CHAPTER 1

INTRODUCTION

1.1 Introduction

The Electrical Substation is provided to many purpose, however the main function of substation is to receives electrical power from generating station via incoming transmission line and delivers electrical power via the outgoing transmission lines. In recent year, the electrical power demand has significantly increased year by year. The growth of the Thai economic and investment from the oversea multi-national company were the main reasons of this change.

There are many companies supply and delivery complete substation in Thailand. In this thesis, I have selected one company named XYZ company which is the multi-national company. This company do business as the substation contractor and supply own products as well.

1.2 Outline Company

The XYZ group is an electrotechnical company with global operations. The XYZ group develops, produces, sells and services systems and products in a wide range of areas generally related to the production, distribution and application of electrical energy. Worldwide business activities are grouped into Business Segments and further broken down into Business Areas. Each carries responsibility for global strategies, business plans, allocation of manufacturing responsibilities and product development.

The XYZ group is a world leader in electrical engineering. It is a synonym for high quality technology in its areas of competence ranging from the sales and service of a comprehensive offering of electrical power products, to project management, to the design and manufacturing of complete automation systems and solutions. The XYZ group serves a wide range of customers involved in the generation, transmission and distribution of power, as well as industrial equipment and transportation.

In Thailand, XYZ Limited is headquartered in Bangpoo Industrial Estate, Samutprakarn. It operates several engineering, manufacturing, sales and service centers.

The XYZ company is a leader in many of its business sectors, including the construction of transmission systems for electrical power, the manufacture of transformers and electrical drives

for both domestic and export markets, the engineering and supply of process control equipment for pulp and paper and other industrial plants.

The XYZ company is a major supplier to the mining industry, providing hoists, underground transport and other high-technology equipment. It is an expert in the specialized field of High-Voltage Direct Current transmission. The XYZ company is also at the forefront of environmental technologies, focusing much of its efforts on the design and development of new air and energy technologies, furnishing products and systems for environmental protection, the reduction of energy consumption and the maximization of industrial process efficiency.

1.2.1 XYZ Substation Business

The XYZ Company Substation Business in Thailand is part of the engineering center substation network of the XYZ group with know-how transfer and support from oversea the XYZ Company Substation

The XYZ Company Substation Business handles all types and aspects of transmission and distribution investments from the generator terminals to the industries, urban areas as well as rural areas in the voltage range 0.4-800 kV. for approximately 25 years. This has given a comprehensive experience and knowledge in project handling, engineering and site activities including legal aspects and business culture from all parts of the world.

The XYZ Company Substation Business deals with the whole range of undertaking from a pure supply of equipment up to complete Turnkey projects. The normal minimum undertaking is however an "engineered package" i.e. at least a number of different product which requires some technical co-ordination and engineering to constitute a functional package.

1.2.2 The Organization Chart

The organization structure for XYZ Company Substation Business is a functional structure as shown in figure 1.1. The responsibility for each functional department are as below;

Business Control is responsible for cost control, cost development of all variations to the contract, invoicing to customer and matters related to insurance, bonds, Letters of Credit, exchange rates, taxes, duties, and etc.

Sales & Marketing is responsible for tender work and market planing by separating into market segment as Electricity Authority of Thailand (EGAT) and Independent Power Producer (IPP) segment, Metropolitan Authority of Thailand (MEA) and Province Authority of Thailand (PEA) segment, and Industry segment. This also separate the product sales to be the individual segment by responsible for all customer.

Project Management is responsible for managing and executing of the project according to contract specifications and schedules and also for obtaining the best possible financial result.

Engineering is responsible for carrying the total technical of the project according to contract specification. This includes to prepare required drawings and technical specifications for customer's approval.

Erection & Site Management is responsible for establishing a detailed program for the construction, civil, installation and site work. This includes to organize working area and storage area, prepare resources required for the construction such as personnel, cranes, tools, site offices and other facilities.

Commissioning & Service is responsible for performing equipment and system functions testing after completion of the erection and construction work.

