L&T Electrical & Automation

Control & Automation

CANVAS

INTEGRATING EXPERIENCES

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Editorial Message

Dear Readers

India is blessed with long coastline spanning 7,517 km forming one of the largest peninsulas in the world. It has 13 major ports and about 187 notified minor ports. The country is currently 17th largest exporter and 11th largest importer in the world. Port segment plays a significant role in India's growth story by handling about 95% of foreign trade in terms of volume and about 70% in terms of value.

The country is targeting 8% GDP growth during the 12th five year plan. Accelerated Infrastructure development during the plan period holds the key to this growth. Ports being an important infrastructure element, the Ministry of Shipping has announced "Maritime Agenda 2020", the perspective plan for maritime industry, with proposed investment of Rs. 2773 billion in various port development projects and proposed port capacity of 3130 MTPA (~ three-fold increase) by 2020. Over the last 5 years, traffic at major ports has increased by 4% CAGR and at minor ports by 16% CAGR making it an attractive business proposition.

All major ports, except one, are government administered but private sector's participation in ports has increased during last decade. About 95% out of total investment in "Maritime Agenda 2020" is expected to come up through the PPP route. Participation of private sector is expected to bring in healthy competition amongst market players with increased focus on improving operational efficiencies in line with global benchmarks. Deployment of Electrical & Automation and IT technologies in the port plays a vital role in planning, control, monitoring and reporting of overall cargo handing at the terminal apart from ensuring round the clock availability of the equipment.

L&T has rich domain experience in providing integrated solutions for Bulk Dry Cargo Handling, Liquid Handling Terminals to the port segment. Our Port Information Management System helps user to enhance operational efficiency by monitoring the entire facility including KPIs in real time enabling sound business decisions.

We have automated more than 75 km long material handling system at various ports in India. You will find an article on one such installation at APSEZ, Mundra. Hope, you will find it interesting.

L&T has made significant contributions in building infrastructure for India. We are committed to developing efficient and innovative Electrical & Automation solutions for the ports segment in times to come.

Happy Reading !

Sandeep Bhat

Trends in Port Operation & their influences

India is one of the fastest growing emerging economies in the world. Port sector plays an important role to meet the nation's rising demand for handling of cargo logistics. As marine terminal operation volumes continue to grow throughout the world, port operators are seeking ways to improve the productivity and efficiency. Modern day terminals are expected to handle increased cargo volumes, larger vessels with greater capacity and shorter turnaround time. These changes have an influence on the method of working and labour deployment at the terminals. More mechanisation, unitisation and automation of cargo handling are becoming an imperative.

Rapid advances in Information and Communication Technology are reshaping all spheres of life. Some important developments which have changed the landscape of Port operations are:

- Automatic Identification System (AIS) using RFID's for logistics and transport planning
- Use of Optical Character Recognition (OCR) for fast processing of incoming/outgoing containers

- Wireless high speed data network enabling easy connectivity between equipment spread over large geography
- Real time data exchange between all port assets and Port Information Management System (PIMS)
- Seamless connectivity between ERP System, Vessel Traffic Monitoring System, PIMS and other business systems involving supply-chain logistics

In order to improve Port performance, operators are implementing AIS systems, setting-up of Wireless Wide Area Network (WAN) within the Port and connectivity within various port assets like Cranes, Ship Loaders/Unloaders, Tugs, Liquid Terminals, Hoppers, Conveyors, Stockyard, Silos, Fuel Management System to exchange data seamlessly with PIMS, planning system, ERP system. This helps operator to integrate various information systems in real time and deliver the Right Information, at the Right Time in the Right Place to create a real time Management Dashboards for KPIs like

- Average Pre-berthing Detention of Vessels (in hours)
- Average Turnaround Time of Ships (in days)
- Average Output per Ship Berth-day (in tonnes)
- Average Berth Occupancy (%)
- Percentage Capacity Utilisation of berths
- Average moves per Crane-hour

Ultimately, the above-mentioned infrastructure is expected to get integrated with Port Community System (PCS) which will enable Electronic Data Exchange between all Ports in India and various stakeholders involved in the value chain. PCS is an important initiative being undertaken under the 12th Plan to implement E-Commerce in Indian Port business.

