



Editorial Message

Dear Readers

Electricity accounts for about 40 per cent of global energy-related Green House gas emissions and these emissions are expected to grow to 58 per cent by 2030. The conventional power plants do not meet the environmental norms and efficiency demands of the future.

As a power-deficit country, India has the challenge to significantly increase its generation capacity as well as reduce carbon emission. The per capita consumption of electricity is a lead indicator of growth of the generation sector. Here, India is ranked 153th in the world; its per capita electricity consumption is 493kWh against world average of around 2800kWh. In the last fiscal, against the peak demand of 1,35,453 MW, the total power availability was 1,23,294 MW - a deficit of 12,000 MW. The country had to tackle an average deficit of 9.3 per cent and a peak demand/availability deficit of around 10.6 per cent. This indicates that there is a large potential for growth of this industry.

To meet this challenge of increasing demand, two-pronged action has been initiated in the generation sector - addition of generation capacity and enhancing the operational efficiency. At the same time being a signatory to the Kyoto Protocol, India has to reduce the generation-related impact on environment.

Coal is likely to continue as the preferred fuel for power generation due to its cost advantage and abundance. Having said this, there is an increased awareness and sensitivity towards environment protection globally and therefore, using the latest technology to ensure minimum emission is a mandate. Thus, Supercritical and Ultra Supercritical coal fired plants are going to be the future in Indian market. Supercritical steam conditions improve the turbine cycle heat rate significantly over subcritical steam conditions. A supercritical power plant can register higher levels of efficiency.

To cater to this growing industry with limited resource and fierce competition, the only option is to enhance operational efficiency across the value chain right from achieving speed to reducing fixed cost to increasing reliability and availability.

In this environment, power generation is one of C&A's top-priority segment. As we continue to be innovative, the cover story talks about transforming the way you procure C&I for station controls to achieve a better competitive positioning. I-BOP as a concept addresses the most pressing challenges of integration of C&I systems. The concept comprises 'integrated solution' to minimise your coordination with various low value C&I package vendors / OEMs, reduce manpower requirement for vendor engineering, reduced site coordination and supervision through single window approach and improve the overall speed of project implementation.

This year is an exciting one for C&A, as we have further expanded our DCS offering and built engineering capabilities in our Power Gen C&I. We offer integrated C&I solution for power generation including Station DCS, Boiler & Turbine integral controls, IBOP and C&I for TG & SG.

In the case study section we are featuring a project executed by C&A for 2X700 MW Supercritical plant for Nabha Power Ltd where we have delivered an Integrated DCS system involving Boiler, Turbine and Station Controls on a Uniform platform. This project demonstrates our technical competence, domain expertise, experience base and capabilities.

Happy Reading !



Sandeep Bhat



IBOP gaining popularity with customers



"Today I-BOP is the emerging trend in the market, where companies have started procuring complete C&I systems as a single package. This helps users as it minimizes multiple vendor evaluation, order placement, co-ordination and vendor engineering and thereby free-up resources for some other activities. It is convenient for end-to-end responsibility for site Co-ordination and management. Thus, on a overall basis it offers cost advantage to the owner.

The key success factor for an IBOP contract would be the choice of the vendor. The vendor has to be reliable and financially strong. The vendor has to be a specialist in C&I domain, offer best in engineering practices and high-end project & site management skills. Also, it is very important to properly define Change Management in the contract, since IBOP is finalised at a relatively early stage of execution and as engineering progresses, changes would be inevitable."

Srinivas Ramesh
Sr. Exec. VP - Reliance - Infra

The Indian power sector is going through a phase of growth, witnessing positive changes in terms of reforms and opportunities for the players across the value chain and emerged as the second largest market for Power (after China). All the major technology players and private owners targeting to grab the opportunity and thus keeping continuous pressure on the market price levels. Increasing input cost, is making the margin challenging for the EPC contractors and enhancing the capital cost further for Owners. The only solution seems to be improving the efficiency of execution and operation and having a lean structure to offer minimal fixed cost.

