OPTIMIZATION OF CLIENT SIDE MANAGEMENT SYSTEM FOR INDUSTRIAL CLIENTS

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ABSTRACT
With the ever-rising service requirements from power consumers, simple electric load control systems are no longer enough for neither the consumer nor the grid operator. It is particularly important to establish an electricity service and management system on the spot. Based on the realization and optimization of industrial electricity clients' own DSM, this paper introduces the structure of client side management system, its help to clients to achieve wise consumption of electricity, monitoring and measurement of consumption demand and effective control of maximum demand and etc. This paper will help industrial clients to realize their own load monitoring, to adjust peak and valley electricity consumption, improve electricity efficiency.

INTRODUCTION
The traditional load control system played a positive role when there was a shortage of power supply for it relayed load-reduction orders from grid control centers to industrial clients. With this kind of systems, the panel on the load control terminal was the only way for industrial clients to know what's going on. Little information can be found on the panel. It is known to all that Demand Side Management needs both the efforts of the grid operator and the clients. Only when the clients have enough information about electricity consumption, can they make wise decisions of load and tariff control.

SYSTEM STRUCTURE AND WORKING MODE
The new industrial clients side management system introduced in this paper consists of a data server, a front PC, an analysis PC, the load management terminal and several control terminals. The front PC is connected with the load management terminal by RS232 and with the control terminals by RS485 (RS232 converted to RS485). All PC are linked with a network (Figure 1).

Hardware structure of the system
The new system includes the load management terminal, a management system (namely, a front PC, a data server and an analysis PC) and several control terminals. All terminals are connected with the front PC by direct cables. The load management terminal is linked by RS232 and the control terminals is linked by RS485 (RS232 converted to RS485). All PC are linked with a network (Figure 1).

Software structure
The system can call the load management terminal to obtain the customer information, real-time data, historical data by day and by month and policies such as power limitation and max demands. The program will obtain the data from the load management terminal and store at the data server for further inquiry and analyze (Figure 2).
**Working mode**
The front PC executes timed tasks to obtain data from the load management terminal and store them in the data server for inquiry purposes from the analysis PC. After the data are thoroughly analysed, the PC will apply specific arithmetic and come out with a wise load management proposal to be sent to control terminals for automatic execution.

**MAIN FUNCTION OF THE SYSTEM**

**Data sharing and analysis**
Industrial clients are really concerned about its load curve which determines the amount of money they will pay for electricity. For grid operators, it is a good news the peak load is reduced and the grid can have a break since more and more industrial clients pay close attention to their own load curves and rearrage their shifts. So it is of great importance that the load data be shared between the grid operator and industrial clients. At present, the following data can be shared with the clients:

1. Load and consumption curves within a single day of 1,440 minutes
2. Real-time and historical data inquiry
3. Various setting values such as the start time of peak period, different tariff, consumption amount by day and by month, pre-purchased consumption amount

The system will analyse the data and help the client to make decision about energy conservation.

**Economic power consumption**
Since all control terminals are linked with the front PC, it is possible to control the consumption of different workshops.

1. To formulate economic power consumption proposals according to the policies provided by grid company.
2. To set power consumption limitation for large-capacity equipment for energy conservation according to the regulations from the government.

**Power quality monitor**
The system can collect the data of voltage and harmonic, monitor and analyse the voltage qualification rate and monitor the equivalent value of all times of harmonic. It can also provide real-time and historical voltage, power factor and harmonic data inquiry.

**Maximum demand control and management**
Maximum demand control and management has the following functions:

1. Parameter setting by PC such as: PT ratio, CT ratio, Demand value, Alarm proportion, Trip proportion, Alarm delay time, Restoration proportion and time after trip
2. AC sampling of three-phase voltage, three-phase current, active power, reactive power, active consumption volume, reactive consumption volume, real-time demand and maximum demand by month.

(3) Local workshop demand control can be enabled or disabled. When it is enabled, according to the pre-set demand value, alarm proportion, trip proportion and delay time of 4-phase before trip, the system works automatically. When the real-time demand exceeds the alarm proportion, it will set the alarm. And the real-time demand exceeds the trip proportion, after the delay time, it will execute the phase 1 trip. If the demand is still over the trip proportion, it will execute the following phases of trip. If the real-time demand is below the trip proportion and over the alarm proportion, it sets the alarm. Only when the demand is below the restoration proportion (after trip) and after the delay time will it allow to close the circuit breaker.

(4) Remote control. With this system, the circuit breakers can be opened and closed remotely.

(5) The terminal stores the latest 10 record of remote trip, demand control trip and time stamp of blackout and restoration. All these can be called from the front PC.

(6) The terminal records the real-time demand very 15 minutes which can also be called from the front PC.

(7) The terminal has the record of active and reactive consumption volume by day and month, maximum demand by day and month with time stamp, active and reactive power by day and month and power factor. All can be called from the front PC.

**A REAL CASE**
This system has been installed at a local car components factory with fruitful results. The client knew little about its demand before the installation due to lack of monitoring means. After the installation, the factory’s daily load curve is available and optimized. Figure 3 to 6 show how to set the parameters and the information the client can obtain from this system.

![Figure 3: Interface to set the parameters](image)
CONCLUSION

The new industrial clients side management system was installed at a local car components factory. With this system, both the client and the grid operator can share the data about power and consumption. The client takes a more active role in improving power quality and reducing the cost of electricity. More and more industrial clients are encouraged to install this system by the grid operator in order to have a smooth load curve for the whole grid.

BIOGRAPHY

Graduated from Fuzhou University in South China majoring in Electric System Automation and Electricity Marketing in 2003. Have been working for Shanghai Municipal Electric Power Company for 5 years as industrial customer (connection voltage 10KV) manager, interested in demand side management and load control.