Bulk dry cargo handling is entirely mechanised in terminals built over the past five years including Truck or Wagon Loading System resulting in high throughput. Handling of cargo in stockyard through Stacker Reclaimers still involves manual operation. Operational safety has been major concern that is preventing users to go for unmanned Stacker Reclaimers. With advances in sensor technology, reliable 3D-Laser Cameras and SIL-2 rated Real Time Kinematics (RTK) GPS arrays, one could get real time visualisation of stockpile and implement reliable anti-collision plus collision avoidance system. Typically, this system is expected to improve stockyard throughput by 10-15%.

More than 70% of India's oil requirement is met through imports. A typical liquid terminal handles Crude Oil, Petrochemicals, Edible Oil, Biofuels, Chemicals and the cargo handled is inflammable, hazardous. It is, therefore, important to handle these products safely and the need has been felt to automate liquid terminals to handle product receipt, in-line blending, storage, despatches and have seamless integration with business systems for planning, scheduling, billing and reconciliation. Automation provides terminal operator greater flexibility to switch from one product to another in shortest possible time. Going forward, greater emphasis would be on Safety, Health and Environment (SHE). Occurrences of spillages while filling operation would have to be brought down to minimum. Use of products which meet higher Safety Integrity Level in the entire process chain may become mandatory to ensure higher reliability. Fire & Gas Detection System, Intrusion Detection Systems (CCTV) will get integrated into Terminal Automation System. With mobility solutions gaining popularity, it would be possible to control/monitor entire terminal operation on a smart device.

Though the Ports are expected to handle organized traffic involving Cargo and designated ships backed up with Coast Guard, they are exposed to security threats because there is a variety of unorganized traffic arising out of fishermen, sailors, surfers, suspicious elements, wanderers etc. who transit through with relative anonymity as it is extremely difficult to manually track these objects through cameras and uniquely determine their threat value. With a number of Ports developing Single Point Mooring (SPM) facilities for handling crude oil and petroleum products which are located up to 10-20 nautical miles into the sea, it would be extremely difficult to identify elements for their threat value without access to the Surveillance infrastructure. Currently, these are monitored manually and assisted by Patrol Boats around the SPMs.

Maritime Surveillance solution addresses the challenges of secured operation. The solution brings out Situational Awareness of the identified sea area integrating data from multiple coastal and sea based assets, with system capable of identifying threat situations and generating the necessary alerts calling for closer video surveillance, tracking, image stabilization and subsequent actions.

World over, the environment is no longer a negotiating point. It may become imperative to operate ports in good harmony with environment; land, water and air. This has prompted many ports to undertake initiatives toward reduction of carbon emission and carbon foot prints through various measures by which green ships/green ports are being promoted. Rubber Tyre Gantry (RTG) cranes operated using diesel generators constitute major pie of fuel consumption in Ports. Usage of electrified RTG cranes which cut fuel consumption by 90% (estimated) would be an important transition to facilitate greener port operations.

Conclusion

Growing participation of private sector and healthy competition amongst market forces will bring our ports on par with international ports in terms of performance and capacity. This will promote extensive use of Automation, Information and Communication technology. Port operators will look forward to a single entity having an ability to integrate all technologies seamlessly and provide a comprehensive solution. In coming times, we will see greater emphasis on Green Ports and reliable surveillance infrastructure.

E, C&I Solutions for Ports

The Competitive Advantage of a Port is driven by parameters like

- Average output per ship berth day (tonnes)
- Average ship turnaround time (days)
- Average pre-berthing detention time (hours on port account)

Port operators strive for continual improvement in these parameters to enhance profitability. Electrical, Control and Instrumentation (E, C&I) solution deployed in the Port plays a significant role in this endeavour.

