

Control and Instrumentation

New technologies to maximise power plant efficiency

In order to operate power stations at an optimum level, power technology has, over the years, become more and more dependent on automation and control. Increasing computerisation has enabled the use of some very sophisticated techniques for controlling and monitoring power systems. Earlier, control and monitoring systems were usually made up of simple circuits. Operators supervised processes continuously and used their judgement to make necessary changes to set values. Now, monitoring and control in power plants are based almost entirely on computerised equipment, which has considerably simplified the control of processes involving multiple variables.

In fact, control and instrumentation or automation at power plants has become critical to maximising efficiency and availability. It has allowed faster collection and processing of all data from various parts of the plant and has even provided for remote control of all devices. It has also helped optimise fuel utilisation and lower operational costs.

In a typical power station, the major systems for power plant monitoring and control are:

Process control system

This is a closed loop control system that takes its direction from the energy management system (EMS) and automatically collects plant data by reading instruments. Physical and electrical parameters associated with the boiler, turbine and generator are monitored on a continuous-cycle basis. Alarms and events are logged. Control of pumps, valves and switches for routine functions and for start-ups or shutdowns are provided.

Plant monitoring system

This is strictly a data collection system for fuel monitoring and performance calculations. No control actions are performed. Data is stored and retrieved as required to prepare reports and performance analysis.

Operational monitoring system

This is used by plant operators to enter manually collected operational data for record keeping, report writing and analysis. In addition to these systems, the power plant may also use computers for security, environmental, controlled access and chemical analysis systems.

Power plant maintenance

The power plant maintenance systems stores pertinent information for analysis of maintenance costs and evaluation of equipment performance. The interactive portion of the system provides plant personnel with the capability to enter problem data, planning data and work execution data. Interactive functions are also provided for entry and maintenance of an equipment database and for access to equipment history.

Automatic generation control

The automatic generation control (AGC) system performs a very critical task – it adjusts generation against load. The objective is maintenance of quality and minimisation of costs – of energy production and transmission. This is done primarily through load frequency control and economic dispatch. Both these functions are done in real time.

Major DCS installations in the last five years			
Project	Capacity (MW)	Year	Contractor
Suratgarh stage-II	210	1996-97	IL Kota
Raichur TPS	2x210	1997-98	Yokogawa Blue Star
Sanjay Gandhi TPS	2x210	1997-98	Yokogawa Blue Star
Panipat Unit-IV	210	1999-2000	Yokogawa Blue Star
Jojobera	2x210	1998-99	Tata Honeywell
Bakreshwar Units I&II	2x210	1996-97	BHEL
Kayamkulam CCPP	330	1997-98	BHEL
Wadi CCPP	50	1997-98	BHEL
Vindhyachal Units VII&VIII	2x500	1997-98	BHEL
Bakreshwar Unit III	210	1997-98	BHEL
FG Unchahar Units III&IV	2x210	1997-98	BHEL
Khaperkheda Units III&IV	2x210	1997-98	BHEL
Faridabad CCPP	450	1997-98	BHEL
BSES Kochi STG	39	1997-98	BHEL
Neelachal CCPP	55	1998-99	BHEL
Kovilkalappal CCPP	90	1998-99	BHEL
Simhadiri	2x500	1998-99	BHEL
Suratgarh	2x250	2000-01	BHEL
Pragati CCPP	330	2000-01	BHEL
Surat Lignite Units I&II	2x125	1996-97	Siemens
Mejia Units I&II	2x210	1996-97	Siemens

Load frequency control

The load frequency control (LFC) system monitors generation load, constantly looking for imbalances. The LFC system needs to maintain frequency at the scheduled value, net power interchanges with neighboring control areas at the scheduled values and power allocation among generating units at economically desired values.

Economic despatch

Different generating units that are online have different costs of generation. It is therefore necessary to optimise the contribution of each of these units so that the load is met at minimum cost. This system takes into account not only the per unit generating costs of power plants but also their geographical location. This enables the despatch manager to minimise transmission losses and thus achieve the true "minimum cost". Other factors such as reserve margins and transmission limits are also considered.

