CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This retrofit study delivered the following results. For the design case, the optimum minimum approach temperature was 10°C, where as for the actual case it was 12.736°C for incremental area efficiency. The area efficiency, α, of the existing network were 0.436 and 0.381 for design case and actual case, respectively. It indicated that the existing design used the area inefficiently. Hence there were some scopes of process improvement. As the constant α targeting gives a conservative approach, the incremental α of unity was used to set the target of the retrofit. The scope of energy savings were 23.516 and 11.612 MW for design and actual case respectively. Analyses of the existing design in actual case showed that there were five process to process exchangers that transferred heat from above to below the pinch. Also, there were some violations of pinch analysis, like the hot utility exchangers supplying heat below the pinch point, and process modifications were needed.

The retrofit design was undertaken using the network pinch method. The net work pinch, with limits of energy recovery, can be overcome by topology changes that shift heat from below to above the network pinch. The minimum approach temperature for the network was set by targeting, using the area efficiency concept. A set of modifications was carried out to increase the energy recovery of the process. For a practical retrofit design the number of modification was limited. The generated design options were optimized to trade off capital cost with energy savings. For actual case, all four designs had payback period of less than a half year and had good scope for savings. The final design, which was chosen for the retrofit, was design option D that had the most savings and appropriate payback period.

In design option D four new heat exchangers were added, and two hot utility exchangers using HP and MP, HEX 18 and HEX 36, were removed as their duty tends to be zero. (In practice, they were not removed but would be used for heat exchangers of the new matches). HEX 2 transferred a large amount of heat across the pinch in the existing network. By repiping it, it was effectively moved to above the pinch. All the modifications carried out in the diagnosis stage reduced heat transferred across the pinch.

The suggested retrofit design provided energy savings of 16.846 MW, about 15.6% of all utility in the HEN. The utility cost savings is $1,995,866, about 19.74% decrease in the utility bill. This required an investment of $ 678,126 with a payback period of just about 4 months.

The study showed that there was scope for improvement in HEN of an existing aromatics plant in reformer area and the new network was designed using the network pinch method. It was found that targeting for maximum energy savings at each modification tends to give good trade-off between area and energy. In this case study the cost was dominated by utility costs.

5.2 Recommendations and Suggestions for Further Work

The study suggests modification for the retrofit design of the HEN. These modifications can be further investigated for impact on the operational, control and safety constraints. The results would be used as a preliminary design for further detailed energy study of the process.

The piping cost should be further estimated to obtain a good approximation of the total cost required to implement the modification. Also the pressure drop consideration should be further studied to investigate the impact on the pumping requirement of the process. Column integration and process integration with the column should be done for more energy recovery in the process.