

MANAGEMENT CASE

describes a real-life situation faced, a decision or action taken by an individual manager or by an organization at the strategic, functional or operational level

Tata Power Delhi Distribution: Automation vs Manpower

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'This is the magic of automation,' said Sanjay Banga, Head-Power System Control & Automation. 'We had to go through a coal mine to get this shining diamond, SCADA.¹ Apart from increased reliability and quality of power for our consumers, we have successfully unmanned our 50 grid substations through automation reengineering and I can assure you, this was not an easy task,' he added.

And meanwhile, the office boy entered with tea for visitors. It was January 20, 2012; the visitors constituted executives from different state electric utilities of India who had come to visit Tata Power Delhi Distribution's (TPDD) Supervisory Control and Data Acquisition (SCADA) control centre under a training programme at the TPDD training centre to learn about the best practices adopted by TPDD over its decade long existence. The SCADA control centre was located at the CENNET (Centre of Network) Building, Pitampura, which was the centralized location to control TPDD's operations of the electricity distribution of North and North-West areas in New Delhi, the capital of India. The entry to the control centre was prohibited. A special state-of-the-art visitor's gallery was an important part of the SCADA control room, which was like a balcony in a theatre. As visitors entered into the gallery on the top floor of the CENNET Building, their excitement took over when they saw a big wall-size screen at the front showing a graphical representation of the complex electricity network and officers managing the electricity of Delhi with mouse clicks sitting in the SCADA control room. Everyone was surprised and said that it was interesting to see how the officers in the control room restored the electricity of areas miles away from there within seconds. This not only saved the physical movement time of breakdown attending crew to identify and rectify the fault in the complex network but also won consumer satisfaction in terms of much more reliable electricity.

'Where is the unmanned grid staff now? And how was it initiated?,' an eager visitor asked Banga. Banga picked up the tea cup while looking out of the glass window and replied, 'They have been redeployed to other manpower deficit divisions after providing training as per need.' While answering this query, Banga remembered those days when the substation automation was about to be proposed and executed years ago.

KEY WORDS

Public-Private Partnership

Power Distribution

Technological Innovation

Business Process
Transformation

Change Management

Technological Innovation

Talent Management

THE COMPANY

The Tata Power Delhi Distribution (TPDD) transformed a loss-making government entity into an efficient and profitable business enterprise (Vemuri, 2012) that has become a hallmark for public-private partnership² (PPP) in India not only in the power sector but also in other sectors. This was achieved by winning the hearts and changing the mindsets, and through technology and commercial innovation.

TPDD (erstwhile North Delhi Power Limited (NDPL)) was a joint venture between Tata Power and the Government of National Capital Territory of Delhi with the majority stake being held by Tata Power. It served a population of about five million. The company started its operations on July 1, 2002 post the unbundling of erstwhile Delhi Vidyut Board (DVB) (see Table A.1 for Comparative Performance of DVB and TPDD). Post unbundling, the electricity generation and transmission were the responsibility of the Delhi Government, while its distribution was privatized. TPDD operated with a registered consumer base of around 1.2 million households (2,35,000 customers for every square kilometre) and a peak load of around 1,350 megawatt (MW), and the company's operations spanned across an area of 510 sq. km. (length of the network was 9,952 km).

TPDD's utility business was governed by the provisions of distribution and retail supply license issued by the Delhi Electricity Regulatory Commission (DERC)³ for the distribution and supply of electricity in the North and North-West Delhi for a period of 25 years. DERC regulated the working of the entire power sector of the state of Delhi, including the determination of tariff chargeable to end-consumers and establishing performance norms (mainly related to loss reduction, reliability of supply, and consumer service delivery). The norms/targets were set by DERC⁴ after taking into account ground realities (prevailing norms) for other utilities across the country together with the expectation of stakeholders (regulatory authorities/employees/Tata management leadership team/civil society/consumers/other utilities) which were captured through open public hearing. TPDD had consistently over-achieved its targets and over a short span of nine years brought down the Aggregate Technical and Commercial (AT&C) loss⁵ level from 53 per cent⁶ to approximately 13 per cent, beating the world average of 15 per cent, along with major improvements in the reliability of network and consumer⁷ services.

By early 2004, the State of Affairs of the Electricity Board in the North and North-West Delhi started turning around. TPDD revamped the entire network through its run-repair-replace policy, reengineered the entire revenue cycle management process, upgraded the information technology (IT) and automation infrastructure, and established a performance management system to make the employees accountable. It engaged with its employees through various programmes for mentoring, motivation, and training, and also established a structured reward and recognition system. TPDD also established its Center for Power Efficiency in Distribution⁸ to train its employees and upgrade their capabilities making them adaptable to the IT and automation initiatives undertaken post takeover.

Innovation and technology was the prime choice of TPDD. Being one of the youngest companies in the Tata group, TPDD has been achieving continuous success since it began the journey in spite of tough hurdles faced after starting its operations in New Delhi. Technical and management expertise support had continuously flown from its parent company, Tata Power, pioneer in the power sector in India. Resistance from residents of New Delhi in 2002 towards the privatization of the electricity distribution was a barrier for the Delhi Government as consumers were not ready to pay for electricity, considered as necessity and perceived to be borne by the government. Electricity theft, elongated outages, and poor reliability of power were a few important factors which led to the privatization of the power distribution in Delhi into three distribution companies – TPDD, BRPL,⁹ and BYPL.¹⁰ BRPL and BYPL were the companies of Reliance, the renowned business group of India. Consumers were habitual of long blackouts. The entry of a Tata group company in electricity business was to turn around the image of the power distribution. It gave consumers the hope of reliable power. The reform process in the Delhi power sector was the first of its kind in India and Tata Power had an opportunity to gain initiative advantage. To achieve the vision of reliable power supply to consumers through reengineering and change management, TPDD began its journey, considering that external forces were the only challenge. However, it soon realized that meeting the expectation of employees was extremely difficult to manage as well.

The power sector in India had still miles to go and Tata Power, a pioneer and a leading power sector company, took it as a challenge to improve the lifestyle of residents of New Delhi through quality electricity. Technical and

managerial support from Tata Power proved to be a harness for TPDD during its initial phase of operations.

Due to continuous improvement in performance for almost one decade, TPDD had become a point of attraction for other utilities and regulators as well. On the power supply front too, TPDD areas had shown remarkable improvement. Power outages (Vemuri, 2012) in the region it lighted up were down from a regular five hours a day to near zero and revenues were up by 60 per cent. Just as significantly, the number of enterprises in the TPDD distribution area had grown six times, thanks to the reliable power supply. The company embarked upon an ambitious plan to implement high-tech automated systems for its entire distribution network. Systems such as SCADA and geographical information system (GIS) were the cornerstone of the company's distribution automation project.

Organizational Strategy

The strategy planning process was spearheaded by the Managing Director (MD) along with the Senior Leadership Team (SLT) that set the direction for the organisation. TPDD adopted best practices such as PESTLE,¹¹ Strength, Weakness, Opportunity, and Threat (SWOT) analysis, Scenario analysis, and Comparative analysis. Over the years, TPDD had won several accolades¹² for its pioneering efforts in power distribution reforms.