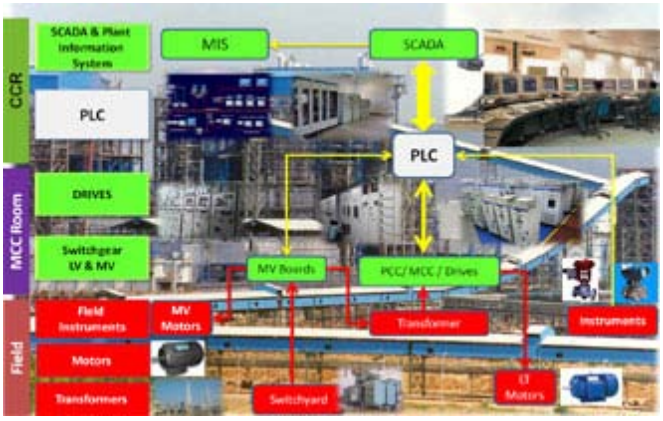
L&T - C&A is an experienced and reliable partner for E, C&I system for the Port. Our integrated solution helps user in terms of better control, monitoring, reporting of every aspect of port operations so that one could make sound business decisions and improve efficiency.

Our E, C&I Solutions for ports includes bulk material cargo handling, liquid cargo handling, port information management systems.

Bulk Material Cargo Handling

We provide seamlessly integrated E, C&I system for a facility comprising of Ship Loader/Unloaders, Conveyors, Stacker/Reclaimers, Storage Yard/Silos, Truck or Wagon loading / unloading including Wagon Tipplers.

Our tailor-made solutions have enabled port operators achieve a throughput of more than 50 million tonnes of bulk material cargo each year, till date. Equipped with more than three decades experience in Port domain, we design equipment suitable for reliable functioning in arduous environment. We also take care of pertinent points related to safety and security which is vital for Port installation.



Our offering comprises :

- Instrumentation comprising of Pull Cord/Belt Sway Switches, Belt Weighing System, Belt monitoring system, Silo level monitoring, Condition Monitoring systems etc.
- Power Distribution system including power & distribution transformers, MV and LV Power Distribution Motors and Variable Speed Drives for long conveyor control Automation system with redundancy at various levels Servers, data network, controllers, power supplies & IO network for maximum plant availability
- Automatic operation and visualisation of entire facility from Control Room using L&T iVisionmax platform Automation functionalities include Operator, Engineering, History/archiving, Alarm & Events logging, Power management system, Asset management systems & Web Interface Stations including Remote Diagnostics, monitoring system for headquarters
- Surveillance CCTV, Public Addressing System, Fire Detection & Alarm System
- Interface with MIS/ERP systems, Quality control systems Lifecycle Services including system upgrades and long term AMC contracts

In Ports land is always at a premium. Also locating a control room space at an early stage of project is a challenging task. To overcome this situation, we have come out with compact containerised housing for Electrical and Automation equipment. This solution has been extensively used for Cranes and applications involving mobility. These are specifically designed to offer best performance in terms of least footprint, highest reliability, without compromising on safety aspects. They come fully assembled and tested at our factory for quick, easy installation and start-up.

Typical equipment placed inside container are :

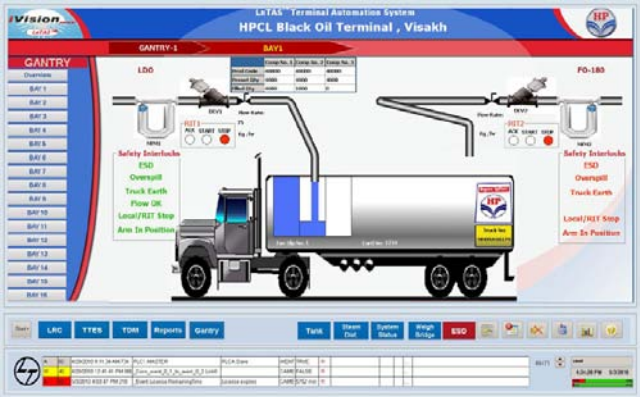
- LV/MV Transformers
- LV/MV Switchgear Panels
- VFD Panels
- Automation Panels
- Auxiliary Panels

Liquid Cargo Handling

Our solution handles movement of liquids at Port through tankers, ships, tank farm, trucks, railway wagons and pipelines, whilst guarantying safety against tank overflow and other hazards related to handling of inflammable liquids.

