The Integration of Management and Control System in Guizhou Qingzhen Power Plant

With the economical developments and deepening of the economic reform, the electric power industry of China has been developing rapidly in the recent years. The power industry enterprises, now playing a very important role in the economic development, utilize computer-based technologies in every aspect to improve their management, efficiency and images. With a high level of automation, the power industry has advanced more in informationization than many other industries. These favorable conditions enabled the birth and growth of real-time information systems.

Based on several international-leading technologies, Beijing HollySys Co., Ltd has developed an automation platform to promote many professional products and provide different industries and customers with automation solutions in all aspects. In nowadays hotter competition, industrial enterprises have their unique production practices and needs to enhance their advantages and competences. Based on this situation, management experiences of many industrial enterprises and the advanced management and control theories, our company has been helping these enterprises by providing solution for them from the foundation control of productions to the enterprise-level management.This solution consisted of three parts: the management system (ERP), the control systems (DCS, FODCS and MACS) and the real-time information system. This solution has been successfully implemented in Guizhou Qingzhen Power Plant.

Overview of the Project:

Located at the side of Hongfeng Lake in Qingzhen City, the Guizhou Qingzhen Power Plant with an installed capacity of 658MW is one of the biggest thermal power plants in Guizhou Province and one of the best power plants in China. Qingzhen Power Plant has had four mechanical and electrical integration alterations in year 1996 to 1999 to implement the automation of control systems; its ERP system was implemented in April 1999 with a seamless link with the DCS control system to achieve a comprehensive management and control integration. The implemented control systems included the DCS (DAS + MCS + SCS +DEH) of 7# 200MW generator unit and the DCS (DAS + MCS + SCS +DEH) of 8# 200MW generator units. Consisted of 8 subsystems of real-time information management, equipment management, production data management, production plan management, safety monitoring management, operation management, raw material management and office automation, the ERP system was implemented by different phases and steps that were completely fulfilled in April 2000.

The completed implement of the management and control integration has brought significant benefits to the enterprise:

1. Based on the former production processing procedures, the integration system utilizes computers

to store, auto-process and provide statistical reports of information that was processed manual before.

2. Standardized operation procedures of the power plant to effectively improve productivities, lengthen the equipment life-time, increase utilization of equipments, lower redundancy material cost and reduce maintenance.

3. Flexible and convenient functions of searching and decision making for the management team to help them acquiring enterprise information in time to make the correct decision.

4. Strict management and control of the equipments and production that significantly reduce the maintenance cost of equipment and raw material.

5. Improvements of efficiency, for example, the Fuel department of the power plant used to have 5 staffs working on the huge amount of tabulations, calculations and statistics. Despite of their careful works, mistakes were unavoidable. Now, most of the statistical jobs are done by computer systems and the main responsibility of staff is making decisions according the data auto-analysis. The number of staff in this department has been reduced to 3, and the job quality is still under control.

6. Shorter time of decision making, for example, the processing procedure of non-leakage data used to include steps of summary of equipment faults, print, manual search and system input that consumes no less than one day. In other word, other related departments would only see the process results in the next day before they made any decisions. Now, the fault-removing subsystem sent all related data directly to the non-leakage subsystem, the process of which only took a few minutes.

7. Convenient monitoring and managing for the management team. The managers may use just one computer in their office to shift from different DCS systems to gather information of the operating status in the production fields, for example, the status of material purchase and storage may be acquired from the supply system with no meeting or phone calls.

Overall, through the integrations of enterprise human resource, finance and logistics management and the precise allocation of materials and resources, the openness of data is increased, the working time is reduced, the efficiency is improved and the competitiveness of the enterprise is enhanced. The real-time information system is the key of our solution for Qingzhen Power Plant management and control integration. As know to all, the power industry requires strict security and possesses high danger potential. It was a tough challenge for the newly developed real-time information system whether the production data can be transformed by accurately and in time and whether they can meet the requirements of practicability, safety and high efficiency of the power plant. It is proved that the real-time information system has never had any data errors or loss, and it has never hanged because of the large data flow. Its high reliability and stability is appreciated by our users.

Implement of the Project:

The ERP project of Guizhou Qingzhen Power Plant is the first power plant project of HollySys ERP business department, the original researching and developing team of the HS2000ERP power generation version. This version consisted of 28 modules (see table 1) that cover almost all the

management requirements of a power plant and accomplish all the managing operations in the system. To be compatible with the existing software and small programs of ht power plant, and for the convenience of reporting the plant data to the electricity bureau, some special data interfaces have been tailored in the system in order to merge the data and results generated by these programs into the whole management system.