Competitive Scenario

The power sector in India is government regulated and the power distribution is licensed in the allocated area. Due to the complexity of the power system and the requirement of long learning duration, high technology costs and large human resource are the barriers to entry. And, due to public resistance towards the privatization of the power distribution, it is difficult to enter into the power distribution business. But, with government support and favour of industries to get quality power, and the increasing demand for electrical vehicles and appliances, there is a potential to attract big players in the emerging power distribution business.

There are suppliers of power and power equipment in this business. Power is scarce; there is already a huge gap in the supply and demand of power. The increasing cost of fuel for power-generating plants is leading to increased power cost to end consumers. Since the power sector in India is government regulated, power plants cannot increase the cost of power

on their own. But there is huge competition among the vendors who supply the power distribution equipment or technology to the utility as the vendors have realized the future of the power sector. The end-consumers of electricity do not have multiple choices to switch to another electricity supplier, and even after the enactment of the Electricity Act 2003, in open access, consumers have to pay wheeling charges to switch the electricity supplier. Moreover, the electricity tariffs are decided by the government, and the existing scenario of monopoly of power distribution companies does not offer any choice for consumers to purchase power at a competitive price from other power distribution utilities. The power distribution licenses are allocated to distribute power in different geographical areas, and there is no practical competition. But due to open access and to gain government support, the power distribution utilities are silently competing to sustain in the future.

Organizational Environment

TPDD had been in the forefront as far as adoption of latest technology in the power utility sector was concerned. Together with the culture of consumer service excellence, continuous learning, performance orientation, innovation, and empowerment, it was able to set benchmarks of the accelerated reduction of AT&C losses (~75%) and enhance consumer satisfaction. TPDD leadership evolved an inspiring vision and mission since inception, which was revisited periodically. The workforce of TPDD was an amalgamation of employees from erstwhile DVB (under Delhi Government) and new employees recruited after takeover. As of year 2013, there were 3,981 employees. TPDD was an equal opportunity employer and encouraged diversity in experience, skills, and background.

TPDD had its own Government of India accredited training centre – Centre for Power Efficiency in Distribution (CENPEID) – for in-house training as well as training of the personnel of other distribution utilities. Over the years, CENPEID became the 'mecca' of TPDD because of rigorous training provided to unskilled and non-qualified workforce after takeover from DVB in spite of resistance from these employees for training due to lack of work culture. TPDD had many firsts to its credit for innovative and successful adaptation of advanced technologies to upgrade from a conventional power system to a modern smart power system as defined by Electric Power Research Institute (see Exhibits 1A and 1B).

Exhibit 1A: Conventional Power System

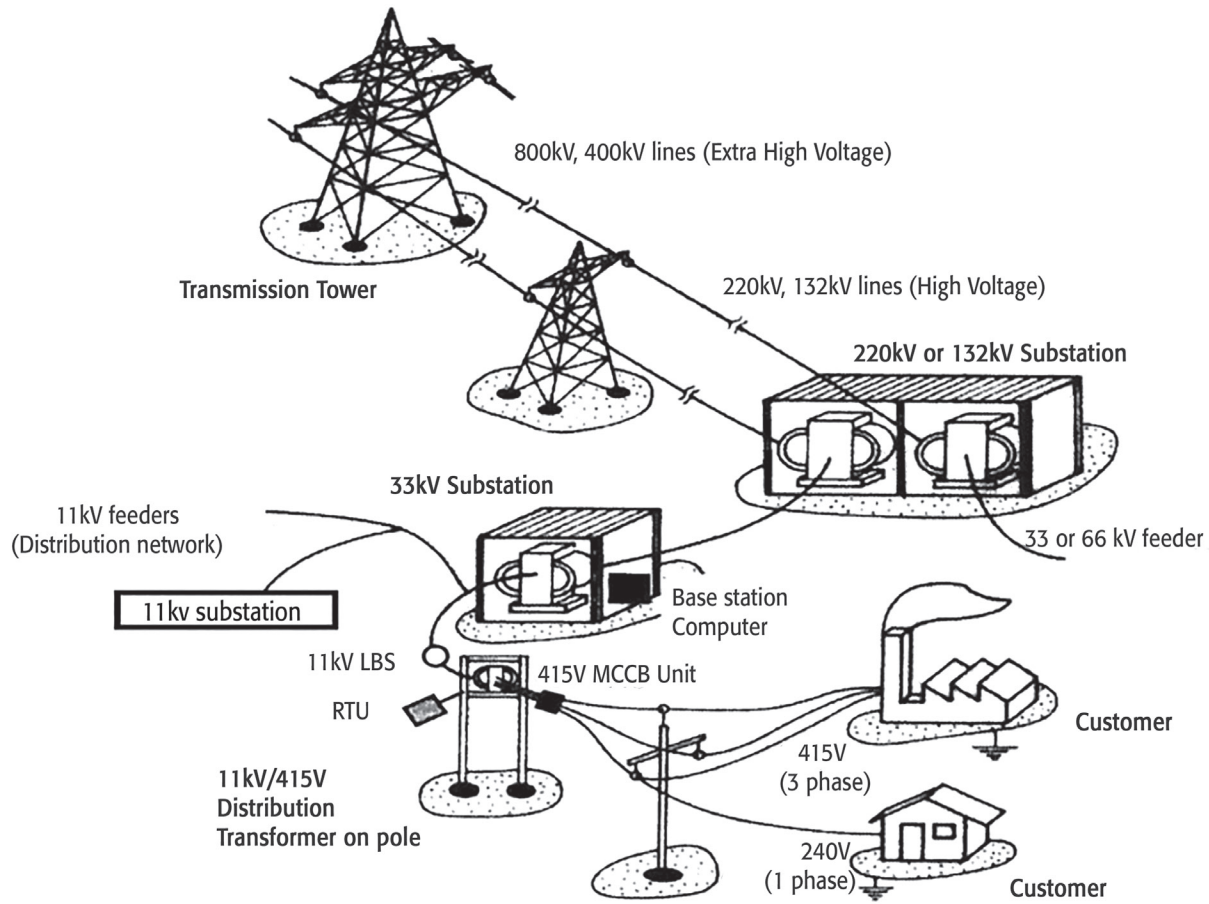
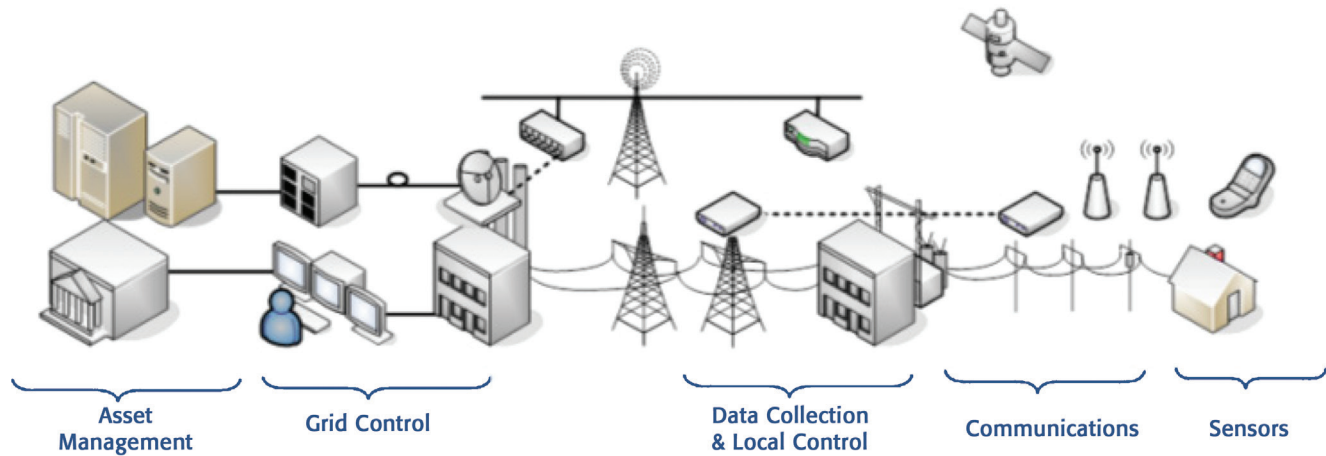


