CHE 477 – Project 1 Economic Optimization

You should work this project in the same team of one or two as your CHE 478 project 2. Enroll all group members in the Brightspace group *before* submitting the report.

Economic Optimization of Unit 700: Production of Ethylene Oxide

Management of ACME Chemicals would like to move forward with expansion of our existing ethylene facility to add ethylene oxide production capability. A feed stream (1) of 333.2 kmol/hr of ethylene is available to the process. Your role is to optimize the production of ethylene oxide by maximizing the NPV objective function.

For this analysis, you should begin with calculating the base case economics for the process described in Appendix B. The raw material, product and utility costs are given in chapter 8. Use capital cost estimation methods from chapter 7. You may use the CapCost Excel macro program.

The primary optimization for your analysis to focus on is the separation of stream 7 in T702. You should vary number of trays, feed tray location, reflux ratio and utility usage to achieve the lowest NPV case for producing the same purity of products as the base case. Aspen modeling should be used (sensitivity analysis is helpful).

The utilities available include low pressure steam at 5 barg, 160°C; medium pressure steam at 10 barg, 184°C, and high pressure steam at 41 barg, 254°C. Evaluation of the proposed design in relation to heuristics may lead to further recommendations for improvement. (Note you will also be performing heat integration on these streams in project 2 and may use those results to suggest improvements to this base case.)

An internal interest rate of 10%, tax rate of 30%, construction period of 1 year, project life of 10 years, and depreciation by 5-year MACRS should be used for economics. Assume no land is being purchased and salvage value is negligible. Costs should be reported based on CEPCI value from the year 2022.

Global Issues Awareness (ABET): The proposed facility is intended for construction in Dongjiakou Port Industrial Zone Park, Qingdao City, Shandong Province, People's Republic of China. Please investigate the basic issues that make this location different than building in the Gulf Coast region of the U.S., such as transportation, raw material supplies, energy, environmental, labor and other issues. Also, report on the legal system, ability to establish contracts, labor and environmental laws and other social issues. Internet sources of information are fine, but give references. Please conduct your economic calculations in US dollars using the textbook values, but comment on which costs would be different in this location.

Safety Concerns: Include a basic summary of the particular safety concerns inherent in this process and recommendations for mitigating risk.

Results should be presented as a technical memo - approximately 3 pages of text, excluding Tables, Figures and Calculations, which should be presented as properly labeled appendices. The report should include an overview of the problem, the methods you used to solve it, discussion of results, and conclusions/recommendations. A supplemental excel file and Aspen simulation should be included in addition to your uploaded report (Word) file on Brightspace.

Table 1. Summary of Performance Metrics for Project 3

Subject Area	**Category Weight**
Analysis of Capital Costs	15%
Analysis of Operating Costs	15%
Analysis of Profitability Criteria	10%
Analysis of Tower Optimization	15%
Other Optimizations / Heuristic Checks	10%
Safety Concerns	5%
Global Issues Awareness	5%
Written Presentation	15%
Figures and Tables Presentation	10%
Total Points	100

Peer evaluation will also be submitted. Results may impact individual member grades.