



CHAPTER I

INTRODUCTION

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 aim of this study was to utilize an exergy analysis to evaluate the exergetic efficiency of plant 2 which is one of the complexes in the Bangchak refinery located in Bangkok and individual units in the complex. The low exergetic efficiency units would be assessed in detail of which the exergetic efficiency of equipment was to be determined in order for providing some approaches in the plant improvement.