Qualitative

The power generation business is purely a technical intensive business, having less administrative support. There is no significant difference between private sector and state owned power generation sector, in this regard. But the participation of administrative staff is bit higher in private sector. Therefore the people/staff involvement of power generation plant is comparatively higher in private power generation sector. Dendro power and mini-hydro power plants need more staff involvement for the operation, even though the plant capacities are lower compared to other types of power plants.

When assessing the company involvement in ICT in its power generation business, the no. of computers used in the business is a one indicator. Both technical and administrative staff uses the computers. Since the computer usage is higher, the annual generation is also higher in the private thermal plants when compared to similar type state-owned plants. Therefore more administrative and technical activities will be involved in operation process. This depicts that higher usage of computers and its applications, higher the use of ICT technology and higher the operation process efficiency.

The thermal private power plants use large no. of computers in their business. Most of them are related to operation processes of the power plant, which can be seen in the control room.

Most of mini hydro power plants use less no. of computers in their business. Among those most computers are used as personal computers, which are not directly related to the normal operation at the power plant.

Computer usage is higher in the private thermal plants than similar type state-owned plant. The power generation plants use computer applications, commonly for word processing, data storage & analyzing applications. The usage of other applications in private owned thermal power generation sector is very much high compared to the others. This is because they use monitoring system applications all most every time at the plant operation. They need to update the CEB system control room the status of their power plant. Due to

Mini-hydro sector uses stand alone PCs for other applications such as inventory monitoring systems, Maintenance schedule monitoring system etc. Generally all power plants use non-operational applications such as Word Processing applications and Data Storage & Analyzing applications

It was found that at least one telephone line connection is available for every power plant. State owned power plants and private thermal power plants have several no. of telephone line connections as well as fax connectivity. Most of the private owned mini-hydro power plants have only one line for both telephone and fax connectivity. And most of them do not have Leased Line connectivity, because most of the locations are rural areas.

But when the power plant capacity is more than 5 MW, there should be a remote connectivity (dedicated data line/leased line) between the CEB system control and the power generation plant, to meet the islanding protection (This is a protection policy introduced by CEB to higher capacity mini-hydro power plants).

Most of private owned thermal power plants use Internet and Email applications and they do not use Intranet. Email application is widely used, mainly to exchange data, information and important documents. The usage of Internet is much higher in private power generation sector than the state owned power generation sector. On the other hand min-hydro power generation sector often use these applications

The usage of Internet and Intranet applications in mini-hydro sector is centralized to higher positions in organizational hierarchy such as administrative and technical staff

who work at their head offices. This shows that they do not use ICT technology for their power generations directly.

Quantitative

Computer usage for the operations applications

There is no much difference according to the staff category, i.e. Administrative or Technical. Both categories were in a same position (67% & 67.5% respectively).

State-owned power plants were in much ahead of private owned power plants (80% & 66% respectively).

There is a significant difference between private owned mini-hydro power generation plants and other types of power generation plants. Private owned mini-hydro power plants were below to other types of power plants (55.5%).

Use of Communications Applications in the operations processes

There is a substantial difference between state-owned power generation plants and private owned power generation plants. State-owned power plants were in little ahead of private owned power (79% & 71% respectively).

Private owned mini-hydro power plants & Dendro power plants were in much below to other types of power plants (66% & 62.5% respectively).

WAN (Internet/Intranet etc) Usage

State-owned power plants are in much ahead of private owned power plants in the case of (80% & 47% respectively) This was also mainly because of the private owned mini-hydro sector.

Nevertheless it is mini-hydro power plant, thermal power plant or Dendro power plant, if it is privately owned, then the "WAN usage" is very low compared to State-owned plants (42.25%, 52.75%, & 57.5% respectively). This was mainly because of time spending for these applications, except email applications (Only in mini-hydro

sector, the email usage is lower) were treated as time wasting in private sector. In mini-hydro plants non-availability of WAN was also a reason for this.

Knowledge on ICT and usage of advanced ICT

When considered, the knowledge on available ICT and usage of advanced ICT in its operations processes of the power generation plant, the technical staff is well ahead than the administrative staff (54.42% & 34.48% respectively).

When considered, the knowledge on available ICT and usage of advanced ICT in its operations processes of the power generation plant, the state-owned power plants are well advanced compared to private power generation plants (70% & 48.7% respectively). This is also because of the small-scale Dendro power plants and mini-hydro power plants. But in case of private thermal power plants, this is different.

The state-owned power plants use advanced ICT in their power generation processes nevertheless what would be the power plant type (70%). But in the case of private power generation plants, only thermal power plants use advanced ICT, and it was little higher than the state-owned power plants too (72.2%).

Small-scale private power plants such as Dendro power and mini-hydro power plants use little amount of advanced ICT in their operation processes (39.8% & 38.4% respectively).

Others

Following problems account in introducing ICT to the min-hydro power generation sector.

- Hardware failures: computer technicians were not available at the rural sites. Hence hardware failures happened to be attended by the head office centers, which often take weeks if not months.

- Narrowband limitations: due to the absence of broadband, projects have to depend on dialup connections. The deficiencies of the Telecom networks hardly could build the consumer confidence on smooth browsing.

- Content deficiency: locally relevant content material was not available to meet the demands of the target community.

- Local language deficiency: the available software were limited to English language. Absence of local language material caused a biggest obstacle against the use of ICT tools by target community.

