CASE STUDY : 24/7 Generation Control Center for Plant and Fleet Level Generation Management

INTRODUCTION

With an installed capacity of 1.9GW of power generation, the state owned generation utility generates power from a fleet of Thermal and Hydro Generating Stations spread across multiple geographical locations. In recent years, with major regulatory and policy changes from government and regulatory commission, the utility has seen a paradigm shift in the business and operational scenario of the company. Unbundling of Transmission, Distribution and Generation operations has resulted in transition from a centralized operational scenario to market based scenario. This change has provided more flexibility and opportunities to Generation Company. Company’s requirement was to implement a centralized management of the fleet of power plants with a real-time monitoring of its generation and to minimize the cost of operations with maximum revenues from various Tariff heads.

REQUIREMENT SUMMARY

The Utility required two tier solution for Generation management at the plant level as well as at the fleet level. For Plant level the key requirements were the following;

- Generation Monitoring – Real time acquisition of metering data from tariff meters, Real time monitoring of plant KPI’s like net generation and gross generation, with trends, reports and charts
- Merit Order Dispatch – Minimizing cost of generation, optimally distributing the entire load across multiple units by minimizing the incremental heat rate.
- Reporting Function - Detailed reporting of plant/unit operations, deviation of plant/unit schedules, plant load factor, and unscheduled interchange etc.

Following were the key requirements of Fleet Management at Generation Control Center –

- Economic Generation – Distributing the day head generation schedule across various plants after considering installed capacity, equipment constraints and outages, location of beneficiary etc.
- Integrated Plant Level Monitoring – Real Time Generation data from each plant to be made available at the Generation Control Center. The data includes generation capacity, cost of generation for each unit, residual capacity, outage & maintenance information, metering data from interface points.
- ABT Optimization and Revenue Reconciliation – Revenue calculations based on the tariff structure called Availability Based Tariff (ABT - Calculation of Capacity Charges, Energy Charges, UI Charges), Validations against Accounting details provided by Load Dispatch Centers.
- An Optimization engine to amalgamate information from different sources and to determine economic loading for power plants by minimizing cost of operation and maximizing total revenues for the utility.
- Generation Scheduling – Automation of the day to day operational business processes are done by plant managers and operators. Solution should assess and declare the generation capability by considering all existing constraints, accept the generation schedule with capacity allocation ratio from
Load Dispatch Center. Implementing the generation schedules ensuring minimal cost and UI losses, thus to maximize overall revenues. Any revisions in schedules due to contingencies had to be supported.

- Tariff Modeling – Capability to modify the tariff structure with a flexibility to add new tariff models when existing regulations get changed. The solution should be dynamic in nature such that the changes in regulations will not impact the overall solution design.

KALKITECH SOLUTION

Kalkitech implemented an intelligent decision support system called ELTRIX. Eltrix’s domain modules for Economic Generation and Generation Management were implemented both at Plant Level and Fleet Level to meet the customer requirements. The plant level solution required a minimal set of functionalities; whereas the implementation at Generation Control Center was more exhaustive. Kalkitech Sync 2000 was used as data concentrators at the plants to acquire data from Interface Energy Meters and Sync 5000 as the metering head end system. Sync 5000 supplied both instantaneous and load profile data to Eltrix over a web service interface supporting IEC-61968/IEC-61970 CIM based metering classes for information exchange. Eltrix comprised of three important components which were used for specific functions in this project.

1. Eltrix Engineering Editor
   i. To build the sub control area and production cost models for each plant
   ii. To configure the meter interfaces and information exchange
   iii. For validation and substitution rules for meter data
   iv. To comply to regulation corresponding to scheduling and tariff calculation as rules and rule sets
   v. For creation and configuration of Data Objects

2. Eltrix Runtime Server hosted with the domain modules Economic Generation and Generation Management. All Energy Accounting and Tariff Calculation were done by the rule engine which is part of the runtime server.

3. Eltrix Decision Portal at the power plant and at the corporate control center provided real-time information to the operators and executives on the existing generation at individual plants and its deviations from the scheduled generation. Eltrix portal had interfaces for end user to perform various business and operational functions; they had access to a set of dash boards, reports and trends. These interfaces provided a detailed overview of entire fleet of plants.
Eltrix deployment at the Generation Control Center, communicated to the plant level Eltrix for accessing the plant specific information and brought together the additional information from the Load Dispatch Center. High Availability architecture using Storage Area Network ensured no loss of information and significantly reduced the possibilities of down times. Diagram below shows an overall architecture of the solution at GCC level.
Figure 2-Overall system and network architecture for the solution
KEY FUNCTIONALITIES

- Automatic meter data collection from ABT energy meters installed at different locations of power station
- Monitoring actual generation versus schedule generation, asking rate for individual plants and units
- Dispatch monitoring
- ABT optimization to maximize unscheduled interchange (UI) revenue
- Raising invoices for total energy exported and UI
- Energy accounting
- Generation scheduling based on the information of maintenance, plant availability and fuel availability
- Security and authentication at various levels

Figure 3-High Availability Architecture for the Generation Control Center
Figure 4 - UI Charges Comparison
Tariff calculation – Energy charges, capacity charges realization based on availability, UI charges, reactive energy charges, and incentive calculation based on PLF, TSC. The formulas were built based on SERC guidelines

- Web based report generation
- Creation/Generation of management information reports
- Exporting report in user defined format like PDF, xls, etc
- Real time and Historical Trending of operational parameters from the respective plants
- Manual import of meter data through MS excel, xml, ASCII files
- Offline data configuration into the system
- Support for Common Information Models (IEC-61970/IEC61968/IEC62325)

Figure 5- Eltrix Web Portal Monitoring Unit wise Generation and Auxiliary Consumption Data