L&T's software enables integrated multi-product terminal operation which includes:

- Ship loading / unloading
- Inventory Management
- Tanker Truck loading / unloading
- Rail Wagon loading / unloading
- Tank data/reconciliation
- Terminal security and access control
- Merchant operations
- Truck entry and exit monitoring
- Bay queue / Truck status
- Fleet Management
- Customer identification and authorisation
- Business Process Interface
- Filling advice note (FAN) generation
- Product Blending Management

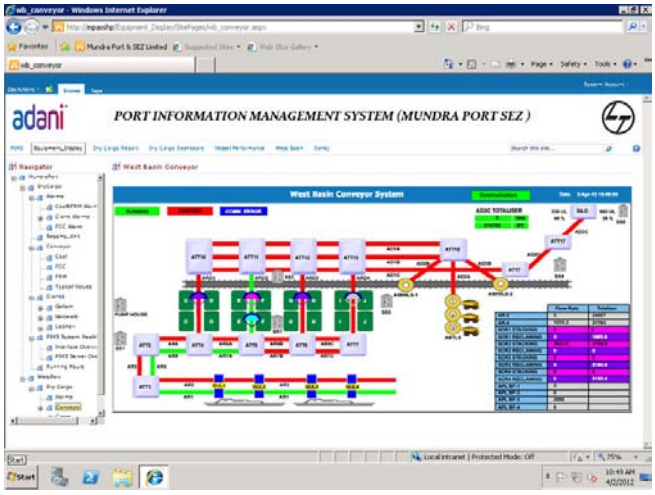


Our offering comprises :

- Instruments for Tank Measurement including radar level transmitters, pressure / temperature transmitters, Mass flow meters, Gauges, etc.
- Control Valves & Actuators
- Loading Arms, Batch Controllers, Card Readers, Earthing Relays
- Tank farm control system including PLC controller, workstations and networking hardware
- Electrical Power Distribution System
- Surveillance CCTV, Public Addressing System, Fire Detection & Alarm System
- Terminal Automation System software
- Management Information System
- Lifecycle Services including system upgrades and long term AMC contracts

Port Information Management System (PIMS)

A Port is a complex ecosystem requiring diverse technology solutions and services for different port operations. This invariably results in deployment of separate computer management and information systems for a given operation. For enhancing the efficiency and increasing productivity of the port, one has to take into consideration all these data islands in real time.



As part of our PIMS offerings, we provide seamless integration of data emanating from various assets like different types of Cranes (including Crane Management System), various Material Handling equipment, yard systems, Vessel Traffic and Port Monitoring System, ERP system and create real time dashboards which help users to take right decision in pursuit of Operational Excellence.

Typical dashboard could have KPIs such as tonnes per ship per productive hours, tonness per ship per berth hours, tonnes per ship per port hours, loading/unloading time, ship turnaround time, ship service time etc.

In addition to above, we also have capability to build networking infrastructure (OFC or wireless) for entire port. We also have skill sets to develop communication drivers for proprietary systems to facilitate data communication.

Salient functionalities of PIMS are:

- Monitor, manage and improve day-to-day operations
- Improve ability to predict and plan maintenance, reliability of enterprise assets
- Improve accuracy of revenue forecasting
- Deliver real-time and historical information to all levels of the organization
- Financial and operational integration
- User friendly and easy to adapt
- Scalable and open system architecture

SSA - Surveillance and Situational Awareness

In view of growing security concerns across the globe, requirement of intelligent security system for Maritime Surveillance is gaining momentum.

L&T's group company, Servowatch, UK serving Marine sector, provides Maritime Surveillance solution for coastal and land surveillance. The leading edge technology developed by Servowatch called Fusion Engine, gathers track data at different locations from multiple coastal and sea based assets. It correlates (fuses) tracks that represent a single contact and Identifies threat situations and generates necessary alerts.

This system was deployed and used by the UK Police force and Ministry of Defence as the primary tool for surveillance of marine vessels during London Olympics - 2012 for sailing event.

