



Integrated DCS for 2X700 MW Supercritical Thermal Power Plant at Rajpura Punjab.

Overview

Country or Region: India

Industry: Power

Customer Profile

L&T invested thru its subsidiary NABHA Power Limited (NPL) for setting up a Coal fired Supercritical Thermal Power plant of size 2X700 MW at Rajpura and is the owner of the plant. NPL awarded an EPC contract to L&T Power towards setting up the plant.

L&T Power is an Independent Company (IC) of Larsen & Toubro, with a mandate to provide end-to-end EPC solution to the thermal power sector based on latest technology.

L&T Power in turn awarded an order to C&A for **Control System package, which included DCS, Operator Training Simulator (OTS), Performance Analysis, Diagnostic and Optimization (PADO), Management Information System (MIS), Computerized Maintenance and Information management System (CMIMS).**

Being a power deficient country, the need of hour is, quick execution and commissioning of large size Power Plants to meet power demands and faster ROI.

Background:

Coal is expected to be the fuel of choice for the foreseeable future in India mainly because of its abundance and affordability. On the other hand, as carbon consciousness is becoming more prominent, technologies for achieving higher operating efficiencies and reducing emissions from coal-fired plants are becoming more critical. Today's supercritical units can achieve thermal efficiency of more than 45%, compared with a typical subcritical plant's 30-38%. Therefore, **Government policies and technology advancement is directing the market towards a Supercritical / Ultra-supercritical technology regime** and sub-critical plants will be existing as a part of old legacy only.

The Challenge:

Critical design of the DCS:

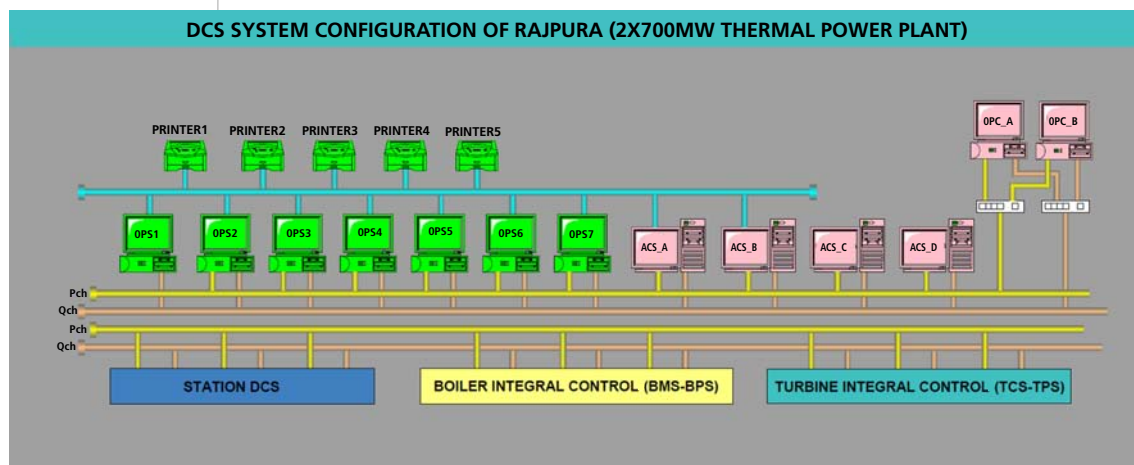
For supercritical plants, the **accuracy and response time of the DCS** is more critical than in subcritical units. A **well-designed control system that provides tight regulation and the ability to reach and**

maintain set points in shortest possible time span can help utilities to capitalize on the economic and environmental potential that these units offer. Further, to obtain higher efficiencies, these units generally operate in sliding pressure / modified sliding pressure modes wherein even a **slight disturbance in any of the critical parameters can lead to a high degree of instability of the plant.** Therefore, this mandates for a very fast response from the control system.

Tightly integrated system:

Another challenge arises during integration of the various control systems. Traditionally, the Boiler and Turbine OEMs provide their proprietary control systems for the Boiler and Turbine protection & Control and the same needs to be seamlessly integrated with the Station DCS system which is supplied by Station C&I contractor and who, in turn, is responsible for the overall control of the Power Plant including Boiler, Turbine and all associated BOP equipments.

Due to requirement of fast operation, it is better to have a **Centralised operation of all the three control systems (Boiler DCS, Turbine DCS and Station DCS) from the same Operator Station.** However, it is challenging to achieve such flexibility of control if these are





three different DCS and are integrated over non-time-critical methods of data exchange such as OPC, MODBUS etc. Moreover, it also requires additional hardware and software for interface.

