

### Overview

Country or Region: India

Industry: Port

### Customer Profile

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.

## Coal Handling System at APSEZ - West Port, Mundra



### The Need:

- 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

## 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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### Our Integrated Electrical & Automation Solutions:

#### Cement

- Material Handling
- Cement Plant E&I
- Automation Solution for Steel Making

#### Energy Solutions

- LV/690/MV Drive Systems
- Solar PV Products and solutions
- Power Management System
- Availability Based Tariff System

#### Infrastructure

- Airport Baggage Handling Systems
- PMS for Airports & Metro
- ECS & TVM for Metro
- AFC for Metro

#### Oil & Gas

- Integrated Process Control System
- 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

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.

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.

