



GLOBAL CIRCULATION OF PLASTICS ECONOMY

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PROJECT OBJECTIVES

- Design a system that separates the pyoil into 4 “cuts”: py gas, naphtha, gas oil, and pitch. Each is defined by their end boiling point (EBP).
- Optimize design to minimize both capital and operating expenses.
- Protect the environment as well as the health and safety of the community.

BACKGROUND

Plastic waste is a global crisis that needs responsible engineers to solve. Global Petrochemical requested a pyoil purification unit design, which takes pyoil (molten plastic) and separates out 4 different streams that will be used as fuel and feed for an ethylene plant . The project is centered around the island of Bali in Indonesia where infrastructure is not in place to properly handle the island’s annual plastic waste.

PROCESS DESIGN

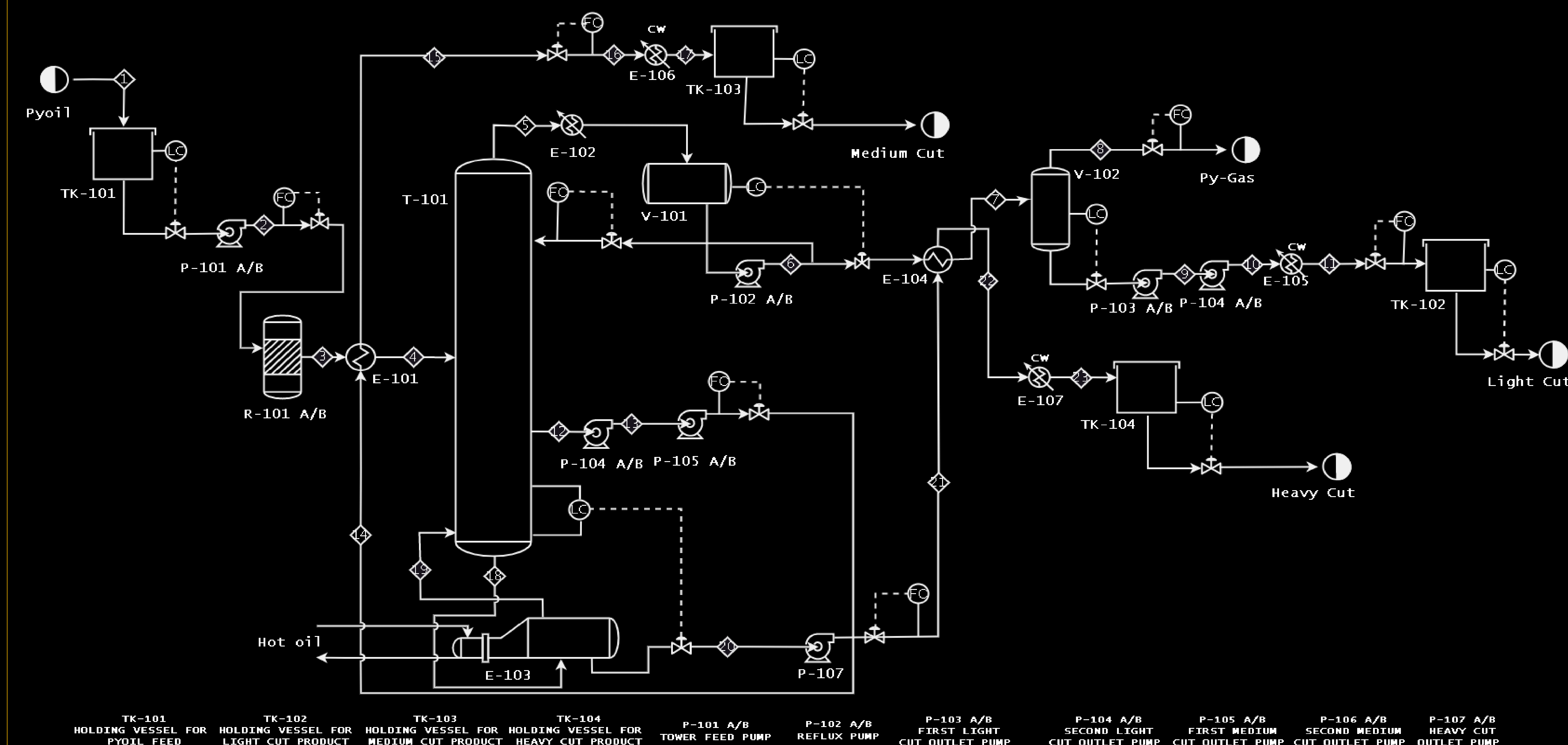
- The centerpiece of this design is single distillation tower with 28 stages, a total condenser, and a partial kettle reboiler.
- A flash vessel separates py gas and naphtha products from column distillate.
- A genetic algorithm was used to find operational conditions that improved separation while minimizing cost via interfacing software.
- BASF® adsorbent beds used in parallel to remove chloride and metal contaminants.
- Hot liquid product streams are used to heat cold feed streams to improve energy efficiency.