Coal Handling System at APSEZ - West Port, Mundra

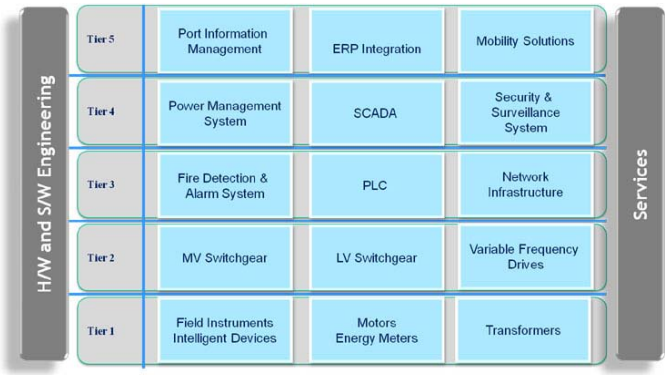
Overview :

Mundra, a coastal town in Gujarat, is one of the largest coal-based power plant hubs in the world housing 4620MW power station owned by Adani Power and 4000MW power station by Coastal Gujarat Power Limited. Coal requirement for these power stations is met through imports. To meet the rising demand for coal at Mundra, the Adani Group decided to invest in berth-3 at its West Port and associated coal handling plant including 2x1.36 km long conveyors (ARD-5, ARD-6). This translated into 16.5 MTPA handling of additional coal per annum. L&T-C&A was entrusted with Electrical, Control and Instrumentation part of this project based on its good performance at Adani Group's similar project at Dahej Port.

Key Expectations :

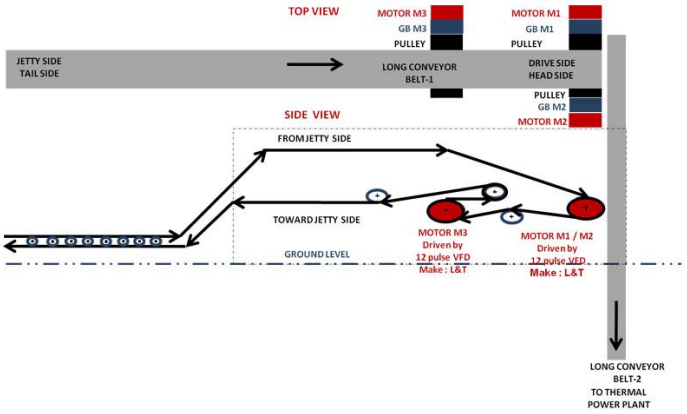
- Seamless integration with existing Electrical & Automation system supplied by a multinational for berth-1 and berth-2
- Upgradation of existing Automation system of berth-1 and berth-2 to have a common control system for entire facility
- Accurate load sharing and speed synchronisation between three motors of long conveyor to ensure uninterrupted operations at various load and speed patterns
- 7 months timeline for completion of the project

Solution Matrix:



Solution :

The heart of this facility is two 1.36km single belt long conveyors operated at 4.6 m/sec speed. They are driven by three 600kW, 690V motors equipped with thruster brakes and variable frequency drives (VFDs). Mechanical arrangement of the conveyors is illustrated in figure below..



Keeping the critical nature of facility in mind, the entire mechanical system is designed to tolerate failure of one motor. Normally, all three motors are in operation when the conveyor is running. In case one motor or corresponding VFD trips on fault, operation could be continued with two motors. User has been provided flexibility to choose any one motor out of three as a master and rest of the motors automatically get configured as slaves through a menu selection in SCADA. Entire electrical power distribution system is designed to tolerate one failure to impart high reliability to the system. Since power system constitutes high quantum of non-linear load, harmonics could have been a major concern. This has been mitigated by deploying VFDs with 12 pulse design. It has enabled us to maintain Total Harmonic Distortion (THD) in the power system well below limits stipulated by international standard IEEE-519.

Most crucial part of this project was to achieve equal load sharing and accurate speed synchronisation between three motors across different operating speeds versus load profiles and during starting i.e. transient conditions. Uneven load sharing / speed synchronisation between motors could result in inappropriate belt tension and adversely affects the belt life. Uneven load sharing results in unequal current in motors and if difference is large, VFDs trip interrupting the plant operation.