Due to above, L&T Power decided to opt for **Uniform Control System for Boiler Integral Control (Burner Management System BMS and Boiler Protection System BPS), Turbine Integral Control (Turbine Control System TCS and Turbine Protection System TPS) and Station DCS**. With this philosophy in mind, the order was given to L&T C&A to provide a **tightly integrated DCS for the complete plant operation** and consequently integrated Factory Acceptance Test (FAT) with all these 3 systems interconnected on a single network was a part of the deliverable of the order.

Challenges envisaged by C&A to execute such an order were:

- Integration philosophy for the three control systems, namely, Station Control, Turbine Integratal Control and Boiler Integratal Control.
- Unification of different control philosophies, like Protection Interlocks, Tagging Philosophy, Graphic Screen philosophy, operating principles.
- Interaction with Multiple package owners for engineering

- Simulation testing of the entire control system during FAT, using a simulator
- Skill sets required for commissioning unified control system.

The Solution:

The solution was **designed to control more than 15000 I/O's as a part of the unified DCS**.

C&A was responsible for Engineering, Procurement, Simulation, Integrated Factory Testing, Site Works and Commissioning. C&A provided Diasys Netmation technology platform of MHI for this critical DCS.

The DCS included functions like Boiler furnace safety (especially during the start-up and low load operations like Runback). Similarly it included Turbine safety functions like Overspeed protection, Turbine Stress Evaluator. It also had the advanced process loops like Automatic Plant Startup, Unit Master Control, Main Steam Temperature & Pressure Controls, Feedwater Flow Control. The key here was to **intelligently design the Function Groups and choose the Controller partitioning accordingly**. The system communicates with 3rd party systems like CHP, AHP, Electrical Distribution Systems through OPC / MODBUS and IEC 61850 (for Relays).



About Us

L&T Control & Automation (C&A) is a Strategic Business Unit of L&T Electrical & Automation. It is a part of Larsen & Toubro – the multi-billion India-based conglomerate. L&T's C&A business is market leader in delivering integrated electrical & automation solutions in India and overseas. With over three decades of experience in diverse industry segments, C&A delivers value through comprehensive solutions based on varied technology platforms and incorporates the benefits of its wide-ranging experience. L&T's state-of-the-art Automation Campus at Navi Mumbai in India has the latest testing and manufacturing equipment. It incorporates a modular manufacturing unit, an application software laboratory and a fully networked office for engineering and project management.

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- AFC for Metro

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- Pipeline SCADA
- Emergency Shut Down System and Fire and Gas
- Terminal Automation

Power

- Integrated Controls for Boilers and Turbines
- Station C&I for Power Plants
- E&I for main plant & BOP Systems

As a part of the Station DCS package, C&A also provided MIS (Management Information System), PADO (Plant Analysis Diagnostics & Optimization), OTS (Operator Training Station) and CMIMS (Computerised Maintenance & Inventory Management System). **All these were integrated with the DCS for bi-directional data exchange and intelligent decision making.**

For testing the integration, checking the performance under simulated plant condition and tuning the system to achieve near optimum performance C&A designed the EMULATOR system which included generic simulator and modeling software to simulate various plant conditions. The system simulates real time conditions for coordinated boiler and turbine control, burner management, data acquisition, motor control, and balance-of-plant processes along with various integration interfaces.

A comprehensive testing and FAT using such a facility ensured testing/tuning of the system in line with the above. This would **reduce commissioning time to a large extent and thereby would help taking the plant to the stable maximum load conditions quickly.**

Salient Features:

- Master database created for integrated DCS system across different applications.
- The Stations Control, Turbine Control & Boiler Control were hooked up to same

real time network and thereby control of the entire plant was possible thru any operator station (subject to authorization level)

- Standardized Human Machine Interface was designed to maintain similar look and feel for ease of operation.

The Benefits:

Significant benefits achieved in providing a Uniform DCS system includes:

- Reduced Engineering time by around 35%. Unified database and Graphics / logic, such that operation is easy and need for operator / maintenance training on multiple systems is eliminated.
- Reduced inventory of Spare
- Minimal 3rd party communication networks due to single integrated DCS for three major applications. Reduction in probability of overall networking failures due to unified real time network.
- Reduction in commissioning time by around 50%.
- The emulator package offers a realistic opportunity to train and prepare plant staff to handle dynamic plant conditions.

Result:

Integrated DCS on a Uniform platform for a large Supercritical Plant provides an optimum solution for a seamless and reliable operation with high plant availability.