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FATEH SAKINAH ABU BAKAR BACHELOR OF MECHANICAL ENGINEERING (THERMAL-FLUIDS) WITH HONOURS 2015 UTeM

EVALUATION OF ENERGY CONSUMPTIONS IN CHICKEN SLAUGHTERING INDUSTRY USING CLEANER PRODUCTION APPROACH

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Final Report
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SUPERVISOR DECLARATION

'I hereby that I read this dissertation and found its content and form to meet acceptable presentation standards of scholarly work for the award of Bachelor of Mechanical Engineering (Thermal-Fluids) with honors'

Signature : ……

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Date : 30 June 2015

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DECLARATION

I hereby, declare that the work in this thesis entitled
"Evaluation of Energy Consumptions in Chicken Slaughtering Industry using Cleaner Production Approach"
is the result of my own research except as cited in the reference.

Signature : ……

Author name : Fateh Sakinah Binti Abu Bakar

Date : 30 June 2015

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DEDICATION

For my beloved parents, siblings and friends.

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ABSTRACT

Cleaner Production (CP) is the one of important tools as an alternative of investigating the operation process that lead to high consumption of energy or reduces the efficiency of the machine used. In Malaysia, CP approach is still a new methods for implemented by the industry especially for chicken slaughtering industry and this approach can improve the operation production of the factory without harmful to the environment. Most of the factory having problem in high consumption of energy that lead to the high utility cost. In order to solving these issue, this research is carry out to measure energy consumptions on chicken slaughtering industry and evaluate CP options to reduce energy consumptions. In this research, the methodology used to achieve the objectives are direct observation on chicken slaughtering factory, survey using CP Implementation Tools (CPIT) software, details audit and cascade method by pinch analysis. From these methods, it is observed that the factory is using a high consumption of energy per month and found that causes of these matter by the unit operation of compressor and boiler. Throughout the survey, it is found that the unit operation that highly consider by the factory according to the CPIT software are Feet Cutting Motor, Pump (by Fuel), Water Chiller Motor and Meat Maker Machine Motor. In conclusion, the comparison between electricity bill and cascade method found that the energy loss is about 6.33 % and all of these unit operation give the most consideration CP options as match the pump size to the application and use more efficient pumping systems (displacement pumps rather than pressure pumps).

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ABSTRAK

Pengeluaran Bersih (CP) adalah salah satu alat yang penting sebagai alternatif menyiasat proses operasi yang membawa kepada penggunaan yang tinggi tenaga atau mengurangkan kecekapan mesin yang digunakan. Di Malaysia, pendekatan CP ini masih menjadi kaedah baru untuk dilaksanakan oleh industri terutamanya untuk industry sembelihan ayam dan pendekatan ini boleh meningkatkan pengeluaran operasi kilang tanpa membahayakan alam sekitar. Kebanyakan kilang yang mempunyai masalah dalam penggunaan tenaga yang tinggi yang membawa kepada kos utiliti yang tinggi. Dalam usaha untuk menyelesaikan isu ini, kajian ini adalah dijalankan untuk mengukur konsumsi tenaga kepada industri sembelihan ayam dan menilai pilihan CP yang dapat mengurangkan konsumsi tenaga. Dalam kajian ini, kaedah yang digunakan untuk mencapai objektif adalah pemerhatian langsung ke atas kilang penyembelihan, penyiasatan kajian menggunakan Pelaksanaan CP Tools (CPIT) perisian, audit butiran dan kaedah lata oleh analisis pinch. Dari kaedah ini, didapati bahawa kilang itu menggunakan penggunaan tenaga yang tinggi setiap bulan dan ia menyebabkan perkara ini dengan operasi unit pemampat dan dandang adalah konsumsi yang utama. Sepanjang penyiasatan kajian, didapati bahawa unit operasi yang optimum oleh kilang mengikut perisian CPIT adalah Motor Kaki Keratan, Pump (Bahan Api), Motor Air Chiller dan Motor Daging Maker Mesin. Kesimpulannya, perbandingan di antara bil elektrik dan kaedah lata mendapati bahawa kehilangan tenaga adalah kira-kira 6.33% dan kesemua unit operasi memberikan pilihan sebagai sepadan dengan saiz pam dengan permohonan itu dan menggunakan sistem pengepaman yang lebih cekap (sesaran pam agak daripada pam tekanan).