Table1: List of Modules in the HS2000 ERP Power Generation Version

No.	Module Name
1	Production Plan
2	Big Fix-Up
3	Operation Management
4	Security Monitoring Management
5	DCS Net-Gate (fore-runner of RealMIS)
6	Electric Belt Scale
7	Bi-Ticket Management
8	Technics Monitoring
9	Transportation Management
10	Salary Accouniting
11	Finance Reports
12	Storage Management
13	Purchase Management
14	Fuel Management
15	Equipment Accounting Management
16	Equipment Fault-Removing Management
17	Equipment Reliability Management
18	Set-Value Protection and Alarm
19	Non-leakage Management
20	Human Recourse Management
21	Insurance Management
22	Environment Protection Management
23	Stimulation Diagram
24	Telephone Fee Inquiry
25	OA System
26	Filing Management
27	Management Inquiry
28	System Management

In the HS2000ERP software, Pharmacy Industry Version, there was a DCS real-time data acquiring

system but with simpler functions. Since Qingzhen Power Plant had higher requirements for the real-time data gathering, HollySys decided to develop a new universal and more practical product, the RealMIS real-time information system based on the DCS real-time information acquiring system. The developing team went to the field for an on-spot development. In the development process, by listening to the power plant end advices, our team continuously improved the product to make it more comprehensive, flexible and user-friendly. After the implement of this real-time information system in Qingzhen Power Plant, the communication between the control system and the management network was enabled with 4600points data uploads (2300 points for each generator unit); and so were the monitoring of production fields, the integrate index analysis of two generation units and the reports inquiry. All these functions solved many practical problems of the enterprise.

The real-time information system must take the credits for the success of the whole application of the project. The reason is that, comparing with other process industries, the power industry has no complicated production procedures and no involvements in sales management. Therefore, the original ERP management of production, supply and sales chain is not very practical with power industry. Hence, all modules in the HS2000 ERP Power Generation Version are basically independent from each other without a network to hold them as a whole. So even if the ERP system has a wide coverage, it still cannot emphasis the advantage of the managements it provides.

Meanwhile, automation systems have already been widely applied in the Power industry since the process automation got more mature. Enterprises need to improve their management to reduce production cost and increase efficiency. How can an enterprise thoroughly understand the management advantages of ERP system? The real-time information system is the answer to the question; it can send the data from bottom productions accurately and timely to the upper level of management network to make the data flow throughout the whole ERP system and connect the upper level management to the bottom automation control through this data flow. With the managements of human resource, finance and materials, real-time information system takes care of all the data of the major production procedures and business, which enables the ERP unified management on all resources of the enterprises to make the best utilization of limited resources.

Analysis of the Project Benefits:

1. Provides accurate and timely data as the assurances for the enterprise production management and decision making. For the power industry, the production must be continuous, stable, safe and efficient. Therefore all the control systems and real-time information systems shall meet the requirements besides being functional. Since there are 4600 points to acquire information from, the real-time information system may need to transform big data flows, so the develop team chose UDP packet for data transformation. This reduced the load of the network to avoid the hang. In practical applications, the real-information system has been proved to be reliable, safe and stable that in nearly a year it has never hanged because of big data flow.

2. Multiple methods have been adopted to assure the safety of data transformation: in database

operation, all modules must record system logs including the module names, operation content, logon codes, computer names; the data operation interfaces and inquiry interfaces of each module are separated to improve the security of almost all the data operations of modules by menu accessibility. All menu items on the main menu can be authorized according to different positions by the system administrator so that anyone without the authorization cannot use the related functional modules; the operating department may set the accessibilities for the inner data operations and inquiry functions, such as the signature functions for the plans of salary module, OA module, supply module; the operating department may also set the password for certain function, such as the data modification function of fuel module.

In the process of enterprise implements, the real-time data were required to have function of simultaneous up and down transforming. However, when the engineers went deeper into the real needs of the enterprise, they find that since the power industry requires high safety, so the up transforming data may provides foundations for timely decision making of the management team; But if the data are simultaneously transformed down, this can cause instruction errors or mistakes from multiple and confusing user ends. Therefore, to ensure the safe transformation of data, the real-time information enhanced the up-transforming functions, gave a deeper analysis of those data for more efficient, practical and accurate information and provided analysis diagrams for decision making according to the enterprise management requirements.

3. Fast and timely inquiries to give feedbacks according to the production status. For the major inquiries, the responding time is lesser than 10 seconds.