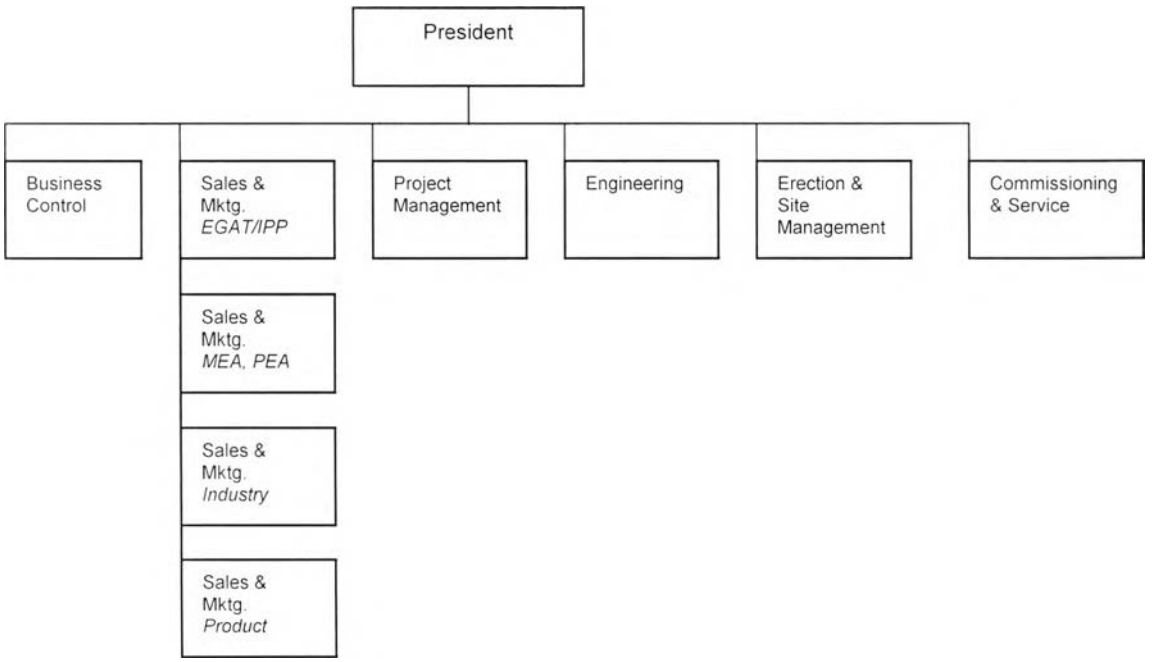

Figure 1.1 XYZ Organization Chart

XYZ Company Substation uses the matrix project organization to implement the project. Authority is divided between the project and the line organization. The line is responsible for how the work is to be carried out and who is to do it. The project organization is responsible for what is to be done and when it is to be done.

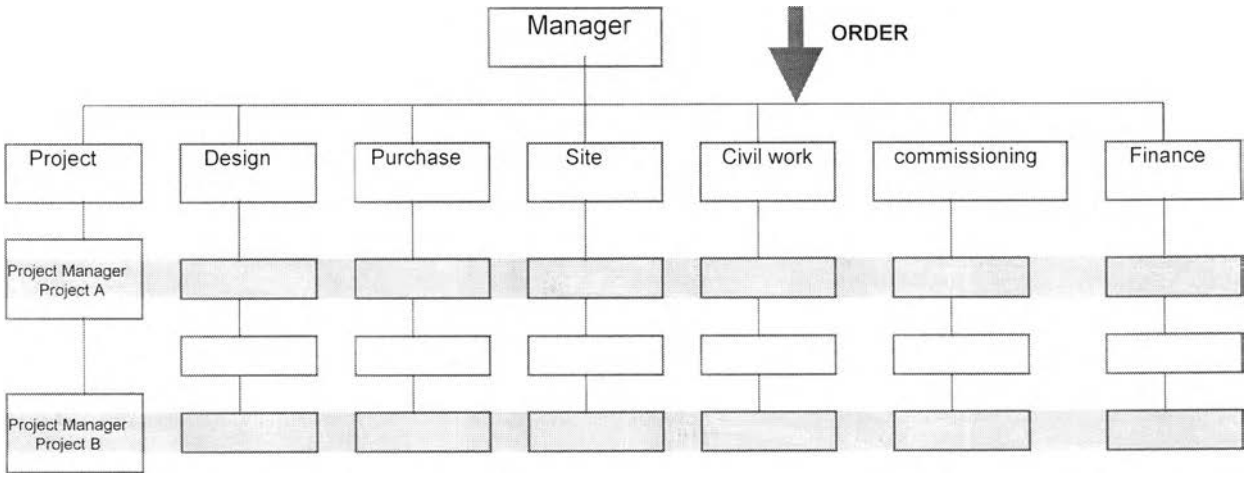

Figure 1.2 XYZ Matrix Organization

1.3 Problem Area

The design function within Engineering Division, XYZ Company Substation Business is the problem area which we selected.

