CHAPTER I
INTRODUCTION

Energy depletion is one of the most-mentioned issues in the public media as well as in the academic world. However, the energy concept itself is sometimes quite confusing. One Joule of electricity and one Joule of internal energy of the seawater are equal, but not equivalent. Only with exergy concept, the valuable quality of energy can be evaluated fairly and reasonably. Exergy analysis as a useful tool is therefore broadly accepted and used in many areas, especially exergy consuming industies such as power generation and chemical engineering.

In an energy analysis, based on the First Law of Thermodynamics, all forms of energy are considered to be equivalent. This has the disadvantage that the quality of energy is not taken into account. An exergy analysis based on the First and Second Laws of Thermodynamics shows the thermodynamic imperfection of a process, including loss of energy quality. Since a petroleum refinery requires a considerably high consumption of energy in its operation, an exergy analysis will indicate the thermodynamic efficiency of each unit within the refinery and the entire refinery. The low exergetic efficiency units can be assessed to determine if improvement can be found.

The exergy analysis is a new technique in which the basis of thermodynamic evaluation is considered from the Second Law rather than the First Law. The Second Law (work is a kind of energy which can be completely converted to heat but there is no possible process which can convert the heat completely into work in such a way that the original state is recovered) illustrates that although no energy is lost, the quality of the energy is always decreased during an industrial process. Another name of exergy that has been used in the past is "Availability Analysis".

The older method assessing the energy disposition of chemical processing was energy transfer and energy transformation by the completion of energy balances or energy conservation which is based on the First Law of Thermodynamics. However, an energy analysis does not give information on the degradation of energy that occurs in the process nor quantify the usefulness of the heat content in the various streams leaving the process such as stack gas, cooling water, waste materials.

Some chemical and thermal processes such as irreversible heat transfer, throttling, and adiabatic combustion are not associated with energy loss, but they lead to a decrease of the energy quality, reduce its ability to be transformed into other kinds of energy and therefore increase the operational cost or the capital cost of the process.

The exergy method is a universal measure of the work potential of different forms of energy in relation to a given environment. An exergy balance applied to a process or a whole plant tells how much the useful work potential, or exergy supplied as the input to the system under consideration has been consumed by the process.

The loss of exergy or irreversibility is a decrease of usefulness of energy, which provides a quantitative measure of process inefficiency. Analysis of a multi-component plant indicates the total plant exergy loss distribution among the plant components, pinpointing those contributing most to overall plant inefficiency.

The Cumulative Exergy Consumption(CExC) analysis is essentially an accounting procedure in which the cumulative exergies associated with all input streams to a process section are distributed to the useful products. This implies that the exergy associated with a waste product discharged to the environment is zero, since such a stream is of no value.

The Cumulative Exergy Consumption(CExC) analysis provides a method of assessing different production methods for similar products. The specfic CExC (Sp. CExC or "c") of the process is a measurement factor in the economics and profitability of one process relative to another. Cumulative exergy values assigned to the product(s) of a process express the sum of the exergy of natural resources consumed in all steps of the process.

The purpose of this study was to identify the cumulative exergy consumption of Plant no. 2 of Bangchak Petroleum Public Co., Ltd. In this work, nine processing units with one energy unit were investigated in order to improvement of the plant efficiency based on the cumulative exergy consumption analysis. The cumulative exergy consumption analysis provides the insights of the total exergy consumption utilized to produce all products under consideration.