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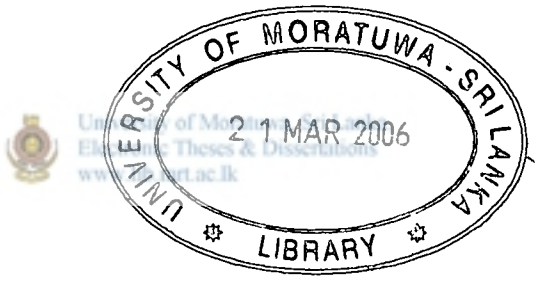

Appendix 1

Questionnaire

.....

I, Priyantha S Dissanayake, a student of MBA/IT program being conducted by University of Moratuwa, kindly request you to fill this questionnaire in order to collect some valuable data, information and suggestions from you, to the best of your knowledge, to do my research project of the program. Please be smart enough to spend few minutes to go through the questionnaire and give your remarkable response.

Note: * If you would like not to fill those blanks you may leave it as it is.

.....

Part A

Name*: .....
Occupation: .....
Company Name: .....
Main Business Focus of the Company: .....
Diversified Business Areas: .....

Your organization is involving on Private/State owned Power Generation? YES / NO

❖ Plants' details of your organization

Plant (Name*)	Type of plant**	Status***	Started In (Month/Year)	Capacity (MW)	Energy Generated (GWh)/annum

** Type of plant would be Diesel, Mini-Hydro, Micro-Hydro, Dendro, Wind, Gas Turbine, Combine Cycle or Other.
***Status indicates that your project is in operation or still in the pipe line.

❖ Staff allocated (# people allocated for each plants)

Plant (Name*)	Operational Staff	Administrative Staff

❖ O & M Expenses

Plant (Name*)	O & M Costs (Rs.) / annum

Total annual income through all plants is .....

Money Allocated for community development ..... per annum.

❖ Indirect job opportunities

Plant (Name*)	Description

❖ Computer Usage for Applications

- No. of computers involve in the business/power generation business? .....
- Application software usage

Description	Software Name	Time spent for the application (hrs/day or week)
1. Word Processing applications	MS Office & Project Management Other:	....
2. Data Storage & Analyzing applications	....	....
3. Other Applications	....	....

❖ Use of Communication Applications

- No. of T.P / Faxes / Leased Lines (Data Lines)? T.P..... Fax Lines..... LL.....

Description of Communication Application	Time spent / day
1. Data Transferring - Fax	
2. Data Transferring - LL	
3. T.P. Communication – T.P.	
4.	
5.	

❖ WAN (Internet/Intranet) Usage

Description of WAN Application	Time spent / day
1. Data/Info gathering	
2. Uploading Information	
3. Visit the Intranet	
4.	
5.	

❖ Your New Ideas

Description	ICT Involvement (SW/HW etc.)	Effect to the Main Operation

Special Comments about the usage of ICT (current usage & ICT usage potential) in your business operations.

.....
.....
.....
.....
.....
.....
.....
.....
.....

Date:.....

Part B

Summary of IT Vs Power Generation in the Organization

Description	Exist	Planned to implement	Recommend	Not-recommend	
					Reason
Essential IT product/services categories					
Distributed control systems					
Process control systems					
Programmable logic controllers					
Control/automation/supervisory system software and hardware					
Process optimization software/neural networks					
Plant design software					
Document management					
Enterprise management software/systems					
Electricity (energy) management software					
Computerized maintenance management systems					
Simulators and training software					
Advanced instrumentation/sensors and predictive maintenance devices					
Environmental compliance management					
Essential IT functions at the plant					
Plant design, budgeting, and estimating					
Detailed plant design, control, supervision and safety					
Environmental compliance					
Automating maintenance records					
Real-time control and optimization					
Communications among workers					
Remote communications to corporate					
Performance monitoring					
Financial calculations (real-time economic information)					
Network management (in-plant like Fieldbus, external like Internet, etc.)					

	Yes	No	Not related; Reason
How IT changes, and is integrated into, the personnel organization and cultures			
Minimizing people			
Making work safer			
Focusing on results			
Moving towards predictive maintenance			
Pushing the envelope on operations and performance			
Breaking down barriers between departments (i.e., maintenance and operations)			

Date:.....

Acknowledgement

I appreciate your support given to me in giving the valuable information to succeed my effort, which will be very useful for our own society some day.

Priyantha S Dissanayake
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MBA in Information Technology
University of Moratuwa, Sri Lanka.