Based on decades of experience, L&T-C&A has developed a special control algorithm for achieving equal load sharing and accurate speed synchronisation between multiple motors for a Long Conveyor application. It has enabled us to achieve proper load sharing between all motors and accurate speed synchronisation. The algorithm also ensures safe shutdown of system in the events like Controller Failure, Speed Mismatch between motors, Network Communication Failure etc. All encoders mounted on motor (used

for speed feedback) are designed to communicate with VFDs on fibre-optic media to ensure noise-free signals over long distance.

The configuration (refer below figure) depicts various elements deployed in the Automation system. Entire operation is controlled by redundant high reliability, high performance Programmable Controller located in the central control room. Automation Communication networks are also redundant and make use of Fibre-optic media to ensure reliable communication over large geographical spread. There are three separate distinct networks to ensure high speed data transfer.

Ethernet network for SCADA, interface with PIMS and other third party systems

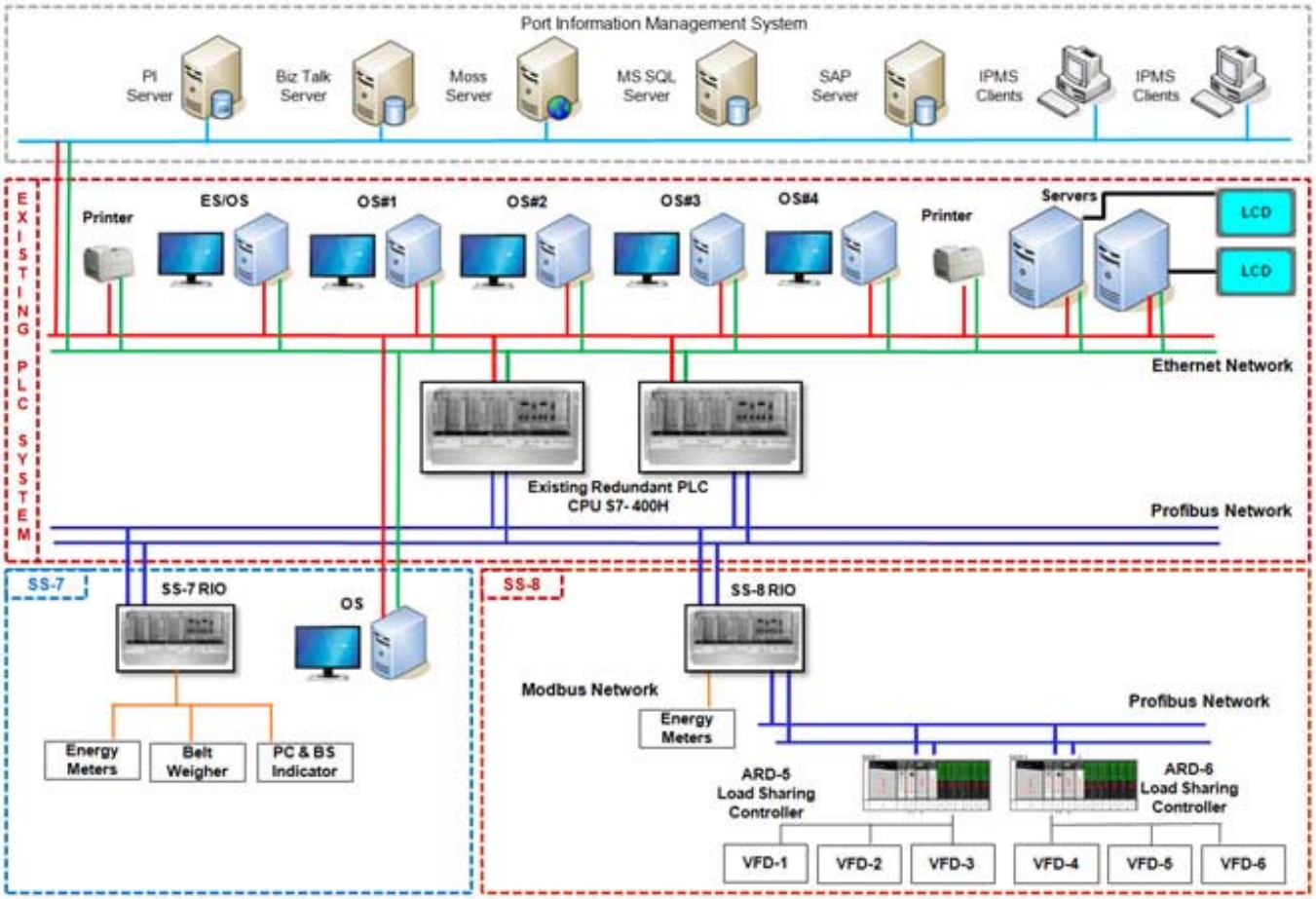
Profibus network for PLC inputs/outputs

Dedicated high speed Profibus network for implementing load sharing and speed synchronisation between VFD's

Entire facility (berth-1, berth-2 and berth-3) is operated from a central control room through a SCADA system. All screen displays, operator commands are menu/icon based and do not entail any specialised training or programming knowledge for control. The software allows operators to access parameters like trends of motor currents, motor bearing temperatures, VFD parameters, belt tension etc. along with alarms superimposed on the plant mimic. Operator could monitor health of each pull cord switch / belt sway switch installed in conveyors spread over approximately 3 km stretch. Operator has flexibility to select material conveying path based on the nature of operation and availability of equipment. All group start/stop operations are available at a keystroke. Asset Management module keeps a track of maintenance logs, alarms for critical equipment and notifies when maintenance is due. Complete Automation system was staged at our factory facilitating quick implementation at site.

Conclusion:

L&T-C&A successfully implemented complete Electrical and Automation system for the Coal Handling Berth within the stipulated project schedule. This project was led by a QPMP certified Project Manager who possessed sound knowledge of Port domain. Every element of project was mapped in the Primavera tool facilitating micro level project planning and control. Site activities were completed without involving any major safety related incident. After conducting successful performance guarantee tests and one month of uninterrupted plant operation, the system was handed over to owner for commencing commercial operations.



