CHAPTER I
INTRODUCTION

It is predicted that the world's energy will be exhausted within a century. In this situation, the countries that have energy resources are trying to reserve their own resources for using them in the energy crisis. This leads to decrease in the production of oil and natural gas, which results in the increase of petroleum price everyday. Petroleum is a major source of energy in our life. The new industry countries (NICs), for example Thailand, have very large energy consumption. The energy sources for these countries are imported from foreign country to match with the domestic consumption. All of the NICs suffer from the high price of petroleum. To resolve the problem, the energy consumption has to be reduced. In Thailand, the government has issued many energy conservation plans for reducing the energy consumption. With the latest plan, the energy consumption is being cut down in factories and buildings, and promoting the use of renewable energy (PTIT Focus, 2001). The industrial sector, which consumes a large amount of energy, is looking for the way to use the energy efficiently.

Energy management is an important element for industry to find a way to use energy efficiently. Energy auditing and pinch analysis are used in energy management to help identify energy-efficient process designs while minimizing operating and capital expenditure. Energy auditing is a study of the net energy consumption of each chemical plants, this technique reviews actual operating or design energy usage and identifies where energy is loss from the process. The net energy consumed by the process unit is then compared to a guideline energy consumption figure for that kind of process unit. If the analysis shows excessive energy consumption, the losses can be investigated and possibly solved by simple housekeeping or low-cost process modifications. However, this method cannot generally identify the energy-saving opportunities that are made possible by design changes. This shortfall can be overcome by the pinch technology.

Pinch Technology is one of the energy optimization methods. It is also the most practical method for process integration. By analyzing the thermodynamics of a process, an engineer can qualify the thermodynamic efficiency of the process,

identify the regions where energy can be better utilized and define the targets for minimum energy consumption. Pinch technology is used mostly for the heat exchanger network synthesis (HENS). It can also be applied for distillation column design, mass exchanger network synthesis, batch scheduling, total utilities system design, etc. The process pinch point refers to the energy optimum point in the process design. The temperature level above this point acts as heat sink, and the one below acts as heat source. Based on rigorous thermodynamic principles, pinch technology matches cold streams that need to be heated with hot streams, which need to be cooled, causing high degree of energy recovery. Thus, pinch technology can be used to determine the minimum requirements for both hot and cold utilities in a process.

An achievement in pinch technology crucially comes from the advancement in computer software. One essential element is process simulation software, the output from which can be used to check sensor-based data such as flowrates, pressures, temperatures, and concentrations. This research work uses Aspen Engineering Suite for process simulation.

Aspen Technology Inc. was founded in 1981 to commercialize, technology developed by the Advanced System for Process Engineering (ASPEN) Project at the Massachusetts Institute of Technology. AspenTech Inc. went public in October 1994 and has acquired 19 industry-leading companies as part of its mission to offer a complete integrated, solution to the process industries (www.aspentech.com, 2003).

Aspen Pinch is a process synthesis and design tool for energy integration. Aspen Pinch is a uniquely powerful tool for designing minimum-cost processes for chemical plants and refineries. With Aspen Pinch, cost savings can be achieved by reducing energy and equipment requirements while still meeting process objectives. Aspen Pinch is used to retrofit existing plants as well as to develop new designs. Aspen Pinch can retrieve the results from an Aspen Plus simulation model for consistent handing of stream data, physical properties, and unit operation models (www.aspentech.com, 2003).

For retrofits, Aspen Pinch uses the targets to determine the energy savings or increased throughout (de-bottlenecks) possible for a given capital investment or

payback requirement. For new design, Aspen Pinch optimizes the energy and capital targets to determine minimum total cost designs.

This study was to apply pinch technology for retrofitting the heat exchanger network to obtain the best design at high degree of energy recovery. The study was separated into three parts. The first part is process modeling and simulation by Aspen Plus. The second part is the process heat integration. The final part is the heat exchanger networks retrofit. The design case of gas separation plant unit I (GSP I) of PTT Public Company Limited was chosen for this work.