Exhibit 1B: Advanced Smart Power System



Source: www.smartgridnews.com

These included SCADA and GIS applications, automatic metre reading (AMR), global system for mobile (GSM) switching, geographical information systems (GIS) and SAP-integrated asset management, CAP on TAP project, distribution management system (DMS)/distribution automation (DA), outage management

system (OMS), Secondary Data Centre, and many more. The relative size and growth of competitive utilities in Delhi are given in Exhibit 2. Since the distribution companies in Delhi are allocated licenses to operate in different geographical areas, there is no direct competition for capturing the market. But to build up an image

Exhibit 2: Size and Growth of Competitive Utilities in New Delhi

Discom	Shareholding (Delhi Govt-49%)	Management Control	Distribution License for geo-area of Delhi	Area (Sq.KM)	Consumers Nos. (Lacs)	AT&C Loss % (Target vs. Actual)					Reduction in 9 Yrs
						A'02	T'07	A'07	T'11	A'11	
TPDDL	Tata Power-51%	Tata Power	North and North-West	510	11	53.1	31.1	23.7	17	13.2	39.9
BYPL	Reliance	Reliance	East	690	10	57.2	39.9	39.1	22	20.6	36.6
BRPL	Energy-51%	Energy	South and South-West	160	17	48.1	31.1	29.9	17	17	31.1

Source: www.derc.gov.in

of a reputed successful company in the society and the government, all distribution companies in Delhi strive to perform better than the others. It also helps in extending the license period in future.

Organizational Performance

TPDD had consistently over-achieved its regulatory targets since its inception and performed better than its competitors in Delhi. This, while restricting the tariff hikes as was anticipated on privatization, had also helped shareholders to earn handsome returns. The provision of open access with the aim 'to provide electricity to consumers in other license areas of Delhi' as per Indian Electricity Act 2003, motivated TPDD to perform above expectations to attract consumers from other license areas. *Hindustan Times* (a daily newspaper) reported,

Under the Indian Electricity Act 2003, consumers enjoy the freedom to choose the power supplier among many and shall pay wheeling charges for switching. But even after nine years of the enactment of the Indian Electricity Act, the concept is yet to become a reality. The Competition

Commission of India (CCI) has started to investigate and promote the open access scenario in Delhi.

In financial year 2007–2008, DERC, through multi-year tariff regulations, brought about significant changes which impacted profitability. The baseline of AT&C losses was changed whereby the loss reduction targets for financial year 2008–2011 were fixed from the actual reduced loss levels reached at the end of financial year 2007, thus severely curtailing the further scope of incentive from the over-achievement of loss reduction targets. Second, the capital base for the allowance of return on equity (ROE) was changed. From financial year 2007–2008 onwards, ROE was allowed only on capitalized expenditure unlike earlier where the same was allowed on entire capex including capital works in progress (CWIP), thereby denying ROE on CWIP from financial year 2007–2008 (Exhibit 3).

'Technology and automation will play a vital role to outperform in a fast competitive emerging market and to serve its consumers above their expectations,' stated P. Devanand, AGM-Power System Control.

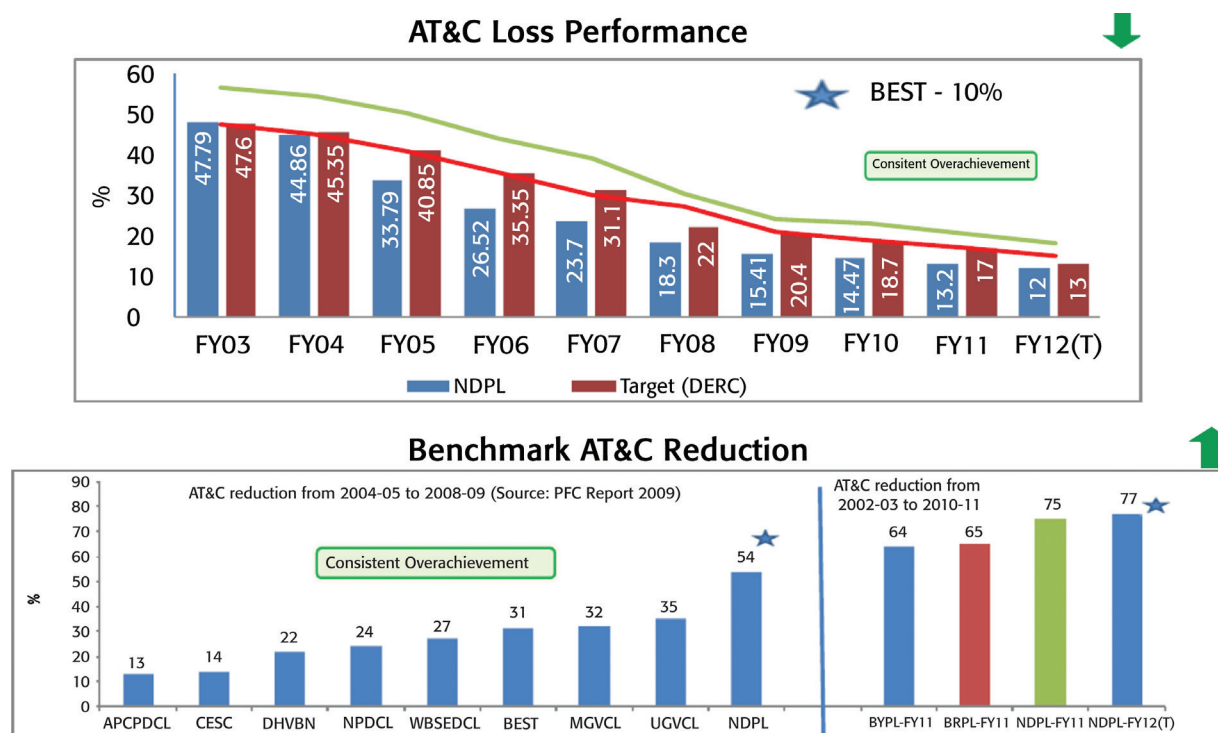
Exhibit 3: Financial Ratios (Multiple Years)

	On Takeover	2002–2003	2003–2004	2004–2005	2005–2006	2006–2007	2007–2008	2008–2009
AT&C loss levels (%)	53.1	50.1	44.9	33.8	26.5	23.7	18.3	15.4
Operating margin (%)	–	5	5	8	11	13	8	13
PAT (\$ Million)	–	5.44	5.85	11.35	22.5	37.35	19.9	34.29
EPS (\$)	–	0.0058	0.0082	0.0178	0.0408	0.0674	0.036	0.0622
ROCE (%)	–	3	4	8	12	13	11	13
ROE (%)	–	6	8	15	24	31	37	19

Note: Data after 2008–2009 is not available.

