

## Case Study: Electrical Load Management System

<b>Provider Name:</b>	KALKI Communication Technologies (P) Ltd.
<b>Client Name:</b>	MNC Automation OEM
<b>Project Title:</b>	Load Management System and Electrical Distribution Management system for Petrochemical Complex

### The Problem/Requirement

The end customer, one of the largest petrochemical complex in the country, wanted to upgrade their old low end Load management system and electrical distribution management system as part of their expansion plans. The electrical system in the petrochemical complex consisted of a Captive power plant with 11X35 Mw gas turbines and 7X35Mw steam turbines which gets connected to a 12 busbar 33kV main receiving station which has connectivity to the 132kV grid. The distribution network within the complex consisted of 22 no:s of 6.6KV substations being fed from the main receiving stations via 33KV tie feeders.

The customer wanted High-End Load management function, which shall enable them to island each bus section, incase of a disturbance and to operate upto 12 simultaneous islands within the petrochemical complex from a normal operating philosophy of unified network. This involved design of complex network topology computation and required highly optimized implementation techniques to achieve the fast response in the tune of few milliseconds. The challenges involved understanding the old low-end system built on a legacy platform with little documentation and to upgrade to a totally new platform supplied by the OEM by keeping the field I/O intact.

Kalki EMS took up the challenge of system integration and designed the high end network topology computation, Multi level priority based Fast Load shedding and Generation control schemes distributed at 33 kV & 6.6kv levels .The electrical distribution management system is implemented to enable the operator to take control of all the distribution substation from a central control room.

### The Solution

The fast applications were programmed in IEC61131-3 tools by highly optimized basic function blocks developed by Kalki EMS team. These were implemented in high end PLCs with fast peer to peer communication channels .The Load management functions for the entire complex were distributed across 12 PLC nodes to overcome the processing limitation of the PLCs. The electrical distribution management system was implemented in 25 PLC nodes distributed across the petrochemical complex, which were connected to each other using industrial Ethernet.

Kalki Engineering Services group tasks involved engineering, FDS preparation, FAT approval, Erection and commissioning activities at site, SAT and hand-over.

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Following are the functionalities implemented for Electrical Load Management System: -

1. Fast Load shedding with backup provided, considering other disturbances.
2. Frequency/Voltage control in the islanded system.
3. Active and Reactive power control at grid exchange point.
4. Synchronization of Bus couplers and Incomers.
5. Breaker Control at 132 kV, 33 kV and 6.6 kV level
6. Integrated and Individual OLTC control.
7. Establishment of modbus and IEC60870-5-103 communication with multi vendor devices (meters and relays).

The OEM SCADA runs on UNIX platform. Communication between the SCADA and controllers located at various sections was through a proprietary protocol over optical fiber communication. The overall network was split into two networks considering the limitation of above-mentioned communication. And a gateway was used for the communication of these two networks.

### Tools Used:

- OEM SCADA. UNIX Operating System.
- IEC61131-3 programming tools.
- Communication diagnostics tools.
- Kalki MIS software.

### Remarks:

- The application software was designed, tested and implemented over a period of 1 year by a team of 5 engineers.
- The system was commissioned in multiple stages and was completed in Feb 2007.