

A SCADA System Application in Load Management

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Abstract: The aim of this research is to study the operation and management cost reduction of the telecom industry through the supervisor control and data acquisition (SCADA) system application during globalization, privatization and liberalization competition. Yet this management system can be proposed functions: prevent faults, operating monitors, the analysis on load characteristics and to drop the cost of management.

Results indicated that the SCADA system has been highly willing to mobile and telecom industry in the development of power supply quality and to drop the operation and management cost. Also this research aims at measuring the benefit on SCADA system applications in telecom stations and to provide decision-makers and managers with useful operation and management strategies as reference.

I. Introduction

In Taiwan, the rapid growth of economy as well as the prosperity of industry and commerce, which result in the increase of power consumption year by year. Besides the construction of nuclear power station and power transmission and distribution was conflict with the doubts of their safety and environmental pollution from the general public. Therefore the projects for power development were hampered by these difficulties and the power supply of on-peak hours was gradually insufficient. Thus Taiwan Power Company (TPC) emphasize on the load management of those industries with large power consumption in this duration. There are therefore many papers and relevant reports related to load management of power energy ready for reference [1] [2] [3].

Recently, Taiwan government has been putting lots of effort on joining WTO and developing the operation center of Asia Pacific area. With these regards, how to open Taiwanese telecom market to be freely and internationally accessed by other communities is an important issue. However, the government owned companies deliberate our steps for performing on the international stage, since they have been criticized with low operating performance. Therefore, how to privatize the government owned telecom industry efficiently and efficiently is of major interest for the government and public. Taiwan telecom industry encounters the difficult of operation and management due to the dispersing of mobile stations and communication system. Therefore it is the important policy that how to draft an

effective management method and to drop the cost of management.

The purpose of this research is to apply SCADA system and a feasible load management options for the telecom industry to reduce the power cost from the view point of demand side management.

Now SCADA system applies in telecom stations and mobile stations in Taiwan, the characteristics of management and operation can be proposed such as monitor, control, load management and analysis [4].

II. A SCADA Management Framework Application in Telecom Industry

II.1 The Management Strategy of the SCADA System

In recent years telecom industry has experienced an unprecedented degree of change in management, process technology, customer expectations, supplier attitudes, competitive behavior and many more aspects. Indeed all the evidence suggests that change is now a permanent feature of business environment and that companies which can adapt to this new environment are likely to gain significant competitive advantage.

Thus, using the Porter (1980) generic strategies as a simple illustration, a firm operating an unfocused, differentiated strategy might also be capable of operating a focused differentiated strategy, but not for example an unfocused, least cost strategy [5]. Some transitions between strategies will be relatively easy, others will be more difficult. Abell (1979) suggests that strategy space can be represented as comprising a number of dimensions which might be market, product or technology groups. Within each dimension a number of levels will be open to the organization depending on its strategic competences [6].

Competitive advantage is commonly defined as a position attained by a business unit and perceived by its customers when it is compared with its competitors. They may be characterized as lower cost or differentiation [5]. Focus, which selects one or more segments of the company's advantage and tries to develop competitive advantages, such as A SCADA system.

A SCADA system management framework include: Terminal Processor (TP), Monitor and Controller (MAC), Sensors and Transducer, shown as figure 2.1.