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LIST OF SYMBOLS

%	=	Percentage
°C	=	Degree Celsius
°F	=	Degree Fahrenheit
a.m.	=	Unit of Time
H	=	Power
hr	=	Hour
K	=	Kelvin
kW	=	Unit of Heat Flow
m^3	=	Meter per Cubic
mc_p	=	Heat Transfer
T1	=	Ambient Temperature
T2	=	Sources Temperature

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LIST OF ABBREVIATIONS

CP	=	Cleaner Production
CPIT	=	Cleaner Production Implementation Tools
DOE	=	Department of Environment
LBR	=	Life Bird Resources
No.	=	Number
PSM	=	Degree Final Year Project
UTM	=	Universiti Teknologi Malaysia

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CHAPTER 1

INTRODUCTION

1.0 RESEARCH OVERVIEW

This chapter briefly explains the introduction of this research regarding the evaluation of energy consumption in chicken slaughtering industry using the cleaner production approach. This chapter also highlights the problem statement, objectives and the scopes of this research.

1.1 BACKGROUND RESEARCH

In this research, the type of food industry is chicken slaughtering industry. In this area, the priorities are the cleanliness and the maintaining the quality based on temperature in the workspace. Therefore, a lot of water is used throughout this overall process with considering the cleanliness of the workspace. Meanwhile, consumption of energy is one of the consideration in order to maintaining the cleanliness and the uses of machines such as air conditioning and cold room for storage the products. Therefore, this area is critical part in order to maintaining the quality of the output product.

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1.2 PROBLEM STATEMENT

Nowadays, the uses of energy as important sources are become interesting in industries especially in food industry. In addition, the industries are the backbone of development and economic improvement with increasing the pressure on the natural resource and lead to the environment problems in unresolvable levels (Karadağ & Korkut 2012). Moreover, these natural sources can be a waste if the sources cannot be consume in optimum ways. In order to dealing these natural resource, most of the process conducted are using a lot of big machine to operate it and causes problem of increase in consumption of energy. Related to this matter, some of problem statement occurs in this research. The problem statements for this research are:

1. High consumptions of energy in industry led to high utility cost in the production process. Example of In'Joy Marketing (M) Sdn Bhd (Malaysia, 2011) and Taiyo Yuden (Sarawak) Sdn Bhd (Malaysia, 2011a).
2. Difficulties to achieve compliance according to Environmental Quality (Industrial Effluent) Regulation 2009. Example of one of factory carry out illegal activity such as burning tires at night and no notification to Department of Environment for installation of fuel burning equipment (Hasim, 2014).

1.3 RESEARCH OBJECTIVES

In order to overcome the problem stated earlier, the objectives of this research are:

a) To measure energy consumptions on chicken slaughtering industry.
b) To evaluate cleaner production options to reduce energy consumptions.

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1.4 RESEARCH SCOPES

In order to achieve the objectives stated earlier, the scopes of this research are generally involved the following:

a) To identify machines occur during the production process leading to energy consumptions.
b) To measure the amount of energy consumption of each unit production from the machine used per month.
c) To investigate the root causes contribute to high energy consumptions.
d) To evaluate cleaner production options to reduce energy using cleaner production approach.

1.5 THESIS OUTLINE

This thesis consists of six chapters, where each of the chapter will represents an important build general construction of this thesis.

Chapter one represents an overview about this thesis including the problem statement, objectives and the scopes.

Chapter two represents a literature review of cleaner production and related to chicken slaughtering, the thesis selected industry (chicken slaughtering industry) and energy analysis using energy pinch analysis.

Chapter three represents about the selected methodology used throughout this thesis. The methodology includes the direct observation at industry, survey, measurement used in collecting data at industry, using energy pinch analysis and uses software such as CPIT software, Hint software and Microsoft Excel Pinch Analysis Spreadsheet data input.

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Chapter four represents the results from direct observation throughout the overall process at the industry, the survey with their scoring, details audit data and temperature profile picture.