Evolution of C&I Industry

The control and instrumentation (C&I) industry in recent times has evolved from producing simple mechanical instruments and gauges to pneumatic instruments and controls to analog controls and, finally, to digital instrumentation and control.

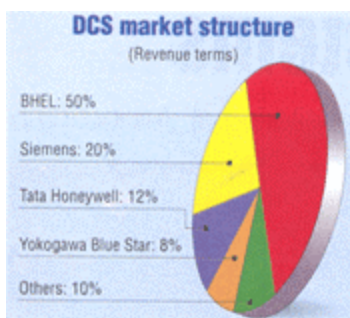
In fact, the industry is fast shifting from first-generation process control instruments to distributed control systems.

Traditionally, the market has been driven by “Greenfield” projects or new establishments planned in the power sector. However, due to quantum improvements in technology and the increasing need to improve the efficiency of these industries, the second generation of C&I business in terms of upgradation of the old solid state systems to new microprocessor-based systems is emerging.

Market size

The total process control industry (PCI) in India grew from \$280 million in 1998 to around \$400 million in 2000. These are, however, the figures for the total process control industry. The business in the power sector comprises around 20 to 25 per cent of the total PCI business transacted.

Distributed control systems account for 45 per cent of the total sales. The power market in India for C&I instruments includes the state sector, central sector and private power projects. Besides, captive power projects are also expected to form a sizeable part of the market in the future.

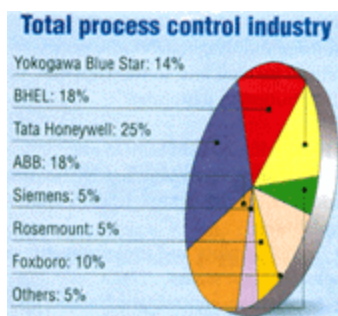


In terms of potential market, an additional 5,000 MW to 6,000 MW of power projects are expected each year, if all goes well in the sector. Market trends therefore point to a sizeable potential for C&I systems.

Market structure

The market for C&I systems is highly dispersed. There are over a 100 companies manufacturing process control equipment. Of these, more than 75 per cent are in the small-scale sector. Large firms account for 65 per cent of the process control instruments sale. About two-thirds of this market is catered to by domestic manufacturers, while the balance is serviced by imports.

Production activities in the sector are divided into two groups: hardware and systems software engineering services. System services include development of process software, and erection commissioning and engineering. Domestic firms import hardware components to manufacture process control instruments and systems. Currently, the imported content of hardware components is around 70 per cent.



Main players

Both small firms and multinational players offer C&I products in India. MNCs like Tata Honeywell, Siemens, ABB, Yokogawa Blue Star, Westinghouse, Foxboro and VA Tech compete aggressively against the government-owned instrumentation Limited (IL) Kota and Bharat Heavy Electricals Limited (BHEL).

IL Kota though very active in the late 1980s, is no longer a major player in the sector. The company has been referred to the Board of Industrial and Financial Reconstruction and the government is likely to divest a majority 51 per cent stake in the venture.

Even though Tata Honeywell is the over all market leader, BHEL has the biggest slice of the power sector market. In terms of number of installations of C&I equipment in power plants from 1986 to 2000, BHEL has a 37 per cent share. Yokogawa is a close second with a 20 per cent market share.

In terms of revenue, BHEL has around 55 per cent of the market share. Siemens had around 20 per cent share and Tata Honeywell accounts for 10 per cent to 12 per cent. Other smaller players such as ABB, Foxboro, NTPC-ABB-Alstom Services Limited and JN Marshals account for another 20 per cent of the market.

New opportunities

Renovation of C&I systems in the existing thermal and hydel power stations has emerged as a big business opportunity in recent years. Besides, the introduction of newer and more sophisticated technologies at regular intervals and the need to operate power stations most efficiently will drive the demand and opportunity in the C&I market.

Reference book:
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