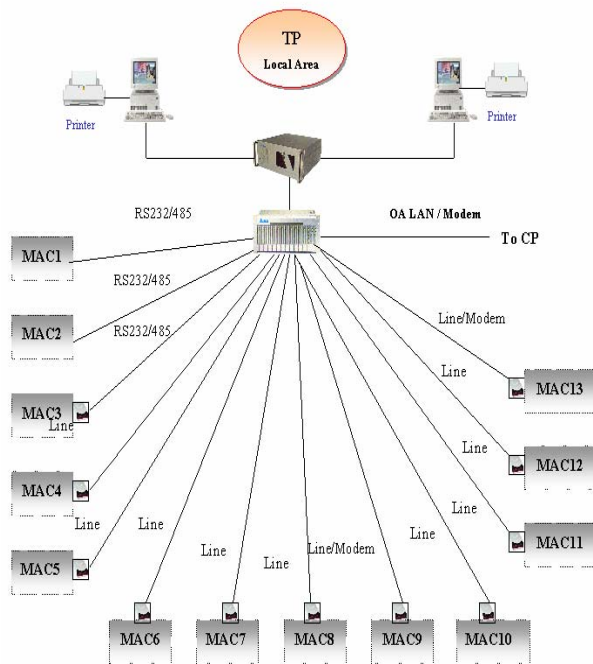


Figure 2.1 The TP Management Framework in SCADA System

II. 2 The Equipment of Monitor and Control in Telecom Station

Monitor And Controller (MAC) provides the interface of monitor and control in telecom station (see figure 2.2) [13] [14].

Alarm items include as follows:

- AC source -- AC current / AC voltage detect
- DC equipment -- DC equipment alarm / DC voltage output
- Air condition -- Air condition operating status and Temperature
- Control Entrance -- Control Entrance detect / Alarm detect

Control item include as follows:

- Air condition control -- Air condition operation / Fan / ON-OFF.
- DC equipment -- DC equipment alarm / DC voltage output.
- Load control and management
- Data collection and analysis

Data collection from SCADA system, the power consumption ratio of each process and power consumption of major equipment in the telecom industry can be analyzed to cope with load management procedure.

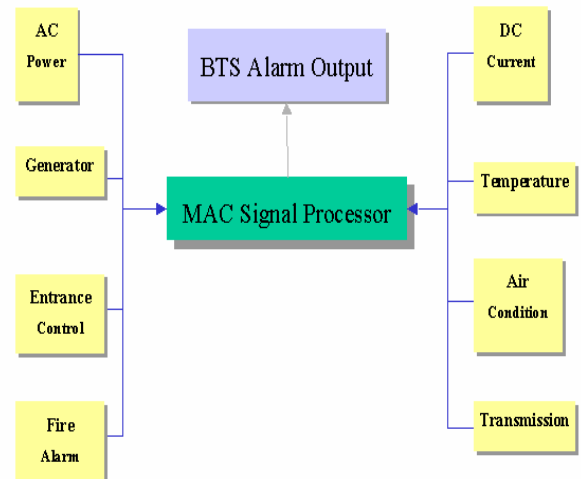


Figure 2.2 The MAC on Monitor and control equipment in SCADA System

III. The Load Characteristics and Rate Analysis

III. 1 Foreword

This chapter will study and analyze the rate policy of Taiwan Power Company. Afterwards the power consumption status of telecom station is observed through SCADA system gathering daily load curve characteristics. In the meantime the electricity rate of customer is served to evaluate its potentiality in the load management participation. This chapter will also discuss the customer's various load factors in order to sum up the power consumption characteristics of the telecom industry.

III. 2 The Load Characteristics Analysis

Generally the implementation of load management centers on price strategy. Assisted with the control of customer load and techniques in changing the power consumption ratio between on-peak and off-peak hours, the goal of price strategy can be achieved by applying various communication and control equipment. Yet the comprehensive and general rates in the price strategy such as demand charge, Time of use (TOU) rate are more complicated. Besides it can be applied to many customers and shall not be changed regularly and greatly. The power industries in the advanced countries adopt localization and selection policy. The target is set on those customers with large power consumption and high power cost. Along with price incentive, the results in the flexible use of power system & resource as well as load management can be attained. This is similar to the rate policy adopted by Taiwan Power Company.

The analysis on power consumption characteristics

Figure 3.1 depicts that the monthly power consumption of sampling customer. It indicates that on-peak power consumption is higher than off-peak power consumption.