Chapter five represents the analysis and discussion related to the survey results and also energy pinch analysis using two software such as Hint software and Microsoft Excel Pinch Analysis Spreadsheet data input.

Chapter six represents the a few recommendations for further research related to this thesis results and the conclusion of this thesis where the objectives are achieve or nearly achieve.

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CHAPTER 2

LITERATURE REVIEW

2.0 RESEARCH OVERVIEW

This chapter elucidates the review of literatures regarding this research. In the first section, it explains the overall concept of Cleaner Production (CP) and the review of CP implementation related to the optimization of water and energy consumption. Next, this chapter focuses the review of CP implementation in food industry and represents several case studies for references in this research.

2.1 CLEANER PRODUCTION (CP)

Cleaner production (CP) approach is an alternative of productions process to clean up the unnecessary process that causes high in production cost and less efficiency of the machine used. Basically, some of the industries that involved in CP approach are pharmaceutical industry, food industry, inorganic technologies and metallurgy, and production of lubricants and industrial oils (Sokolovic et al. 2012).

CP can be defined as the continuous application of integrated preventive environmental strategy applied to processes, products, and services to increase

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overall efficiency and reduce risks to human and the environment (Noor et al. 2009). Another terminology of CP is generally understood to mean cleaner technology (CT).

General meaning of CP can be the one of the options that prevents from too many emitted of pollutant to the environment or on how to get the optimum production with less emitted of pollution. According to Xu and Chen (2013), they considered the CP to be an important meaning of how effective to control the pollution as the win-win situation can be the leading of improving economic and give the benefits to the environment.

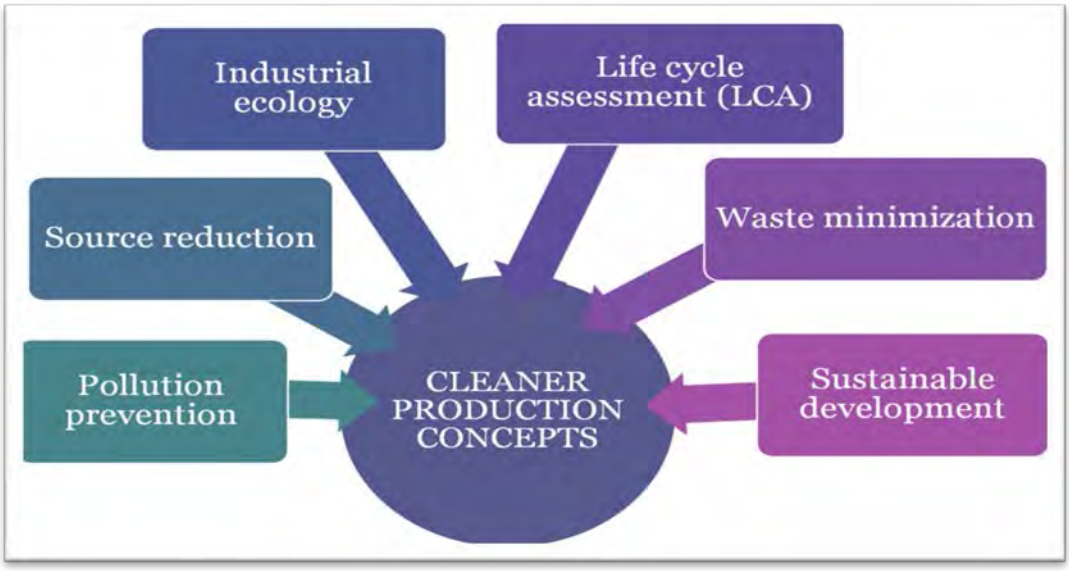

Figure 2.1: CP Concepts (Noor et al. 2009).

As for Sokolovic et al. (2012), they stated that CP is the based on the concept of maximum resource and energy productivity and virtually no waste. The concept of CP as shown in Figure 2.1. In addition result from Jafari (2010), CP is the conservation of raw materials and energy where it ensures the elimination of toxic materials and the reduction of quantity and toxicity of all emissions and wastes from the product materials. Other researcher defines the CP as the inclusion of environmental sensibility to all processes from designing to planning, an approach to

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