Appendix 2

General Data of the Evaluators

No.	Occu. Category	Company	Project Name	Start Operation	Capacity	Type*	Energy Generated GWh / annum	No. of Staff	
								Technical	Admin
1	Technical & Admin.	CEB	GT7 Gas Turbine	Aug, 1997	115 MW	G	600 (Avg)	25	4
2	Technical & Admin.	AES Kelanitissa Pvt. Ltd.	AES Kelanitissa	Oct, 2003	168.1 MW	Com	1100 (Avg)	35	10
3	Technical & Admin.	Hayleys Industrial Solutions	-	Nov, 2004	0.2 MW	MnH	0.9	5	2
4	Technical & Admin.	Vidullanka Limited	BBO	July, 2001	3.2 MW	MnH	11.6	15	7
5	Administrative	Vidullanka Limited	BBO	July, 2001	3.2 MW	MnH	11.6	15	7
6	Administrative & Tech.	Vidullanka Limited	BBO	July, 2001	3.2 MW	MnH	11.6	15	7
7	Technical	Lanka Transformers Ltd.	Walapane DPP	2005	1 MW	Dn	7	10	3
8	Technical	Catapilar O&M - Kooler (Pvt).Ltd.	ACE Power Gen. - Ambilipitiya Ltd.	April, 2005	100 MW	HFO	830	72	8
9	Technical	Lanka Transformers Ltd.	Heladanavi Ltd.	Sep, 2004	100 MW	DI	700	45	9
10		Lanka Transformers Ltd.	Lakdanevi Ltd.	1997	24 MW	DI	168	40	5
11	Technical	Watsila Lanka Pvt. Ltd	ACE Power Gen. - Horana Ltd.	Dec, 2002	25.5 MW	HFO	212	12	4
12	Technical	Watsila Lanka Pvt. Ltd	ACE Power Gen. - Horana Ltd.	Dec, 2002	25.5 MW	HFO	212	12	4
13	Administrative	Lanka Transformers Ltd.	Heladanavi Ltd.	Sep, 2004	100 MW	DI	700	45	9
14	Technical & Admin.	CEB	Kothmale Hydro Power		195 MW	H	100 (Avg)	55	8
15	Technical & Admin.	Hydro Power International	Niriella	2004	4 MW	MnH	15.8	8	2
16	Technical	Eco Power (Pvt) Ltd.	Alupola MHP	2003	2.5 MW	MnH	5.5	6	2
17	Administrative	Eco Power (Pvt) Ltd.	Alupola MHP	2003	2.5 MW	MnH	5.5	6	2
18	Technical & Admin.	Maskeliya Plantation	Brunswic MHP	2003	0.6 MW	MnH	2.1	3	1
19	Technical	Powerbase Technology (Pvt) Ltd.	Wee Oya MHP	2004	1.8 MW	MnH	8.4	6	1
20	Administrative	Hydrodynamics (Pvt.) Ltd.	Atabage Oya MHP	2003	2.2 MW	MnH	5.8	5	3
21	Technical	Hydrodynamics (Pvt.) Ltd.	Atabage Oya MHP	2003	2.2 MW	MnH	5.8	5	3
22	Technical & Admin.	Eco Power (Pvt) Ltd.	Hulu Ganga MHP	2003	3 MW	MnH	10.5	8	2
23	Technical & Admin.	Zyrex Power Co. Erathna Ltd.	Waranagala MHP	2003	9.9 MW	MnH	39.0	12	2
24	Technical & Admin.	Zyrex Power Co. Ltd.	Delgoda MHP	1999	2.6 MW	MnH	8.0	10	3
25	Technical & Admin.	Zyrex Power Co. Ltd.	Rakwanaganga MHP	1998	0.76 MW	MnH	1.7	5	2

Not

* Type of plant would be Diesel (DI), Heavy Fuel Oil (HFO), Mini-Hydro (MnH), Micro-Hydro (McH), Hydro (H), Dendro (Dn), Wind (W), Gas Turbine (G), Combine Cycle (Com) or

* Occupation Category would be Technical, Administrative, Technical Administrative (Perform administrative tasks also having technical background) , Administrative Technical (Handle

Appendix 3

Answers to Indicators identified in the Operationalization Process

Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Computer Usage for Applications																									
§ No. of computers involve in the business	8	20+20	3	7	7	7	5	6+8	3+11	2+7	3+5	3+5	3+11	8+6	3	2	2	1	3	1	1	2	7	2	1
§ Application software usage (hr/day) - 8 working hours per day																									
Word Processing applications	5	1	1	2	4	1	2	1	3	2	1	1	3	2	1	1	2	2	1	2	2	1	3	2	1
Data Storage & Analyzing applications	5	4	1	4	1	3	3	2	4	3	2	2	3	3	3	2	1	2	2	1	1	1	2	1	1
Other Applications *	-	-	-	1.2	3	3	1	6	6	6	6	6	1	2	1	1	1	1	2	2	1	1	2	1	1
Use of Communication Applications																									
§ No. of T.P Lines	2	10	1	3	3	3	1	7	5	4	4	4	5	3	1	1	1	1	1	1	1	1	3	1	1
No. of Faxes	1	2	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2	1	1
No. of Leased Lines (Data Lines) - speed	1-ADSL	1	-	1 (64 kb	1 (64 kb	1 (64 kb	-	1	1	1	-	-	1	1	-	-	-	-	-	-	-	-	1	-	-
§ Usage of communication Applications (hrs./day)																									
Data Transferring - Fax	0.5	5 min	5 min	20 min	10 min	5 min	10 min	0.5	10 min	10 min	10 min	11 min	15 min	15 min	5 min	5 min	5 min	10 min	10 min	5 min	10 min	5 min	10 min	10 min	5 min
Data Transferring - LL	1	1 ~ 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T.P. Communication – T.P.	8	0.5	10 min	4	5	2	2	0.5	0.5	0.5	0.5	1.5	2	2	3	2	2	2	2	3	2	2	4	3	1
WAN (Internet/Intranet) Usage (hrs./day)																									
§ Data / Info. gathering	2	3	-	4	1	1	1	-	1	1	-	-	2	2	3	2	3	-	-	2	-	-	2	-	-
§ Uploading Information	1	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
§ Visit the Intranet	2	-	-	1	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
§ Email	0.5	2	2	2.5	3	4	1	15 min	4	4	0.5	1.5	3	1	4	2	2	-	-	2	-	-	2	-	-