Power Plant's efficiency is dependent on quality of its equipment engineering & style of operations and maintenance. A modern, advanced, C&I system plays a major role in the profitable operation of a plant by achieving maximum availability, reliability, flexibility, maintainability and efficiency.

Earlier Power plant owners or Turnkey EPC contractors would procure individual C&I items separately from respective OEMs. The job of interface engineering and integration was undertaken by the customer / EPC itself. As time progressed, advancements in

Technology brought in more sophistication in features and communication capabilities of instruments for better fault analysis and uptime for the plant. With this sophistication, systems have become more high end and intelligent and thereby the need for integrating these intelligent systems have become very important. The amount of high-skilled design and engineering resource required for integration has become much more than ever before. Similarly, the ordering cycle for such items have gone up due to its complexity. So, the bandwidth requirement of the execution and procurement has gone high for a individual package based ordering scenario.

To face the dual challenges of reduction of fixed cost and need for higher skill set and bandwidth, more and more customers today are looking for specialist partners who can take up the job of providing a complete integrated package that can insure sustained availability of plant at higher performance level, instead of investing into talent and skill in doing it in-house, which in turn increases his fixed cost and thereby lowers competitiveness.

C&I being a critical but relatively low value package and integration intensive, customers find it easy to partner with a reliable party who can offer a packaged solution.

The component of C&I systems for a Power Plant is depicted in the figure below:

Depending upon the packaging philosophy customers adopt, some of the C&I packages get into the scope of the respective boiler / turbine package vendors. Otherwise they are either in the scope of the owner or the EPC Contractor. The trend of clubbing all the C&I items which are left in the scope of the Customer / EPC contractor into one single package gave rise to the concept of IBOP.

Making an IBOP package and ordering it to a C&I specialist party offers the following advantages:

- Lesser Co-Ordination required with various low value C&I package vendors/OEMs
- Lesser manpower requirement for vendor engineering
- Ease in follow-up due to single window approach
- Convenient site Co-Ordination
- Sharing of responsibilities between customer & I-BOP contractor
- Availability of technical expertise from one C&I specialist contractor, rather than multiple OEMs
- Advantage of project management skills, site execution and risk management capability

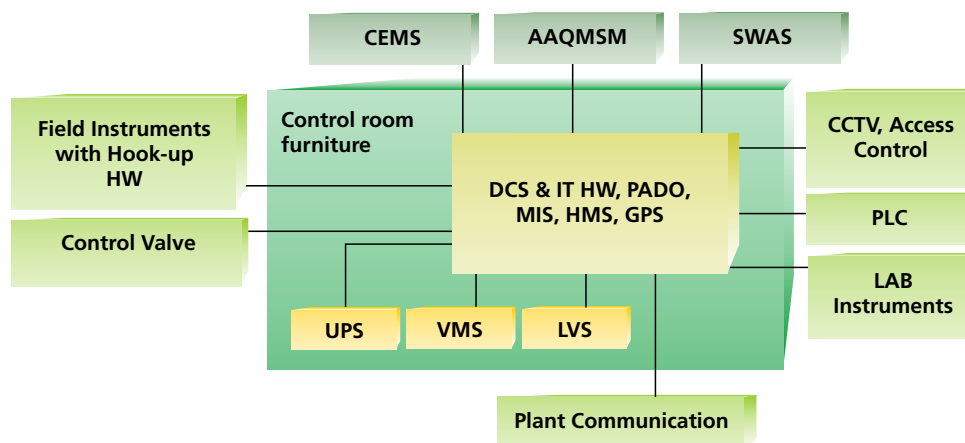
Conclusion

IBOP concept is a timely solution to the customers towards:

- Fixed cost reduction by adopting a skeleton execution structure
- Getting seamless integration and interface engineering done by a single specialist party

For the C&I systems providers also, this concept helps to scale up and thereby provide the cost benefit due to economy of scale to the customers and provide a single window interface for smooth project execution.