ECONOMICS

- The fixed capital investment (FCI_L) is the total cost to purchase and install all equipment, including taxes and fees.
- The yearly operating cost (YOC) is the sum of utility costs (cooling water, fuel oil, electricity) and operating labor.
- The equivalent annual operating cost (EAOC) amortizes the capital investment of the plant with the annual cost of operating the facility over 10 years with an interest rate of 10%.

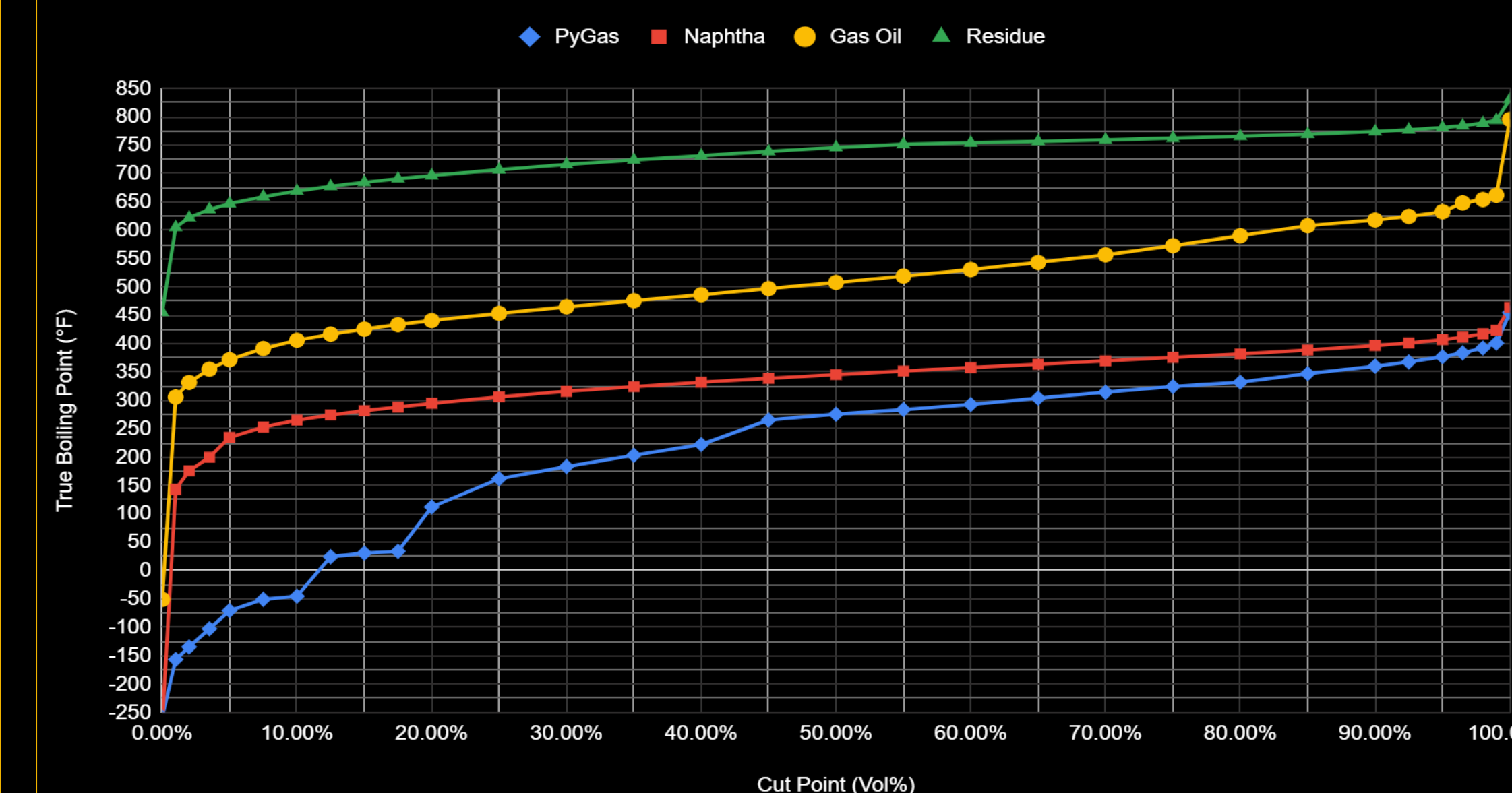
FCI _L	\$8,730,000
YOC	\$4,865,250/year
EAOC	\$6,227,000 /year

PROCESS FLOW DIAGRAM



PRODUCT SPECIFICATIONS

- Global Petrochemicals’ desired specifications for the naphtha and gas oil streams are their 95% ASTM D86 boiling points (T95): 392°F and 620°F, respectively
- This design achieved T95 temperatures of 389.5°F and 604.9°F



CONCLUSION

The design achieves a purity error of 0.6% for the naphtha and 2.44% for the gas oil. The rates of production are 13,239 lb/hr and 33,641 lb/hr, respectively. The emphasis of the process design is to minimize cost while reaching the product specification objectives.

SUSTAINABILITY

Our design uses regenerable adsorption beds that reduce waste, replaces a fired heater with heat integration, and is part of a process that greatly reduces pollution by reusing plastic waste as both a fuel and material.



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