Appendix 4

Summary of the Answers for Identified parameters of "IT Vs Power Generation in the Organization"

Parameters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Essential IT product/services categories																									
Distributed control systems	1	1	4	3	-	4	4	1	1	1	4	4	-	4	4	4	-	4	4	-	4	4	4	4	4
Process control systems	1	1	4	3	-	3	3	1	1	1	1	1	-	1	3	1	-	1	1	-	1	1	1	1	1
Programmable logic controllers	1	1	4	3	-	3	1	1	1	1	1	1	-	1	1	1	-	1	1	-	1	1	1	1	1
Control/automation/supervisory system software and hardware	1	1	4	4	-	4	4	1	1	1	1	1	-	1	4	1	-	4	4	-	4	3	1	4	4
Process optimization software/neural networks	1	4	4	3	-	4	3	1	1	1	3	3	-	1	1	1	-	3	4	-	3	4	1	3	3
Plant design software	1 (GT P	4	4	4	-	3	4	4	4	4	4	4	-	4	1	4	-	4	3	-	4	4	4	4	4
Document management	3	1	2	2	2	2	3	3	2	2	1	1	2	3	3	2	2	4	4	2	4	4	3	4	4
Enterprise management software/systems	4	4	4	4	-	4	4	3	1	1	4	4	-	4	4	4	-	4	4	-	4	4	4	4	4
Electricity (energy) management software	3	4	3	4	-	3	4	4	4	4	4	4	-	4	4	4	-	4	3	-	4	4	4	4	4
Computerized maintenance management systems	3	1	3	1	1	1	2	2	1	1	2	2	1	1	2	1	1	3	3	1	3	2	1	3	3
Simulators and training software	3	1	4	3	-	3	3	3	1	1	1	1	-	1	4	3	-	4	3	-	3	4	1	3	3
Advanced instrumentation/sensors and predictive maintenance devices	1	1	3	2	-	3	3	1	1	1	2	2	-	1	3	1	-	3	3	-	3	2	1	3	3
Environmental compliance management	3	1	4	3	-	3	2	1	1	1	2	2	1	4	4	4	1	4	4	-	4	4	4	4	4
Essential IT functions at the plant																									
Plant design, budgeting, and estimating	3	1	4	4	-	3	3	1	4	4	4	4	3	1	1	4	3	4	4	-	4	4	4	4	4
Detailed plant design, control, supervision and safety	1	1	4	4	-	3	3	1	1	1	1	1	1	1	3	4	1	4	4	-	4	4	4	4	4
Environmental compliance	3	1	4	3	-	3	3	1	1	1	1	1	1	4	4	4	1	4	4	-	4	4	4	4	4
Automating maintenance records	3	1	4	2	2	2	2	1	1	1	1	1	1	1	3	3	1	4	3	2	3	3	2	3	3
Real-time control and optimization	3	1	4	4	-	3	3	1	1	1	1	1	-	1	1	1	-	3	3	-	3	3	1	3	3
Communications among workers	3	4	3	4	-	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Remote communications to corporate	3	1	4	2	-	2	4	3	2	2	2	2	2	3	4	1	1	1	1	1	1	1	1	1	1
Performance monitoring	1	1	3	3	-	3	3	1	1	1	1	1	-	1	3	1	-	2	2	-	2	1	1	3	3
Financial calculations (real-time economic information)	3	1	3	4	1	1	2	1	3	3	3	3	2	1	1	4	2	3	4	1	4	4	4	4	4
Network management (in-plant like Fieldbus, external like Internet, etc.)	1	1	4	4	-	4	4	1	1	1	1	1	-	3	4	4	-	4	4	-	4	4	1	4	4
How IT changes, and is integrated into, the personnel organization and cultures																									
Minimising People	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Making work safer	1	1	1	1	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	1	1	1
Focusing on results	1	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Moving towards Predictive Maintenance	1	1	3	1	-	1	1	1	1	1	1	1	-	1	1	1	-	1	3	-	1	1	1	1	1
Pushing the envelope on operation and performance	1	1	3	1	-	1	1	1	1	1	1	1	-	1	1	1	-	1	1	-	1	1	1	1	1
Breaking down barriers between departments (i.e. maintenance and operations dpts.)	1	3	3	1	-	1	3	3	3	3	3	3	-	1	3	3	-	3	3	-	3	3	3	3	3

Note:

1. Evaluvator no. 2 uses DCS & PCS namely "Mark 5" for gas turbine, "ProControl-ABB" for Steam turbine, "ABB Insy90" for Overall process control and SCADA System. Environment compliance mgt can be done in DCS.
2. Evaluator no. 8 - Even though thery have PCS..there are some more to be implemented..
3. Evaluator no.11 - Workitorki are used..and also ext. codes are used for internal communications among the workers.

Appendix 5

Scores taken by both staff category in power generation sector (Ref Table 4.3.)