The electrical substation design work comprises of two main functions as Switchyard Layout design and Control and Relay Protection design. These functions must use a lot of information to generate their work. The scope of design work includes both in tender stage and after receive order stage. We must break down equipment and support technical data to sales in order to offer our bidding price to customer. And we must establish necessary documents such as drawings and technical specifications for purchase, manufacture and construction after receive order. The design functions also interface to other internal functions (project engineer, sales, civil engineer and etc.) and external functions (customers, suppliers, contractor and etc.)

The design function must have the design criterion such as design procedure, technical data, calculation method, standard document form in order to reduce the problem from estimation errors, wrong specification, design errors, calculation errors, and so on. These results directly impact to the performance of project both in cost and delivery time.

Nowadays, there is no flowchart of the design work in this area. This includes no standard on documentation such as drawing form, calculation form, check list form and so on. The criterion design is different in each other and each project.

For this research, My intention is to study and implement the quality assurance to design procedures cover all function within Engineering Division and also compare the results of design work after implement quality assurance.

The crucial problem often occur are as follows;

(1) Delay of design work

There are many kind of design work issuing from Engineering Division. The example of these are calculation, drawing, BOM (Bill of material), cable wiring table and etc. These document may be submitted to customer both internal and external customer (the internal customer are Civil, Commissioning, Project, Site and etc. and external customer are customer, sub-contractor, suppliers, consultant and etc.) The delay of installation drawing and cable wiring table directly effect to site staff for equipment installation and cable laying, the delay of BOM can be extent the delivery time of equipment used in substation. And also the delay of drawing submit for customer approval may be caused the delay of project schedule. The previous examples are some parts of the impact of the delay of design work. The deep detail of these problem are discussed in the next chapter.

(2) Design Error

The error of design work may be a serious problem and impact to other parties depending on what kind of error type. This includes to the additional cost of project in order to solve such error, for example the error of cable sizing calculation can be effected to the voltage drop, overheat, and loss of power. If the test report does not accepted from the customer or consultant, we may change the new cable and pay more for new cable and cable laying.

(3) Customer dissatisfaction

The customer dissatisfaction are both directly and indirectly impact to our company. The direct affect to our company are discredit to our project result. And if there are some additional

work or the new stage, we may loose the chance to get such work. There are many part of design work make customer dissatisfaction. The following design work are as below;

-The layout of equipment in substation

-The reliability of system (This may be caused in the future)

(4) Design Change during design stage

The design change often occurs in almost project. The result of design change affect directly to the design work and involve to the whole project. For example, the design change may cause project schedule delay, additional cost, addition work. The level of design change effect is dependent on how much and when the design has changed.

The way to describe how the design change affect to the design project may be classified by concerning the progress of design work has done. For example, if the design change occur during the beginning of the concept design, this meant that the process of ordering equipment has not begun yet, the result of this change is not serious. Nevertheless, if the design change occur when the concept design has already finished and approved by customer, and also the equipment has already ordered, This may cause seriously to the design and project work. Because the main equipment used in substation normally take a long time to finalize the concept design prior begin the manufacturing process start for ex. GIS, MV switchgear, Relay and Control panel.

1.4 Objective of Study

To develop a design quality plan for transmission and distribution substation in Engineering Division.

1.5 Scope of Study

1. This study will be covered the design activities within the Engineering Division of XYZ Company Substation Business . These include some activities which interfacing to other departments such as project, commissioning, civil and sale department.

2. This study will establish quality assurance for design control which will be covered on the followings basic parts

    1. General
    2. Design and development planning

3. Organization and technical interfaces
4. Design input
5. Design output
6. Design review
7. Design verification
8. Design validation
9. Design changes
10. Design document control

1.6 Thesis Procedure

The procedure of study quality assurance for design function of electrical substation are as follows;

1. Literature survey.
2. Study standard design procedures of quality assurance.
3. Survey and collect data of the current design procedures in our company.
4. Design and establish the documentation in design activities.
5. Implementation and comparison of quality assurance
6. Analyze and summarize the result of the study.
7. Prepare thesis report.

1.7 Expected Benefits

The benefits of study quality assurance for design function of electrical substation are as follows;

1. This study provides standard and document control on design work of electrical substation design.
2. This study provides monitoring and verifying on design work.
3. This study will be an element of ISO 9001 requirements.
4. This study will reduce errors and lead time of design work