Thus, in today's market IBOP concept offers a win-win solution for both the customers and the system providers.





C&I Solutions for Power Generation

C&A provides comprehensive C&I Solutions for power generation including Station DCS, Boiler & Turbine integral controls, I-BOP and C&I for TG & SG

Station DCS

- Scalable Controls for Thermal Power Plants of 20 MW - 1000 MW unit size.
- Functionalities include Operator, Engineering, History, Alarm & Events, Shift In charge & Web Interface Stations including Remote Diagnostics.
- Plant wide functionally distributed Integrated SOE Reporting
- High speed extendable remote I/O network to cater to remote locations i.e. RW intake, FOPH, CWPH etc
- Third party Interface Through OPC / Modbus / IEC protocol with BOP PLCs, Electrical Control System, BTG Integral Controls etc.

The difference is Integration

Team of subject matter experts with domain knowledge of power plant engineering, processes, control and O&M provides seamless integrated end-to-end solutions.

- Redundancy at various levels data network, controllers & IO network (including field signals) for maximum plant availability
- Services Scope includes design, equipment and interface engineering, manufacturing, procurement, assembly, testing, FAT, installation & commissioning, PG test & handover, Life cycle services

Boiler & Turbine Integral Controls

- Burner Management System (BMS) & Boiler Protection System (BPS) with SIL protection levels





- Triple Modular Redundant Turbine Control System (TCS) and Turbine Protection System (TPS) with SIL protection levels
- System hardware including special cards for protection & Safety
- Redundancy modules for field input/output
- IT hardware system including engineering station, servers & other stations
- Engineering as per BTG OEM's philosophy.

C&I for TG / SG

- TG DCS Control System required for LP bypass, BFP protection, lube oil controls etc.
- Field instruments, Analyzers
- Variable Frequency Drives & motors
- Inverter Duty and Distribution Transformers
- ESP, Turbine and Boiler MCCs
- Earthing and Lightning protection System
- Auxiliary power supply system and UPS, 24 DC system & Distribution Boards
- Control valves, flow nozzles, orifice plates etc.

I-BOP

- Station DCS with Operator Training Simulator (OTS) and Performance Analysis Diagnostic & Optimization System (PADO)
- Plant wide Management Information System and Station LAN
- Large Video Screens, Global Positioning System, Closed Circuit TV's
- 24 VDC System, UPS & Power Distribution Boards
- Field instruments and hook up hardware
- SWAS, CEMS and flue gas analyzers
- Vibration Monitoring and Analysis System
- Control valves and flow elements (Orifices/Nozzles)
- Ambient Air Quality Monitoring System (AAQMS)
- Jbs, LIEs, LIRs, Branch cable trays etc.

The difference is technology

Partnership with leading Power plant technology developers provides you state-of-the-art control systems contributing to efficient plant operation & reliable performance.



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



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.

Customer:

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).

Challenges:

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.

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).

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.

The salient features of integrated solution delivered are:

- 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.