Source: www.tatapower-ddl.com, www.derc.gov.in

Exhibit 4: Set the National Benchmark



Source: www.tatapower-ddl.com; www.derc.gov.in

TPDD aspires to achieve single-digit losses by 2015 under its mission through innovative approaches for the last mile reduction of commercial and technical losses. TPDD achieved the highest delta loss reduction among all utilities in India since its inception in July 2002 based on the comparative data released by the Power Finance Corporation in 2009. Till 2011, AT&C loss reduction for TPDD was 75 per cent compared to 64 per cent and 65 per cent of BRPL and BYPPL, respectively. This resulted in the elimination of subsidy from the Government of National Capital Territory of Delhi to the power distribution sector and also in TPDD being recognized at both national and international forums (refer to Exhibit 4).

Role of SCADA in Overall Success of TPDD

SCADA revolutionized the way electricity was distributed in Delhi and had streamlined the process of power distribution. Positive outcomes due to SCADA were evident in the first few years of its functioning. TPDD needed to sustain the momentum and improve its revenues on an ongoing basis. The government needed more focused efforts in order to replicate this model in other states across the country. The success of TPDD could also serve as a stepping stone for other PPPs across the

country. As far as the various stakeholders of setting up SCADA were concerned, these included regulatory authorities, employees, Tata management leadership team, civil society, consumers, and other utilities.

SCADA helped in understanding the importance of technology in an organization and how it could help companies to improve functioning. TPDD highlighted the PPP model and its increasing popularity as a success strategy, thereby achieving the effective management of aspirations of multiple stakeholders. In addition, the importance of employee training programmes and the effective deployment of resources under a changing environment was also emphasized adequately. Finally, TPDD gave inputs on managing change effectively leading to organizational transformation and highlighted the concept of sustainability of processes and adoption of global best practices.

There was an improvement in the business model with the IT working as an enabler to serve the needs of a large Indian population. There was also a visible impact on the overall effectiveness as well as efficiency levels of TPDD as a result of this initiative. The key success factors leading to the successful implementation of SCADA included the successful deployment of technology, effec-

tive utilization of manpower, ease of use and customer interaction,¹³ and setting up of more centres.

Business Process Transformation

Business process redesign is a critical aspect of change management which lies at the heart of organizational transformation. Managing change is never easy and TPDD sought to remove redundancy for consumers as well as DERC by setting up SCADA. Use of technology as a strategic tool to revolutionize power distribution in India has a number of social implications for society in addition to the achievement of the primary objective of increasing efficiency for TPDD. Prompt correction of power-related issues also creates the perception of an honest and efficient electricity distribution system which morally discourages the unauthorized use of electricity.

The PPP model with TPDD as a private partner enabled the Delhi government to utilize world-class services of a highly intensive IT company. Apart from significant financial benefits of such an arrangement (lower cost of distribution of electricity), power sector reforms initiated as a result of setting up of SCADA had the potential to significantly enhance the quality of life of a large section of the Indian society.

SCADA functioned as a centralized automated facility for the distribution of power. It was based on the ideology of the strategic use of IT to facilitate the business process. By setting up SCADA, TPDD undertook a comprehensive business process restructuring exercise so as to establish international benchmarks in service delivery to consumers, on one hand, and ensuring the legitimate generation of revenue for the company, on the other. This, in turn, enabled the social welfare expenditure programmes of the Tata group to function in an appropriate manner. It was based on an intelligent use of IT to facilitate the process. Table A.1 reflects the transformation of the electricity era from an unhealthy and ineffective DVB to an advanced and process-oriented TPDD. Automation had significantly played an important role to achieve the goals in terms of consumer satisfaction, power quality and safety, reduction in losses, and revenue generation. Automation and redeployment of the workforce in different operational and commercial sections led to effective and efficient operations and accurate billing and collections. In the pre-takeover stage, during power outage, consumers switched to diesel generator (DG) sets which ran on

petroleum fuel with a very high cost in India; hence, consumers found a cost-effective substitute for electricity. Due to reliable power, consumers were indirectly benefitted by saving on petroleum fuel costs or inverter-installation costs.

Technological Innovation

After takeover, when officials observed a poor infrastructure, high AT&C losses, vulnerable network condition, and lack of skilled, trained, and qualified workforce, the feeling of failure was natural. TPDD analysed the existing IT assets during its inception and to its amazement, found only two personal computers being used immediately after takeover. At the same time, consumer base with high per capita consumption provided a ray of hope to improve the future revenue. Commitment from the central and state governments in terms of Accelerated Power Distribution Reform Programme (APDRP) supported TPDD to invest in new technological development projects.

In order to win the confidence of consumers, TPDD initiated a number of customer-centric initiatives and extensively used IT for building a smart distribution network. It led to its technology innovation along with its business/strategic objectives. According to the former Head of Group, Business Excellence and Corporate Quality, Uday Mishra, '95% to 99% of our investment in technology has been driven with a clear cut road-map to serve.' The company laid down a separate IT budget for each year. As told by Wadhwa to PowerLine in August 2009, the actual expenditure for IT in 2008–2009 was \$3.6 million.

According to the Principal Executive Officer, Akhil Pandey, 'The risk factor in taking up all initiatives was high and in taking up one initiative at a time, risk was low. But time factor was more. We decided to work on all the initiatives simultaneously.'

FLASHBACK

SCADA/Automation Implementation Phase

Banga took a sip of tea and continued

The Apex automation committee was formed in the Management team meeting held on February 5, 2004 for logical and smooth conclusion of the above-mentioned

automation projects. It was important that a responsibility centre be defined for the processes to be rolled out as per the integrated automation plan.

This committee was steered by R. K. Narayan (advisor) and was empowered to chart the future course of action regarding the implementation of the plans, network configuration, assigning of the right people as per the structure, and all other enabling activities which were required for the successful implementation of the automation roadmap. Sanjay Banga was the co-coordinator of the project.

The committee discussed the various issues related to resource management and restructuring of the operation process, and also a detailed update on the progress of automation projects and their impact on other systems. The estimated cost of the project under work head 'Establishment of automation in TPDD electrical distribution system' worked out to \$10 million including labour, transportation, and maintenance cost of \$0.16 million per annum.

In order to increase power reliability, TPDD felt the need to increase its capability of observing the network. According to Chief Operating Officer, Ajai Nirula, 'It is essential for the organization to have a visibility of its distribution network, regarding what fault has happened and where the abnormality is.' The company, in 2004, started with the automation of the grid stations. Simultaneously, the company set up the communication infrastructure, which connected all the district offices, grid stations, SCADA, and GIS applications.