Customer Speak

"Seamless Integration is the key...L&T has a pool of subject matter experts having domain knowledge of port operations, associated engineering practices, processes and control ensuring seamlessly integrated end-to-end solution."

Chetan Bajpai
Head of Sea Port & SEZ Construction Projects,
PMC Projects India Pvt Ltd.

L&T-C&A executed the project, "Mechanization of Berth-3 at West Port, Mundra" which included design, engineering, supply, testing & commissioning of Electrical, Control and Instrumentation system for coal yard conveyor system (ARD-5 & ARD-6). We spoke to Mr. Chetan Bajpai, Project Head - APSEZ, Mundra to capture his experience of working with the L&T-C&A team.

Brief us about APSEZ West Port Operations and Berth-3 expansion project and its importance?

Mr. Chetan Bajpai - APSEZ West Port Operations and Berth-3 expansion project is put up with the intent to making it a world class coal terminal in this part of the world to cater to the needs of Adani Power Limited, Coastal Gujarat Power Ltd and the Adani Enterprises trading coal cargo. It is the coal terminal that can handle 80MMT per year.

What were your key expectations from Electrical and Automation supplier for this project?

Mr. Chetan Bajpai - Key expectations from Electrical and Automation supplier were to complete the project in time to efficiently convey, store and despatch the cargo. Automation was the key to mechanisation in order to meet the volumes.

Why did you select L&T-C&A as your Electrical & Automation partner for this project?

Mr. Chetan Bajpai - C&A provides good solutions. It is flexible to accommodate our needs and open to suggestions for delivering good project outcome. We felt they could match our project execution speed.

Share your views on overall execution by L&T-C&A?

Mr. Chetan Bajpai - L&T-C&A has done a good job. We and L&T-C&A worked as a team to achieve the desired project outcome. They conformed to our stringent quality norms while meeting our expectation of speedy execution.

What are Adani's expansion plans for port segment and how likely would you consider L&T-C&A for your future port projects??

Mr. Chetan Bajpai - Adani is a long term committed player in the field of Port & SEZ infrastructure along with its other businesses. It vies for top position in the business it enters. Off course, we shall continue to partner with L&T-C&A for our various Electrical & Automation needs.