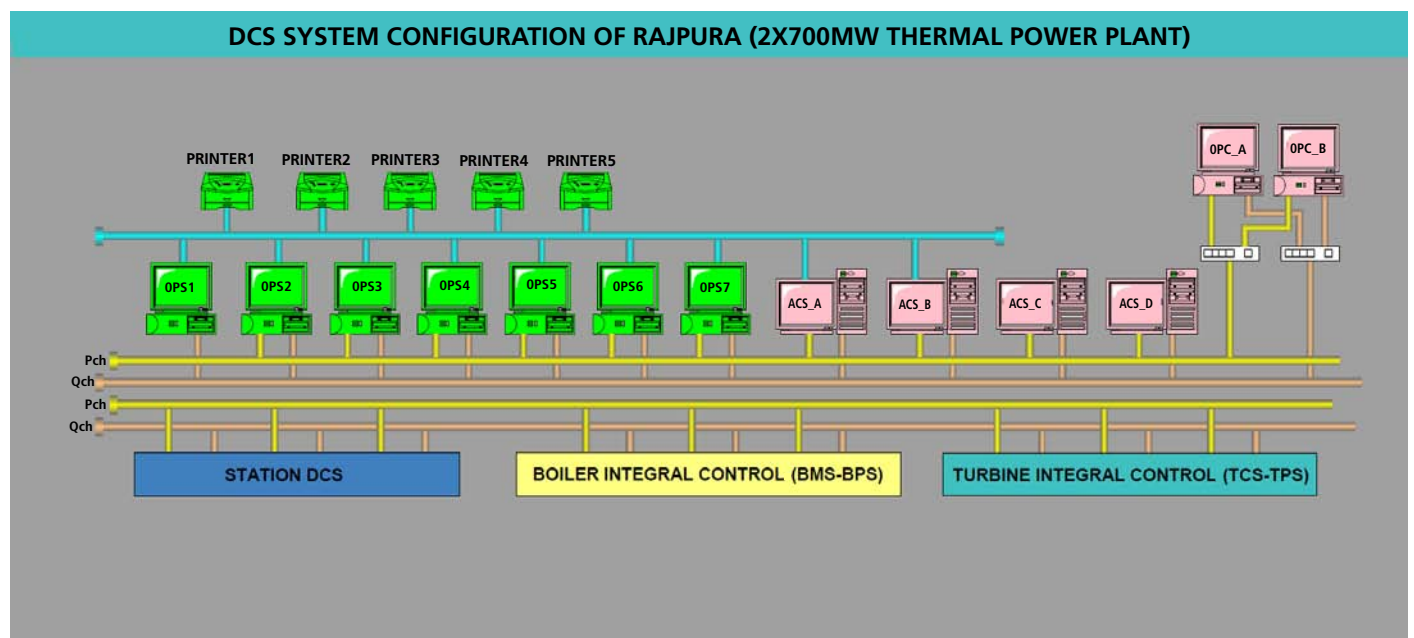
Benefits :

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 Spares
- 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.

Conclusion :

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.





C&A was responsible for the design, supply, installation and commissioning of the DCS package for 2x700 MW Rajpura Thermal Power Plant to Nabha Power Limited. We spoke to Mr. Sunil Bhat, Project Director, L&T Power to capture his experience working with the C&A team and its solutions ..

Can you describe the background of the project?

Mr. Sunil Bhat - It is a 2 x 700 MW coal fired super critical thermal power plant. The plant is being put up at Rajpura, Punjab. Where Turbine and Boiler is of MHI design. L&T Power is an EPC contractor and NPL is the project developer.

Why did L&T Power choose C&A as a C&I partner for this project?

Mr. Sunil Bhat - C&A is a leading player in system integration with process knowledge. Also, it is having flexibility of offering various system solutions under one roof.

Why did you find integrated DCS would be value for your customer?

Mr. Sunil Bhat - Since Turbine and Boiler design is from MHI and their control system is also from MHI, the plant DCS was also preferred to be on MHI platform to have integrated DCS. This will help in single platform for all control system and optimize the hardware requirement. It will offer ease of operability and good from maintenance point of view also.

Now that the Integrated FAT has been successfully conducted and the system has been supplied, can you share your experience of engineering and project execution?

Mr. Sunil Bhat - Project was awarded with tight time schedule for delivery. C&A had done very good work in project engineering with very good coordination with MHI and engineering consultant. Also, it was backed up by a well experienced execution team, which managed the procurement and dispatch as per contract requirement.

How would you consider C&A as Integrated Company for Automation Solution? Does C&A meet your expectations?

Mr. Sunil Bhat - C&A got good knowledge of DCS which was useful in project engineering and execution. Although C&A was offering integrated DCS for the first time at this scale, but based on their past experience of various systems they could complete this challenge very well. C&A can capitalize on this experience to further strengthen their capability of offering customization / solutions for large plants.