The SCADA system was procured from Siemens, Germany, after customization according to the core specifications provided by the TPDD field staff. The TPDD team worked with the Siemens team at the Siemens factory, first in Mumbai and then in Europe. The implementation of the SCADA system was supplemented by an extensive training programme by Siemens, Delhi, to all the operators. When including the grids for remote control through the SCADA system, the strategy of including grids which were least complicated was followed. According to Sanjay Banga, complication involved in including a grid for remote control was judged on the basis of 'number of outgoing lines from the grid, the number of panels and where outage was not a problem.' A backup control system was set up to facilitate disaster¹⁴ recovery. As Banga said, 'No one in India is doing backup control.' The SCADA system not only speeded up getting information from the grid

and improved the reliability of the network but also helped in removing manpower from the grids which were automated. In this context, Banga, said, 'earlier we used to give \$0.20 million per annum as overtime to 500 employees across TPDD. Overtime to all grid people has now come down to zero.'

TPDD was planning to implement the SCADA system for controlling all grid stations from the TPDD Power System Control Centre (PSCC) for the efficient and trouble-free operation of this system. It was highly essential to have well-trained and qualified executives who would be responsible for the operation and maintenance of the PSCC and associated communication system. Different groups were formed to meet the functional requirements of PSCC (Table A.2).

The Human Resources Challenge

The TPDD CEO and Executive Director, Praveer Sinha (Vemuri, 2012), said

A critical challenge was to align the entire inherited workforce from DVB with the Tata work culture and motivate them to address the problem of AT&C losses, the power cuts and so on. The reforms had to be strategized with sensitivity and executed with agility.

'This is a people-based organization. If the staff is not happy, the organization cannot function effectively,' commented Anil Kumar Choudhury, Vice-President, Human Resource Management and Administration.

Redeployment of existing manpower (refer to Appendix B) posted at 50 grid substations was a major challenge for the management of TPDD. Workforce in grid substations had been working for the last 20–25 years and did not get transferred anywhere else during this period. Incidentally, due to prolonged service rendered at grid substations, the workforce was not comfortable with the idea of working in any other department. Coupled with this was a mindset that they needed to learn new things in new departments if they got out of grid substations which had almost become a second home for them. Grid substation officers were royally paid which also included good overtime payments (approximately as high as one-third of their salary). In such a backdrop, considering that grid substation operators might have also taken loans expecting overtime payments as a regular source of income till superannuation, resistance for unmanning was quite obvious.

On November 9, 2006, CEO Anil Sardana, having an open-door policy for employees and known for excellent interpersonal skills, along with the top management of the company, visited PUSA grid substation (Appendix B). This grid was strategically important from the load management point of view as it fed a high revenue area and had stable operations. Sardana already had a clear picture of unmanning grids as the switching operations were undertaken from the remote control centre with SCADA. Sardana interacted with the grid staff and intentionally said, 'We are going to unman this grid in two days.' He wanted to see the reaction of grid staff working there. The statement worked as a grenade for the grid staff; the information flowed immediately to union leaders, and within a few minutes, the union members also reached the PUSA grid. After a long discussion with the union leaders and grid staff on that day, Sardana decided to create the best human resource (HR) policies for the grid staff; convincing them to unman the 50 grids one by one was the biggest challenge of the automation project.

Initially, Sardana wanted to offer grid operators to volunteer to get redeployed as the volunteers were given immediate promotions and salary hikes. Finally, an agreement was reached with the unions. But some grid staff members were rigid on not leaving the grid substations. While unmanning of a few grid substations was done successfully and peacefully with union cooperation, there were some grids where grid workers lay in front of the main gate of the substation to stop the locking of grid after unmanning. Instances of grid workers jumping the boundaries to get an entry inside the grid were also witnessed. With a lot of persuasion and an assurance of a growing career, these people were motivated and trained at the TPDD in-house training centre. Higher education policy (diploma holders were counselled to pursue degree courses and undergraduates were motivated to do post-graduation),

promotions with salary hike, employee ward employment programme, best working environment in offices with clean and hygienic conditions, computer education, personal loan policy (for marriages, etc.), housing scheme policy, AT&C reduction linked bonus and cashless medical facilities, etc. were a few key HR policies which took TPDD towards its vision. Initially, only 8 of the 350 opted voluntarily for the open-door policy which immediately promoted them; this worked as a spark to a dry grass. After that majority of the grid staff chose to be redeployed at different functions. This led to enthusiasm among technical and HR teams for unmanning the grids and redeployment of manpower into different departments where they could efficiently work and improve the TPDD's performance. At that point of time, the zones (operation and maintenance), metre-reading group, revenue-billing group, and power system control were the departments where manpower was required, and hence the training need was fulfilled according to the requirement at the TPDD's in-house training centre, Cenpeid, where the training programmes used to be conducted regularly. Technical as well as management trainings were provided to them. Training themes included operation and maintenance, metre reading, reduction in AT&C losses, ethics, safety, change management, work-life balance, consumer dealing, etc. These trainings are still part of the induction training programme for the new joinees.

Sanjay Banga recalled, 'Now SCADA system will be made operational and all 50 grid stations will be controlled from TPDD PSCC. Since Ranibagh located interim system is already in place, transition to SCADA control centre is expected to be smooth.' Requisite training to PSC operation executives was imparted before the SCADA system became operational. Phase-wise manpower requirement at the PSCC in view of automation is shown in Exhibit 5.

Exhibit 5: Projected Manpower Requirements (3 shifts + 1 reliever = 4 shifts)

Phase	Control Scenario Envisaged	Operating Staff at Terminal Per Shift	Total Other Staff for Directing/Coordinating System Operations in Shift Duty	Total Staff in Shift Duty	Total Staff (Operations) at PSC
August 2005 (Existing Phase)	2 terminals (8 Grids) Remaining 42 grids operated by local staff	1	3	4	16
		Total: 4	Total: 12	Total: 16	
December 2006 Final	SCADA in service (50 Grids)	5	1	6	24
		Total: 20	Total: 4	Total: 24	

Source: Case writer's notes.

TPDD undertook an ambitious programme of subtransmission and distribution automation (complete setup of the SCADA system) to be completed by December 2006. The operation and maintenance functional optimization aligned to automated system environment through appropriate manpower redeployment proved to be the key to the successful implementation of automation efforts. In view of this, manpower requirement for operation and maintenance activities vis-à-vis current strength and future re-organization of operations and maintenance functions was worked out.¹⁵

Release of manpower from automated grid substations and their redeployment was necessary to figure out the financial and operational benefits after grid automation so as to look into the cost-benefit analysis. Sanjay Banga clearly mandated the requirement of precise details to conclusively establish results in terms of financial, manpower, and operational benefits from the automation of 50 grids. The automation cost was approximately \$10 million (cost for funds raised from internal resources may be taken at 9% per annum and tax rate 50%). As no special team/agency was assigned the task of computing the cost and benefits arising from automation, Kinker was asked to coordinate the task among the concerned departments. Kinker coordinated with the departments of the area power system, power system control, and automation, and initially came up with some intangible benefits along with the improvement in system-reliability indices, after assuming the role assigned by Banga. However, Banga was more concerned about relevant cost versus benefits due to the automation of grid substations and consequent manpower redeployment due to automation reengineering to see that more accurate and most relevant cost-benefit could be figured out in monetary terms over the remaining license period of 20 years. He asked Kinker to determine the monetary benefits due to manpower release from grid substations. In this regard, average salary per executive was estimated to be \$600 per month. Kinker, an engineer in the automation department and committed to his assigned tasks with

good cross-departmental management skills, listed the details after discussion with concerned departments as per Exhibit 6.

