarbon oil remaining after distillates have been removed from petroleum. Residue upgrading processes are increasingly important in the modern refinery because of the continuing decline in the demand for fuel oil, their main use. At the same time, demand for motor fuels is increasing and is forecast to continue to do so the next two decades. These volume trends, when coupled with the increasing demand for clean, low-sulfur fuels, ensure the need for additional and better residue upgrading processes will also continue. To upgrade refinery residues, metals, sulfur, carbon residue, and nitrogen need to be removed and the high boiling components converted to lower boiling products.

Coking, resid fluid catalytic cracking (RFCC), and hydrocracking are the dominant residue conversion processes. Gasification and solvent extraction are also important processes and are reviewed. Combinations of processes are increasingly attractive for large volume applications.

This report emphasizes developments in the production of motor fuel intermediates and blend components via delayed coking, hydrocracking, and resid fluid catalytic cracking. Because of the complexity of the combinations, this report determines the economics for each process individually. For a U.S. Gulf coast location with midyear 1998 construction, total fixed cost increases in the order: delayed coking < RFCC < resid hydrocracking. Plant profitability is a strong function of product values. Return on investment (ROI) for each of the three processes ranges from less than 10%/yr to 24%/yr based on midyear 1998 product and feedstock values (crude oil around \$14/b). ROIs improve to the 30-38%/yr for each process when based on November 1999 values (crude oil about \$25/b).

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