



CHE 551 Advanced Topics In Chemical Engineering

Energy Optimization Using Pinch Analysis

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Grade Distribution!

- o Semester Project 30%
- o Homework 20%
- o Midterm 20%
- o Final Exam 30%



References

- 1- Linnhoff, B., et al., “**User Guide on Process Integration for the Efficient Use of Energy**,” IchemE, Rugby, U.K., 1994.
- 2-Smith, R., **Chemical Process Design**, McGraw-Hill, New York, 1995.
- 3- Shenoy, U. V., **Heat Exchanger Network Synthesis**, Gulf Publishing Company, Houston, 1995.



Pinch Analysis

INTRODUCTION



WHAT IS PINCH ANALYSIS?

- Pinch technology is a recently established technique based on thermodynamic principles and offers a systematic approach to optimum energy integration in a process.

MAIN ADVANTAGE OF PINCH ANALYSIS !

- The ability to set an *energy target* for the design.

Energy target: is the minimum theoretical energy demand for the entire process.

OBJECTIVE OF PINCH ANALYSIS



- The principal objective of the process is to match cold and hot process streams with a network of exchangers so that the demands for externally supplied utilities are reduced to a minimum.

MAXIMIZE THE HEAT RECOVERY IN THE PROCESS



- Pinch technology establishes a temperature (the pinch) that separates the overall operating temperature region observed in the process into two temperature regions.
- Once a pinch temperature has been established, **heat from external sources must be supplied to the process at temperatures above the pinch** and **removed from the system by cooling media at temperatures below the pinch.**



HEAT EXCHANGER NETWORK DESIGN FOR THE PROCESS

- Established based on the *pinch analysis* principles. This procedure is designated as the *Pinch Design Method*.
- The best design for an energy efficient heat exchanger will generally result in a **trade-off** between the energy recovered and the capital costs involved in this energy recovery.