VISION FOR FUTURE

Change Management

The success of TPDD depended on an acceptance of change, as much by consumers as the employees of the erstwhile DVB (about two-thirds of the current staff of TPDD were former DVB personnel (Vemuri, 2012)). Effective change management, which included reassuring measures of continuity in terms of employment for former DVB employees, was critical in this process. The fact that the then Chief Minister of Delhi, Sheila Dikshit, personally intervened time and again against power theft was reassuring to the Tata group about the commitment of the Government to facilitate change.¹⁶ SCADA showcases successful adoption of strategies related to managing change effectively leading to organizational transformation (Davidson, 1993). Managing change is never easy and can never be successful if applied through rules unless these reflect the underlying requirement for change. For achieving success, the employees within an organizational setup need to accept and embrace changes in the current business environment. The practice of business process redesign (Hammer & Champy, 1993) has existed for a fairly long time and is undertaken in most cases when any organization feels the need to revisit its primary determinants of success, redesign the practices and procedures which alter the service it renders, and apply the strategic agents of change to develop new success parameters.

Anil Kumar Sardana, the former Managing Director, TPDD, recalls the period when DVB was on its last legs. 'The people, the processes and the premises were no better than the wreckage of a plane crash. We were asked to collect the debris and put it together,' says Sardana (Neelmani, 2006).

Exhibit 6: Cost Details in Automation Department

Reduction in Manpower	Savings due to redeployment of manpower (50 grids with 7 operators per grid and salary @ \$600 per person per month)	\$2.52 million per annum
Downtime Reduction	Savings due to system efficiency	\$0.864 million per annum
Over drawl	Saving due to no over drawl, as compared with other utilities	\$3.6 million per annum
Total		\$6.984 million per annum

Source: Case writer's notes.

DVB, according to Sardana, was brimming with gross malpractices and irregularities. Employees ensured that records were not kept since these would make some of them vulnerable. Sardana also recalls how people thought IT was an infringement of their freedom – the freedom to allow middlemen and brokers to provide connections on behalf of the department and receive kickbacks. DVB did not have a single good example of benchmarking against other agencies. Sardana said there was not even an interest in benchmarking its processes. ‘When we took over from DVB, I saw little or no interest within the company to adopt change management so that we could reach a point where benchmarking was possible,’ says Sardana. To make matters worse, sections of DVB ran off just two desks, which made processes largely manual.

Sardana strongly feels that without IT, they could not have got a noticeable reduction in AT&C losses. Earlier, losses were labelled as T&D (transmission and distribution) losses, which normally describes the difference between the units supplied and what the company billed consumers for. But under the manual regime, employees of DVB could bill consumers and reduce the difference between units supplied and billed for. In short, the losses could artificially be lowered. IT changed that. It also helped create a proud workforce. ‘It brought satisfaction among employees, and a satisfied person at work is a better person at home,’ says Sardana. This change of attitude among employees extended beyond the office and into their homes. TPDD’s office computers were used to train their children after 7 PM every day and on holidays. ‘We want to catch them young. Six hundred have been trained so far,’ says Sardana.

Talent Management and Global Practices

TPDD wanted to ensure that the best talent was attracted and retained for SCADA, which was a very prestigious project for them. To ensure this, TPDD had considered designing suitable HR policies with incentives within its existing policies and procedures. To adopt best global practices, TPDD focused on the areas relating to financial risk profiling to sustain in the loss-making business and computerization to achieve customer satisfaction. TPDD wanted to continue initiatives to adopt best global practices to deliver services to consumers and at the same time perform the role of a power distribution company of the Tata group.

Sustainability of SCADA

As of mid-2012, other state electricity utilities were increasingly coming forward to utilize SCADA to improve electricity reliability. However, Bonga maintained,

We need to become more advanced to remain a front runner in power distribution. Existing SCADA in TPDD is an individual application to control operations of 33KV or 66KV grid substations for the last eight years, but in the near future, TPDD needs to modify its SCADA for integration of various applications like outage planning, limit calculations, and load forecasting.

In future, process-centric application integration will be required where control centre applications are integrated through a service-oriented architecture (SOA). This may involve services, messaging between processes, and short-running workflows. Integration of database-centric applications will enable the exchange of information between databases. Web integration will facilitate users and organizations to collaborate using web-based technologies over the Internet, intranet, or a virtual private network. All these integrations are required for SCADA to sustain in future market. ‘There is good emerging market for power distribution utilities if they use technology with agility. Other state utilities also need to go for advance SCADA systems to sustain in competitive regulated electricity market,’ Bonga added.

THE ROAD AHEAD: NEED TO ADOPT SMART GRID

To sustain within the power industry with limited resources for power generation, transmission, and distribution, it is mandatory for any leading utility to adopt smart grid in the immediate future. SCADA is a pre-requisite for smart grid. Without SCADA, TPDD could not even think of adopting smart grid.

Automation and unmanned substations in TPDD has changed the business process. Motivating other utilities to replicate this concept and adopt new technologies to change consumer’s perspective and enhance employee’s working efficiency is a challenge now. Government regulations towards climate change are diverting many commodity market to depend on electricity (electricity charged vehicles will be preferred) leading to increased demand for power. In view of the existing power

scenario in India, many organizations have already entered into power generation as non-core business realizing the future prospects. The distribution sector is much more complex, and TPDD has shown remarkable improvement and hence the Indian government is also moving towards more privatization of power distribution utilities in the other states of India. Power distribution is dependent on new technologies now and hence the technology developers have a bright business opportunity ahead.

Power system grid has its inherent weaknesses. It is a unidirectional process from the point of generation to the point of consumption. Power is distributed through various stations and substations. Intense manual supervision is required to control power system grid through SCADA system. With power not capable of being stored and consumers having practically no control over the grid system, consumers can at best, restrict its use. They cannot participate in power production and distribution. The use of alternate concept called 'Smart Grid' may be useful in this regard. It allows two-way flows of power and information. It allows real-time monitoring of power use but SCADA is a pre-requisite for implementing smart grid. Communication system are digitized; no individual can take the system to ransom.

Banga emphasized,

Power distribution industry will be like telecom industry in the coming days, with lots of competitions, individual electricity connection on non-payment would be disconnected from remote with 'smart grid' system. Consumers shall be communicated their real time consumption and real time cost of power through electricity smart meters.¹⁷

Through the adoption of the smart grid, consumers will participate and have a stake in power generation

and transmission. This would prevent widespread blackouts by prioritizing the distribution as per pre-set instructions. Many countries such as the US, European Union, Australia, and New Zealand have already taken a lead and are in an advanced stage of using the 'smart grid.' SCADA has made the operations fast and safe, but to meet the future load growth with the existing power system infrastructure, it alone may not be enough. TPDD has to move a step ahead and to deploy the concept of smart grid which includes the automation of micro-level consumer metres.

The Indian power industry is on the verge of a revolutionary transformation as it is working to develop the smart grid to meet the needs of an electronic society. Expectations of consumers and utility commission incentives/penalties are leading changes to the power industry where data are required quickly, on-demand, and in an easy way. Consumers are seeking a higher reliability and greater choice and are willing to evaluate and change their energy-consumption patterns. To achieve this, the concept of smart grid is needed. The smart grid is a prediction-based concept, but it is a strong combination of the electrical grid with the information and communication technology which makes it more reliable and efficient. With the smart grid, higher consumer satisfaction will be achieved along with greater power generation from the power grid, and higher power generation and distribution will result in enhanced asset utilization to a large extent. TPDD has already completed SCADA, DMS, DA, and OMS. These were broad milestones to develop the smart grid, but the biggest challenge would be consumer participation. And, TPDD has taken charge to emerge within the power distribution sector as a shining star to gain long-term consumer faith.

