

# CHAPTER I

## INTRODUCTION

### 1.1 Background

Electricity growth of a country is twice the economic growth. With economic growth, people's purchasing power has also increased. Increased purchasing power is characterized by the increasing number of non-linear load owned by Industry. On the other hand, with the growing development of the use of electronic technology in power systems will increase the harmonics in power system. This non-linear load will be affected in power quality, because this non-linear load is the main source of harmonic interference. A high level of harmonics in an electric power system is undesirable because it can cause power losses [1]. Harmonic is a very important thing to learn because if it is not immediately addressed, the negative effects will be even greater and have a negative impact on the performance of electrical equipment [1].

The causes of harmonic interference in industrial sector due to the large number of power electronics equipment used, especially equipment that using switching devices like rectifier, inverter and DC to DC converter [7]. The harmonics load were Computer and tools, Variabel Frequency Drive (VFD) to control industrial motors, thyritor controlled reactors, fluoesent lamp, electric arc furnaces, induction furnaces, welding machines, where there loads change over time quickly, as well as equipment based on switching processes.

The electricity system that will be taken as a case study is the 6.3 kV distribution system at PT Semen Padang. This factory is an industry with a specialization in the business of cement production, where in many production machines use non-linear loads that produce harmonics. If the harmonics that occur in a system exceeds the allowable limit will cause several problems, including heating on neutral wire and transformers, malfunction of protection system, damage to bank capacitors, irregularities in the appointment of measuring devices and causing losses in the transmission and distribution system. Because the harmonic current can affect the power system so, it is necessary to study the impact of

harmonics produced by variabel frequency drive to power quality and losses at coal mill area substation 448 indarung 5.

## **1.2 Problem Statement**

The formulation of the problems contained in the research to be carried out are as follows:

1. What are the harmonic sources in the industrial factory area
2. How to calculate and analyze the effect of harmonics on power losses and power factor

## **1.3 Scope of the research**

In order not to deviate from the subject matter that has been determined, this research will limit the problem as follows:

1. Harmonic data is taken from the measurement results of harmonic in the Coal Mill area substation 448 Indarung 5.
2. To compare between measurement result of THD and data calculation.
3. Harmonics analysis will be referes to the IEEE standard 519-2014.
4. To determine the impact of harmonic on power factor and power losses of transformers.

## **1.4 The objectives of the research**

1. To measure the harmonics voltage and current in the coal mill area substation 448 Indarung 5.
2. To Analyze effect of harmonics on power losses and power factor in the coal mill area substation 448 Indarung 5.

## **1.5 The benefit of the research**

1. As reference for PT. Semen Padang in determining the effect of harmonics on power factors and losses.

## **1.6 Systematics research**

To make it easier to understand the writing of this research, the authors write a systematic research final report writing as follows

### **CHAPTER I : Introduction**

This chapter contains background, problem statement, scope of the research, objectives of the research, the benefits of the research and systematics research.

### **CHAPTER II : Literature Review**

This chapter contains of previous studies with clear objectives (journals, proceedings, scientific articles), theories related to the discussion and explanation of provisional statements or by answering problems that are proven in research.

### **CHAPTER III : Research Methods**

Explain in detail what equipment and materials are needed, explain the stages of research in the form of a flowchart, overview of the analysis system to be examined.

### **CHAPTER IV : Results and Analysis**

Explain the technical data collection, testing, calculation and analysis so that research can be clearly directed.

### **CHAPTER V : Conclution and Recommandation**

Contains conclusions and suggestions related to research.

**References**

**Appendixes**