For instance, on-peak power consumption in July is more than off-peak power consumption by 300,000 kilowatt-hour. The analysis of power consumption characteristics of sampling customer is as follows:

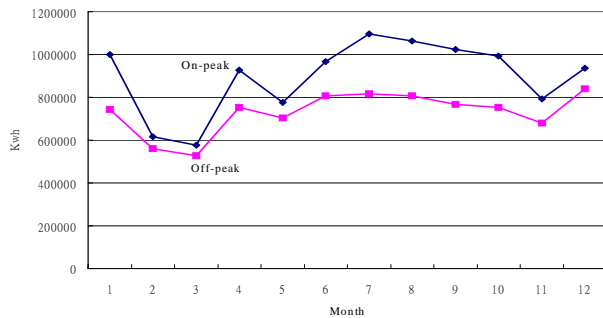


Figure 3.1 The Monthly Power Consumption Kilowatt-hour of On-peak and Off-peak Hours

The daily load curve of sampling customer is shown as figure 3.2, which indicates the power consumption in on-peak and off-peak hours is more than that in off-peak time. In this figure, the load factor in the scope of work day is within 70% ~ 85%, while that of non-work day is 80%.

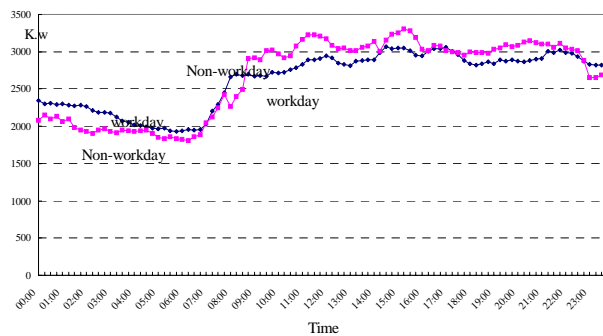


Figure 3.2 The Daily Load Curve

Figure 3.3 is the weekly demand factor of sampling customer. In this figure, the demand factor of work day is small and within 52% ~ 60%, while that of non-work day is about 57%.

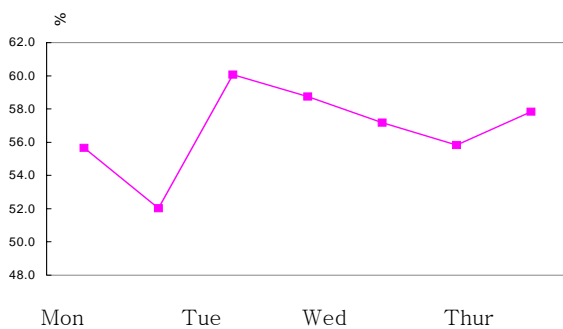


Figure 3.3 The weekly demand factor of customer

In figure 3.4, the demand factor of work day is small and within 52% ~ 60%, while that of non-work day is about 57%.

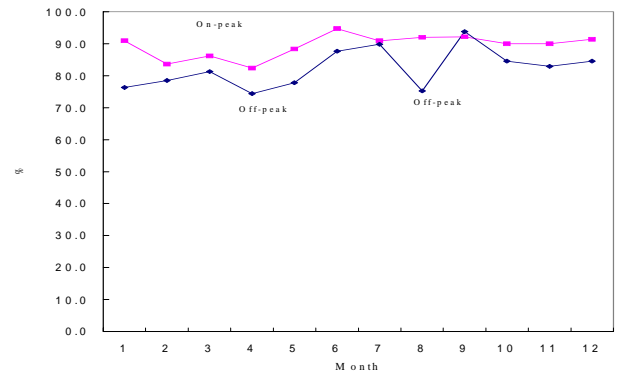


Figure 3.4 The Monthly Demand Factors in On-peak and Off-peak

IV. The Analysis of Load Management

IV.1 The Analysis of Interruptible Load

Taiwan Power Company is proactively engaged in the power development and implements the various load management measures such as the interruptible rate, TOU rate and seasonal rate in continuous effort with the hope that the reliability of system power supply and clipped peak load can be increased. Taking the interruptible rate for example, Taiwan Power Company started the implementation since 1987 and expanded as well as revised its contents year by year. Based on the power system, the six different scope of the interruptible rate is planned for different industrial customer's selection. Besides according to its interruptible capacity, Taiwan Power Company has its demand charge discount, if the customer inks the contract with Taiwan Power Company.