	Parameters	Weight	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Avg.Score (S)
Computer Usage for Applications		**20**	***16***	***14***	***9***	***16***	***16***	***17***	***20***	***19***	***17***	***17***	***16***	***12***	***9***	***10***	***11***	***9***	***8***	***16***	***9***	***8***	***13.5***
A	§ No. of computers involve in the business	10	10	10	7	10	10	10	10	10	10	10	10	7	5	5	7	5	5	10	5	5	8
	§ Application software usage (hr/day) - 8 working hours per day																						
B	Word Processing applications	3	3	1	1	2	2	1	3	2	1	1	2	1	1	2	1	2	1	3	2	1	1.7
C	Data Storage & Analyzing applications	3	3	3	1	3	3	2	3	3	2	2	3	3	2	2	2	1	1	2	1	1	2.2
D	Other Applications *	4	0	0	0	1	1	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1.6

Appendix 6

Scores taken by State-owned & private power generation plants (Ref. table 4.4.)

	Parameters	Weight	1	2	Avg. Score (S)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Avg. Score (S)
Computer Usage for Applications		**20**	***18***	***16***	**16**	***14***	***9***	***18***	***18***	***18***	***18***	***17***	***20***	***19***	***17***	***17***	***17***	***12***	***9***	***9***	***10***	***11***	***8***	***9***	***8***	***16***	***9***	***8***	**13.2**
A	§ No. of computers involve in the business	10	10	10	10	10	7	10	10	10	10	10	10	10	10	10	10	7	5	5	5	7	5	5	5	10	5	5	7.9
	§ Application software usage (hr/day) - 8 working hours per day																												
B	Word Processing applications	3	3	2	2.5	1	1	2	3	1	2	1	3	2	1	1	3	1	1	2	2	1	2	2	1	3	2	1	1.7
C	Data Storage & Analyzing applications	3	3	3	3	3	1	3	1	3	3	2	3	3	2	2	3	3	2	1	2	2	1	1	1	2	1	1	2.0
D	Other Applications *	4	0	1	0.5	0	0	1	2	2	1	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1.7

Appendix 7

Scores taken by each type of power generation plant (Ref. table 4.5.)

	Parameters	Weight	Thermal-SO	Hydro-SO	Dendro-PO	Thermal-PO								Mini-Hydro-PO															
			Avg. Score (S)	Avg. Score (S)	Avg. Score (S)	1	2	3	4	5	6	7	Avg. Score (S)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Avg. Score (S)
Computer Usage for Applications		**20**	***16***	***16***	***16***	***14***	***17***	***20***	***19***	***17***	***17***	***17***	17.3	***9***	***16***	***16***	***16***	***12***	***9***	***9***	***10***	***11***	***9***	***9***	***8***	***16***	***9***	***8***	**11.1**
A	§ No. of computers involve in the business	10	10	10	10	10	10	10	10	10	10	10	10	7	10	10	10	7	5	5	5	7	5	5	5	10	5	5	6.7
	§ Application software usage (hr/day) - 8 working hours per day																												
B	Word Processing applications	3	3	2	2	1	1	3	2	1	1	3	1.7	1	2	3	1	1	1	2	2	1	2	2	1	3	2	1	1.7
C	Data Storage & Analyzing applications	3	3	3	3	3	2	3	3	2	2	3	2.6	1	3	1	3	3	2	1	2	2	1	1	1	2	1	1	1.7
D	Other Applications *	4	0	1	1	0	4	4	4	4	4	1	3	0	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1.1

Appendix 8

Scores taken by State-owned & private power generation plants (Ref. table 4.7.)

Parameters		Weight	State-Owned			Private																							
			1	2	Avg. Score (S)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Avg. Score (S)
Use of Communication Applications		**40**	***32***	***31***	**31.5**	***38***	***25***	***30***	***30***	***30***	***25***	***34***	***33***	***33***	***30***	***30***	***33***	***25***	***25***	***25***	***25***	***25***	***25***	***25***	***25***	***31***	***25***	***25***	**28.3**
E	§ No. of T.P Lines	10	5	7	6	10	5	7	7	7	5	10	10	10	10	10	10	5	5	5	5	5	5	5	5	7	5	5	6.9
F	No. of Faxes	8	6	7	6.5	7	6	6	6	6	6	7	6	6	6	6	6	6	6	6	6	6	6	6	6	7	6	6	6.1
G	No. of Leased Lines (Data Lines) - speed	4	3	3	3	3	0	3	3	3	0	3	3	3	0	0	3	0	0	0	0	0	0	0	0	3	0	0	1.2
	§ Usage of communication Applications (hrs./day)																												
H	Data Transferring - Fax	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
I	Data Transferring - LL	4	4	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2
J	T.P. Communication – T.P.	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8

Appendix 9

Scores taken by each type of power generation plant (Ref. table 4.8.)

	Parameters	Weight	Thermal-SO	Hydro-SO	Dendro-PO	Thermal-PO								Mini-Hydro-PO														
			Avg. Score (S)	Avg. Score (S)	Avg. Score (S)	1	2	3	4	5	6	7	Avg. Score (S)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Avg. Score (S)
	Use of Communication Applications	***40***	***32***	***31***	***25***	***38***	***34***	***33***	***33***	***30***	***30***	***33***	***33***	***25***	***30***	***30***	***30***	***25***	***25***	***25***	***25***	***25***	***25***	***25***	***25***	***31***	***25***	***25***	***26.4***
E	§ No. of T.P Lines	10	5	7	5	10	10	10	10	10	10	10	10	5	7	7	7	5	5	5	5	5	5	5	5	7	5	5	5.5
F	No. of Faxes	8	6	7	6	7	7	6	6	6	6	6	6.3	6	6	6	6	6	6	6	6	6	6	6	6	7	6	6	6.1
G	No. of Leased Lines (Data Lines) - speed	4	3	3	0	3	3	3	3	0	0	3	2.1	0	3	3	3	0	0	0	0	0	0	0	0	3	0	0	0.8
	§ Usage of communication Applications (hrs./day)																											
H	Data Transferring - Fax	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
I	Data Transferring - LL	4	4	0	0	4	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J	T.P. Communication – T.P.	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8

Appendix 10

Scores taken by State-owned & private power generation plants (Ref. table 4.10.)