APPENDIX A

Table A.1: Comparative Performance: 2002 Then to 2012 Now

Factor	DVB	TPDD
Power outages	Normally 5 hours a day	Assured 24-hour power supply
Voltage fluctuations	Rampant	Extremely rare
Street lighting	Less than half the street lights were functional	Introduced power-saving initiatives such as LED fixtures for streetlights. The Delhi government subsequently asked other power distribution companies to emulate this pioneering initiative (Vemuri, 2012). All street lights are functional at all times.
Power drawn from grid	5,200 million units	7,500 million units (23% increase)

Table A.1 continued

Table A.1 continued

Pending applications for new connections	20,000 applications	Highly significant as all new connections are installed in a fixed time frame
Industrial units within North Delhi	3,000	18,000 (tremendous growth due to reliability of power supply)
AT&C losses	53%	13%
Computers in use	2	Over 2,000
Metres	Faulty metres	Theft-proofing through tamper-resistant smart metres
Employee behaviour and attitude	Unprofessional and mostly rude	Highly professionalized given the commitment conveyed by being a Tata group business enterprise
Performance benchmark	Absence of any benchmark	China light and Power, Baltimore Gas and Electricity and Mauritius Central Electricity Board
Use of information and computer technology	Virtually none	Extensive use of information and computer technology. For instance setting up of SCADA centre, use of enterprise resource planning (ERP) applications, a distribution management system (DMS), an operations management system (OMS) and software that enabled automated metre reading.
Distribution lines	Low voltage distribution lines	High voltage distribution lines
Aesthetics and safety in open wiring	Totally absent	Insulated aerial bunched cables are installed which improves safety and reduced losses.
Grid stations	Manually operated	Remotely operated grid stations (56 new grid stations)
Customer service	Harrowing experience	Electronic metring, online account management, 24 hour call centre and over 1,00,000 pending complaints resolved within one year have all brought considerable delight to customers overall experience
Company performance	A loss-making government enterprise	A profit-making Tata group company in joint venture with the Delhi Government. TPDD benefitted from Tata Business Excellence Model (TBEM), a quality framework that helps companies strive for and achieve business improvement.
Employee learning and training	No structured mechanism in place	Setting up of separate training centre in 2005 (Centre for Power Efficiency in Distribution) which today renders training not only to employees of TPDD but also to other power companies
Backup plan	Non-existent	Setting up of the Rithala captive power plant as part of TPDD's islanding system to serve as a backup in the case of breakdown (essential in case of hospitals and streetlights).
Cost of distributing electricity	122 paise per unit	2 paise per unit (100 paise makes 1 INR) primarily due to technology interventions
Industry recognition	Not there	Distinction of being recognized as the first success story of power reforms in India
Associated businesses	None	Setting up a wholly-owned subsidiary NDPL Infra, a venture that targets business opportunities outside the licensed area of company's power distribution activities.

Table A.2: Groups formed to Meet Functional Requirement of Power System Control Centre (PSCC)

Group	Responsibilities	Manpower Requirement
A. SCADA Maintenance Group (SMG)	<ul style="list-style-type: none"> a. Database engineering and application development maintenance b. Day-to-day maintenance work and trouble shooting c. Maintenance planning and updating annual maintenance contracts d. Capable of attending all system troubles like system hang, software bugs, and errors 	<p>SMG will consist of Electrical/ Electronics engineers with IT experience related of database administration / maintenance and software application development.</p> <p>Total six executives are required considering control room 24x7 operations. These executives will be in shift duty till the system gets stabilized.</p>

Table A.2 continued

Table A.1 continued

<p>B. Control Room Network Operation Group (NOG)</p>	<p>a. Day-to-day operation including control and monitoring of sub-transmission and distribution network b. Coordinating with field staff to attend planned, unplanned, and emergency outages c. Issuing safety permits d. Generation of Management Information Systems and other reports</p>	<p>NOG will be formed of Electrical Engineers with basic knowledge of network and distribution system. In consultation with the Automation Consultant and PSC (Power system control) it was decided that 5 engineers would be operating SCADA system on a shift basis. In addition, there would be 1 Manager level person in-charge of SCADA operations coming in day shift. Considering 5 operation engineers per shift for manning SCADA terminals, requirement of minimum 24 new executives is projected for 24x7 operations (Exhibit 5). It is proposed to develop Manager/Assistant Manager level executives from this NOG as they would have acquired sufficient experience in network operations /management and dealing with Delhi Transco Ltd. (DTL) and Reliance Energy Ltd (REL). Out of 24, 16 executives can be selected from the existing work force available. Hence additional requirement is 8 executives.</p>
<p>C. Communication Support Group¹⁸ (CSG)</p>	<p>a. Operation and maintenance of communication network which will include terminal equipment, communication system for distribution automation system and trouble shooting in SCADA related to communication system b. Operation and maintenance of physical media that is OPGW, OFC and all dielectric Self-sustaining (ADSS) and radio link c. To provide all future communication requirement for grid station and RMU and their linking with SCADA system d. Coordination with the local area network (LAN) networking group (IT dept). It is envisaged that LAN networking (except SCADA LAN) will be taken care by IT dept separately. e. Terminal equipments have been finalized and training for network management system to be given to executives who will manage the network configuration</p>	<p>CSG in charge with a team of four executives with electronics and communication background are required for maintaining the system.</p>
<p>D. Network Planning and Analysis Group¹⁹ (NPAG)</p>	<p>I. Network Planning</p> <ul style="list-style-type: none"> - Short-term and long-term planning of 66/33/11 kV and 415 V network in view of addition of new grid stations, power transformers, new sources from DTL and new connections/ disconnections, etc. - Preparation of yearly CAPEX (Capital Expenditure) plan for network management i.e. network augmentation/improvement schemes, etc. - Periodic review of the network load growth pattern; Identification of automation points for enhancing reliability; and Improvement of power quality indices - Coordination with SCADA system to get network parameters for load flow analysis <p>II. Commercial Interface</p> <ul style="list-style-type: none"> - All commercial connections of large industrial power (LIP) and small industrial power (SIP) before being sanctioned by commercial group shall be analysed by NPAG for their potential impact and load planning on network. This process shall initially be operational through e-mail approvals; however, low tension (LT) connection below 15 KW will be sent to NPAG for network updating in GIS after field deployment. <p>III. GIS Interface</p> <ul style="list-style-type: none"> - Updating the GIS electrical network. Presently, the GIS group having prepared the GIS map updates it regularly. However, in future, as NPAG will be involved in the process for all new connections/ disconnection and other new schemes, this activity will better be managed by NPAG to keep the electrical network updated in GIS. 	<p>To begin with, this group may be formed by enveloping the existing System engineering group, network planning group available with Corporate Operations Services (COS) and two GIS associates</p>

APPENDIX B: CIRCULAR FOR GRID DEPLOYMENT (RELEVANT EXTRACTS)

The organizational self renewal exercise is a continuous process to keep various systems & processes at the cutting edge of knowledge & practices. To keep pace with the technological advancements being made in power distribution, automation of 33/11 KV grids was being carried by NDPL for past some time. On completion of the preparations, the issue of redeployment of manpower engaged in Grid Operations was considered and discussed with representatives of employees. While deliberations were being held in the matter, the following two prime objectives were identified:

1. To effectively utilize the available technical manpower in the viable functions for gainful employment in the service of organization
2. To provide opportunities to the redeployed manpower for career growth & advancements so that reasonable aspirations could be addressed. Based on consultations with the stakeholders, this Redeployment plan has been finalized for redeployment based on option for conversion of existing Grid operation employees working as SSA-II, SSA-I, SI & SO in Supervisory category, without disturbing their channel of promotion.