IV.2 The Load Demand Control Analysis

The control method of load consumption is another way to reduce electric cost. The load consumption in automatic control can prevent the customer from penalty of exceeding contract capacity. It means when the power consumption climbs up to the climax, this method can get rid of unimportant load or the interruptible electricity equipment [7] [8].

The rate, which Taiwan Power Company charges to the industrial customer, is the total power consumption in each months, i.e. how much is one kilowatt-hour? In addition, the added rate is defined as "how much is the power consumption climax in one month." The load control device of power consumption aims to prevent the occurrence of new climax with the hope of reducing the added rate.

Owing to the deviation factor, all electricity equipment doesn't operate at the same time. Besides the power consumption is in the status of dynamic variation due to the reasons of the boom-and-bust, season or production and sale plan. The customer has to carry out the control management of load consumption, if the purpose of the economical use on the electricity equipment is required. The monthly power consumption can be reviewed at any time to decrease the electricity cost.

IV. 3 The Analysis of the Optimal Demand Contract

With the rapid growth of air conditioner load, the peak loading of customer in summer daytime period increases dramatically and the condition of peak loading in 15-minute leading demand contract become more serious. According to the electric price system in TPC, customers are asked to pay extra cost with respect to the portion of basic fee in the case that the peak loading is higher than the demand contract. On the other hand the inappropriate higher demand contract setting can avoid the occurrence of previous stated problem but will results another problem of higher basic electric fee payment. The basic idea of optimal demand contract strategy is to derive a better demand contract such that the annual electric basic cost can be minimized.

V. Discussions and Conclusion

V. 1 Discussions

The Analysis of Implementation of TOU Rate (Strategy One)

During the plant visit, the customers expressed their interests in the daily load curve figure of the power consumption. In line with the power consumption and rate analytical figure of on-peak & off-peak hours provided by this research, the customer realizes that the TOU rate measures will save its electricity cost in very short time. Thus the customer participates in the load management options. Meanwhile, the telecom industry will consider how to change process to cope with various beneficial rate options provided by Taiwan Power Company.

Due to the characteristics of process and equipment running, the telecom industry can further implement the TOU rate options.

The Analysis of the willingness of participating the Interruptible Rate (Strategy Two)

The customer usually operates in the full load production. Yet under the recession impact, the actual peak load has already decreased to 75% of the original demand contract or it has been lower than that. It can be realized by introducing between the peak load and the demand contract of daily load curve. It is therefore suggested that the customer should review its actual load capacity to well coordinate with power consumption. The reduction of demand contract or participating the interruptible rate package can be the alternatives to drop down demand charge. Besides the customer can arrange the equipment of the original production equipment under the condition non-full loaded. Meantime the production procedure and time can be re-planned and arranged to avoid the concurrent operation of heavy load equipment which will result in the very high load demand can not be reduced.

Since the customer worries about damaging the semi-product; They will transfer the process to the night and thus increase the difficulties on management.

The Analysis on the Load Demand Control (Strategy Three)

The customer expressed willingness in the load demand control, but the installation of automatic load controller need extra operation cost which therefore reduce the participation willingness from the customer. From the long term viewpoint, this load management strategy will save electricity cost for the customer. After the explanation, the customer can accept the concept and will proceed to implement this alternative.

The Implementation of Optimal Demand Contract (Strategy Four)

In the plant visit, the optimal contract capacity is not well implemented for customer. As the customer roughly estimates the optimal demand contract based on the historical information and doesn't rigidly analysis by the mathematical method. Thus the expenditure of demand changed increase. After explanation and analysis, the customer willingly proceeds the implementation of optimal contract capacity.

V. 2 Suggestions

1. It is suggested that the telecom industry should review the ratio between current capacity and demand contract in order to decrease the demand contract or participate in the interruptible rate package for the reduction of demand charge.
2. It is recommended that the customer should adopt the load demand control to automatically adjust load as long as the load consumption varies so that the peak load won't exceed the demand contract.
3. The final suggestion is that the future research shall focus on the analysis of power consumption characteristics for the various industries with large power consumption.

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