Parameter		Weight	State-Owned			Private																							
			1	2	Avg. Score (S)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Avg. Score (S)
WAN (Internet/Intranet) Usage (hrs./day)		**40**	***37***	***27***	***32***	***30***	***15***	***32***	***33***	***28***	***23***	***15***	***23***	***23***	***15***	***15***	***27***	***30***	***27***	***35***	***0***	***0***	***0***	***27***	***0***	***27***	***0***	***0***	***18.5***
K	§ Data / Info. gathering	15	12	12	12	15	0	12	8	8	8	0	8	8	0	0	12	15	12	15	0	0	0	12	0	12	0	0	6.3
L	§ Uploading Information	5	5	0	2.5	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2
M	§ Visit the Intranet	5	5	0	2.5	0	0	5	5	5	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0.9
N	§ Email	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	0	0	0	15	0	15	0	0	11.1

Appendix 11

Scores taken by State-owned & private power generation plants (Ref. table 4.11.)

			Thermal-SO	Hydro-SO	Dendro-PO	Thermal-PO								Mini-Hydro-PO														
Parameter		Weight	Avg. Score (S)	Avg. Score (S)	Avg. Score (S)	1	2	3	4	5	6	7	Avg. Score (S)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Avg. Score (S)
WAN (Internet/Intranet) Usage (hrs./day)		40	37	27	23	30	15	23	23	15	15	27	21.1	15	32	33	28	30	27	35	0	0	0	27	0	27	0	0	16.9
K	§ Data / Info. gathering	15	12	12	8	15	0	8	8	0	0	12	6.1	0	12	8	8	15	12	15	0	0	0	12	0	12	0	0	6.3
L	§ Uploading Information	5	5	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0.3
M	§ Visit the Intranet	5	5	0	0	0	0	0	0	0	0	0	0	0	5	5	5	0	0	5	0	0	0	0	0	0	0	0	1.3
N	§ Email	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	0	0	0	15	0	15	0	0	9

Appendix 12

Scores taken by both staff category in power generation sector (Ref. table 4.13.)

Parameter	Weight	Administrative Staff						Technical Staff																			
		1	2	3	4	5	Avg. Score	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Avg. Score
Essential IT product/services categories	60	11	27	15	15	11	16	44	44	9.2	28	23	41	51	47	36	39	38	27	37	20	24	22	24	38	22	22	31.9
Distributed control systems	4	0	0	0	0	0	0	4	4	0	2	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	1.1
Process control systems	6	0	3	0	0	0	0.6	6	6	0	3	3	6	6	4	6	6	6	3	6	6	6	6	6	6	6	6	5.2
Programmable logic controllers	6	0	3	0	0	0	0.6	6	6	0	3	6	6	6	4	6	6	6	6	6	6	6	6	6	6	6	6	5.5
Control/automation/supervisory system software and hardware	4	0	0	0	0	0	0	4	4	0	0	0	4	4	4	4	4	4	0	4	0	0	0	2	4	0	0	2.1
Process optimization software/neural networks	4	0	0	0	0	0	0	4	0	0	2	2	4	4	4	2	2	4	4	4	2	0	2	0	4	2	2	2.4
Plant design software	4	0	2	0	0	0	0.4	4	0	0	0	0	0	0	0	0	0	0	4	0	0	2	0	0	0	0	0	0.5
Document management	4	3.2	3.2	3.2	3.2	3.2	3.2	2	4	3.2	3.2	2	2	3.2	3.2	4	4	2	2	3.2	0	0	0	0	2	0	0	2
Enterprise management software/systems	4	0	0	0	0	0	0	0	0	0	0	0	2	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0.5
Electricity (energy) management software	4	0	2	0	0	0	0.4	2	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0.3
Computerized maintenance management systems	8	8	8	8	8	8	8	4	8	2	8	3.2	3.2	8	8	4	6.4	8	6.4	8	4	4	4	6.4	8	4	4	5.6
Simulators and training software	4	0	2	0	0	0	0.4	2	4	0	2	2	2	4	4	4	4	4	0	2	0	2	2	0	4	2	2	2.3
Advanced instrumentation/sensors and predictive maintenance devices	4	0	2	0	0	0	0.4	4	4	2	3.2	2	4	4	4	3.2	3.2	4	2	4	2	2	2	3.2	4	2	2	3
Environmental compliance management	4	0	2	4	4	0	2	2	4	0	2	3.2	4	4	4	3.2	3.2	0	0	0	0	0	0	0	0	0	0	1.5
Essential IT functions at the plant	40	7.2	20	24	25	15	18.48	26	36	6	10	16	38	33	33	33	33	32	22	18	15	15	15	16	23	14	14	22.52
Plant design, budgeting, and estimating	4	0	2	2	2	0	1.2	2	4	0	0	2	4	0	0	0	0	4	4	0	0	0	0	0	0	0	0	1
Detailed plant design, control, supervision and safety	4	0	2	4	4	0	2	4	4	0	0	2	4	4	4	4	4	4	2	0	0	0	0	0	0	0	0	1.8
Environmental compliance	4	0	2	4	4	0	2	2	4	0	2	2	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	1.5
Automating maintenance records	4	3.2	3.2	4	4	3.2	3.5	2	4	0	3.2	3.2	4	4	4	4	4	4	2	2	0	2	2	2	3.2	2	2	2.7
Real-time control and optimization	4	0	2	0	0	0	0.4	2	4	0	0	2	4	4	4	4	4	4	4	4	2	2	2	2	4	2	2	2.8
Communications among workers	4	0	0	4	4	4	2.4	2	0	2	0	0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3.2
Remote communications to corporate	4	0	3.2	3.2	4	4	2.9	2	4	0	3.2	0	2	3.2	3.2	3.2	3.2	2	0	4	4	4	4	4	4	4	4	2.9
Performance monitoring	4	0	2	0	0	0	0.4	4	4	2	2	2	4	4	4	4	4	4	2	4	3.2	3.2	3.2	4	4	2	2	3.3
Financial calculations (real-time economic information)	4	4	4	3.2	3.2	4	3.7	2	4	2	0	3.2	4	2	2	2	2	4	4	0	2	0	0	0	0	0	0	1.7
Network management (in-plant like Fieldbus, external like Internet, etc.)	4	0	0	0	0	0	0	4	4	0	0	0	4	4	4	4	4	2	0	0	0	0	0	0	4	0	0	1.7
	100	18	48	40	40	26	34.48	70	80	15	39	40	79	84	80	70	72	70	49	55	35	39	37	40	61	36	36	54.42