The key features of this plan are enumerated below:

- A. Redeployment areas: Based on requirement and available skill set, services of these employees will be utilized in emerging areas such as a. Energy Accounting and Energy Audit; b. Safety deployment, enhancement and Audit; c. O&M functions; and d. Commercial functions
- B. Training & Development needs: Suitable training modules will be designed and imparted for smooth transition and performance oriented contribution by these employees.
- C. Career progression opportunities & associated benefits: 1. Since some of the grids are likely to remain manually operated for some more time, 'Last-In-First-Out' (LIFO) principle will be adopted for redeployment. Accordingly, in this phase, employees currently working as Sub Station Attendant Gr. II, Sub Station Attendant Gr. I, Shift Incharge and Shift Officer will be eligible to exercise their choice for redeployment. 2. The existing designations of the Grid Operation employees shall be retained after redeployment. Functional supervisory designations as applicable will be given in the redeployed areas.

3. Following benefits will be extended to only those eligible Grid operation employees who exercise option for redeployment:
 - a. One promotion will be given in the existing CoP. However, for all employees in S.O. grade who exercise option for redeployment as Sr. S.O. (Selection Scale) will become ₹ 8000–275–13500.
 - b. Functional allowance as shown below will be payable on redeployment.
 - i. Reimbursement of amount equivalent to 40 l. of petrol subject to usage of own 2/4 wheeler for official purpose.
 - ii. Special Pay of ₹ 600.
 - iii. Telephone facility up to 400 calls.
 - c. Upon redeployment and completion of 10 years grade service as Sr. S.O. (Selection Scale) the concerned employee will become eligible for placement as Sr. S.O (Higher Scale) in ₹ 11250–325–13200–350–15300–375–17550.
4. Career progression and transition:
 - Redeployment of grid operation employees will be carried in phased manner and it will be synchronized with the technical aspects of the overall automation plan. Efforts shall be made to complete redeployment of manpower by March 31, 2007. In case some of the employees (who have opted for redeployment) remain in grid designated for manned operation after March 31, 2007 they shall become eligible for benefits as applicable to the ones redeployed.
 - In case of employees opting for redeployment out of grid, eligibility for promotion to next level shall be retained as applicable now. While considering these employees for promotion to next level after completion of eligibility period, vacancy constraints will not be applicable.
 - 22 of the employees currently working as Shift Incharge grade who have not been promoted (because of vacancy constraints; in spite of completing eligibility periods on different dates) since formation of NDPL, will be considered for promotion to S.O. grade if they opt for redeployment out of the grid under this scheme. A special relaxation of 2 years will be considered for such employees while considering them for promotion to next level after that. Similarly one such employee working as SSA Gr. I will also be given special relaxation of one year while being considered for promotion to next level after redeployment. However, promotions shall be subject to performance & other relevant criteria as applicable.

Source: Circular Ref: NDPL/HR/Grddated 05/01/2007

NOTES

- 1 Supervisory Control and Data Acquisition (SCADA).
- 2 There are many models/schemes and modalities to implement PPP. Build-own-operate (BOO); build-develop-operate (BDO); design-construct-manage-finance (DCMF); buy-build-operate (BBO); lease-develop-operate (LDO); wrap-around addition (WAA); build-own-operate-transfer (BOOT); build-rent-own-transfer (BROT); build-lease-operate-transfer (BLOT); build-transfer-operate (BTO); and manage-service-provide (MSP) (Source: *Public-Private Partnership in Indian Infrastructure Development: Issues and Options*. Accessed through http://www.rbi.org.in/scripts/BS_VIEWContent.aspx?ID=1912).
- 3 www.derc.com
- 4 DERC, the state regulatory agency, determines electricity tariffs, promotes competition, efficiency, and economy in power industry, setting standards and directing discoms regarding their work based on consumer-satisfaction survey.
- 5 AT&C loss is the actual measure of the overall efficiency of the distribution business as it measures both technical and commercial losses. AT&C loss $\frac{1}{4}$ (energy input vs. energy realized) $\frac{1}{4}$ (energy realized) $\frac{1}{4}$ (energy billed) $\frac{1}{4}$ (collection efficiency). Collection efficiency $\frac{1}{4}$ amount realized $\frac{1}{4}$ amount billed.
- 6 Without the participation and cooperation of all employees, the company could not have brought the AT&C losses down to the current 12% since most losses were due to commercial rather than technical reasons.
- 7 'We are a recognized part of TATA Group, Along with the achievements and reduction in AT&C losses, we have more challenges and more accountability towards our consumers' – Anil Kumar Choudhary, Former Vice President, Human Resource Management and Administration (Source: Video released on New Year 2012 'TPDDL AAP TAK').
- 8 Established in 2005, this centre helped create a skilled workforce for TPDD and other power distribution companies.
- 9 BSES Rajdhani Power Ltd.
- 10 BSES Yamuna Power Ltd.
- 11 Political, Economic, Sociological, Technological, Legal, and Environmental.
- 12 First power distribution utility from India to win 2008 Edison Award and again the same award in 2009 for Policy Advocacy. Some of the other key recognitions include International Palladium Balanced Scorecard Hall of Fame Award 2008, SAP Ace Award 2008; UPN, USA Metering Award; Asian Power Award 2011 (fifth consecutive year), Asia's Best Employer Brand Award 2011, Falcon Media Group – Best Performing Utility (Urban), India Power Award—Research and Technology and the Asian Power Most Inspirational CEO of the Year 2008 Award (source: www.tatapower-ddl.com).
- 13 Based on customer satisfaction index, inputs such as the reliability of power, quality of power, availability of power, restoration of supply during any fault, etc. were incorporated. Direct customer inputs taken through monthly meetings with resident welfare association (RWA) were also duly considered. Since SCADA significantly improved all these factors, the integration of the customer helpline with the SCADA centre plays an important role for correct and quick information regarding power outage or interruptions.
- 14 In view of the disaster management system, TPDD will have a backup centre located at Inder Puri. The plan is to set up a backup power generation plant to supply key facilities such as hospitals and public lighting. The backup control centre manpower requirements shall be met by the executives already working as SCADA executives.
- 15 Source: Interview with Sanjay Banga (HOD-PSC and Automation) and P. Devanand (HOG-PSC).
- 16 The Delhi Government extended financial support in addition to political support to TPDD, as it did to other power distribution companies in the National Capital Region during the transition period.
- 17 Theft-proofing through tamper-resistant metres and high-voltage transmission lines played a key role in TPDD's success.

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