Appendix 13

Scores taken by State-owned & private power generation plants (Ref. table 4.14.)

Parameter	Weight	State-owned			Private																							
		1	2	Avg. Score	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Avg. Score
Essential IT product/services categories	*60*	*44*	*38*	*41*	*44*	*9.2*	*28.4*	*11.2*	*27.2*	*23.4*	*41.2*	*51.2*	*47.2*	*36.4*	*38.8*	*15.2*	*27.4*	*37.2*	*15.2*	*20*	*24*	*11.2*	*22*	*23.6*	*38*	*22*	*22*	*27.7*
Distributed control systems	4	4	0	2	4	0	2	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8
Process control systems	6	6	6	6	6	0	3	0	3	3	6	6	4	6	6	0	3	6	0	6	6	0	6	6	6	6	6	4.1
Programmable logic controllers	6	6	6	6	6	0	3	0	3	6	6	6	4	6	6	0	6	6	0	6	6	0	6	6	6	6	6	4.3
Control/automation/supervisory system software and hardware	4	4	4	4	4	0	0	0	0	0	4	4	4	4	4	0	0	4	0	0	0	0	0	2	4	0	0	1.5
Process optimization software/neural networks	4	4	4	4	0	0	2	0	0	2	4	4	4	2	2	0	4	4	0	2	0	0	2	0	4	2	2	1.7
Plant design software	4	4	0	2	0	0	0	0	2	0	0	0	0	0	0	0	4	0	0	0	2	0	0	0	0	0	0	0.3
Document management	4	2	2	2	4	3.2	3.2	3.2	3.2	2	2	3.2	3.2	4	4	3.2	2	3.2	3.2	0	0	3.2	0	0	2	0	0	2.3
Enterprise management software/systems	4	0	0	0	0	0	0	0	0	0	2	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4
Electricity (energy) management software	4	2	0	1	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0.3
Computerized maintenance management systems	8	4	8	6	8	2	8	8	8	3.2	3.2	8	8	4	6.4	8	6.4	8	8	4	4	8	4	6.4	8	4	4	6.1
Simulators and training software	4	2	4	3	4	0	2	0	2	2	2	4	4	4	4	0	0	2	0	0	2	0	2	0	4	2	2	1.8
Advanced instrumentation/sensors and predictive maintenance devices	4	4	4	4	4	2	3.2	0	2	2	4	4	4	3.2	3.2	0	2	4	0	2	2	0	2	3.2	4	2	2	2.4
Environmental compliance management	4	2	0	1	4	0	2	0	2	3.2	4	4	4	3.2	3.2	4	0	0	4	0	0	0	0	0	0	0	0	1.6
Essential IT functions at the plant	*40*	*26*	*32*	*29*	*36*	*6*	*10.4*	*7.2*	*20.4*	*16.4*	*38*	*33.2*	*33.2*	*33.2*	*33.2*	*24.4*	*22*	*18*	*25.2*	*15.2*	*15.2*	*15.2*	*15.2*	*16*	*23.2*	*14*	*14*	*21.1*
Plant design, budgeting, and estimating	4	2	4	3	4	0	0	0	2	2	4	0	0	0	0	2	4	0	2	0	0	0	0	0	0	0	0	0.9
Detailed plant design, control, supervision and safety	4	4	4	4	4	0	0	0	2	2	4	4	4	4	4	4	2	0	4	0	0	0	0	0	0	0	0	1.7
Environmental compliance	4	2	0	1	4	0	2	0	2	2	4	4	4	4	4	4	0	0	4	0	0	0	0	0	0	0	0	1.7
Automating maintenance records	4	2	4	3	4	0	3.2	3.2	3.2	3.2	4	4	4	4	4	4	2	2	4	0	2	3.2	2	2	3.2	2	2	2.8
Real-time control and optimization	4	2	4	3	4	0	0	0	2	2	4	4	4	4	4	0	4	4	0	2	2	0	2	2	4	2	2	2.3
Communications among workers	4	2	4	3	0	2	0	0	0	0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3
Remote communications to corporate	4	2	2	2	4	0	3.2	0	3.2	0	2	3.2	3.2	3.2	3.2	3.2	0	4	4	4	4	4	4	4	4	4	4	3
Performance monitoring	4	4	4	4	4	2	2	0	2	2	4	4	4	4	4	0	2	4	0	3.2	3.2	0	3.2	4	4	2	2	2.6
Financial calculations (real-time economic information)	4	2	4	3	4	2	0	4	4	3.2	4	2	2	2	2	3.2	4	0	3.2	2	0	4	0	0	0	0	0	2.0
Network management (in-plant like Fieldbus, external like Internet, etc.)	4	4	2	3	4	0	0	0	0	0	4	4	4	4	4	0	0	0	0	0	0	0	0	0	4	0	0	1.2
Total	**100**	**70**	**70**	**70**	**80**	**15**	**39**	**18**	**48**	**40**	**79**	**84**	**80**	**70**	**72**	**40**	**49**	**55**	**40**	**35**	**39**	**26**	**37**	**40**	**61**	**36**	**36**	**48.7**

Scores taken by each type of power generation plant (Ref. table 4.15.)

Parameter	Weight	Thermal-SO	Hydro-SO	Dendro-PO	Thermal-PO								Mini-Hydro-PO															
		Avg. Score (S)	Avg. Score (S)	Avg. Score (S)	1	2	3	4	5	6	7	Avg. Score (S)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Avg. Score (S)
Essential IT product/services categories	*60*	*44*	*38*	*23.4*	*44*	*41.2*	*51.2*	*47.2*	*38.4*	*38.8*	*15.2*	*39.1*	*9.2*	*28.4*	*11.2*	*27.2*	*27.4*	*37.2*	*15.2*	*20*	*24*	*11.2*	*22*	*23.6*	*38*	*22*	*22*	*22.6*
Distributed control systems	4	4	0	0	4	4	4	4	0	0	0	2.3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Process control systems	6	6	6	3	6	6	6	4	6	6	0	4.9	0	3	0	3	3	6	0	6	6	0	6	6	6	6	6	3.8
Programmable logic controllers	6	6	6	6	6	6	6	4	6	6	0	4.9	0	3	0	3	6	6	0	6	6	0	6	6	6	6	6	4
Control/automation/supervisory system software and hardware	4	4	4	0	4	4	4	4	4	4	0	3.4	0	0	0	0	0	4	0	0	0	0	0	2	4	0	0	0.7
Process optimization software/neural networks	4	4	4	2	0	4	4	4	2	2	0	2.3	0	2	0	0	4	4	0	2	0	0	2	0	4	2	2	1.5
Plant design software	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0	0	2	0	0	0	0	0	0	0.5
Document management	4	2	2	2	4	2	3.2	3.2	4	4	3.2	3.4	3.2	3.2	3.2	3.2	2	3.2	3.2	0	0	3.2	0	0	2	0	0	1.8
Enterprise management software/systems	4	0	0	0	0	2	4	4	0	0	0	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity (energy) management software	4	2	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0.4
Computerized maintenance management systems	8	4	8	3.2	8	3.2	8	8	4	6.4	8	6.5	2	8	8	8	6.4	8	8	4	4	8	4	6.4	8	4	4	6.1
Simulators and training software	4	2	4	2	4	2	4	4	4	4	0	3.1	0	2	0	2	0	2	0	0	2	0	2	0	4	2	2	1.2
Advanced instrumentation/sensors and predictive maintenance devices	4	4	4	2	4	4	4	4	3.2	3.2	0	3.2	2	3.2	0	2	2	4	0	2	2	0	2	3.2	4	2	2	2
Environmental compliance management	4	2	0	3.2	4	4	4	4	3.2	3.2	4	3.8	0	2	0	2	0	0	4	0	0	0	0	0	0	0	0	0.5
Essential IT functions at the plant	*40*	*26*	*32*	*16.4*	*36*	*38*	*33.2*	*33.2*	*33.2*	*33.2*	*24.4*	*33.0*	*6*	*10.4*	*7.2*	*20.4*	*22*	*18*	*25.2*	*15.2*	*15.2*	*15.2*	*15.2*	*16*	*23.2*	*14*	*14*	*15.8*
Plant design, budgeting, and estimating	4	2	4	2	4	4	0	0	0	0	2	1.4	0	0	0	2	4	0	2	0	0	0	0	0	0	0	0	0.5
Detailed plant design, control, supervision and safety	4	4	4	2	4	4	4	4	4	4	4	4	0	0	0	2	2	0	4	0	0	0	0	0	0	0	0	0.5
Environmental compliance	4	2	0	2	4	4	4	4	4	4	4	4	0	2	0	2	0	0	4	0	0	0	0	0	0	0	0	0.5
Automating maintenance records	4	2	4	3.2	4	4	4	4	4	4	4	4	0	3.2	3.2	3.2	2	2	4	0	2	3.2	2	2	3.2	2	2	2.3
Real-time control and optimization	4	2	4	2	4	4	4	4	4	4	0	3.4	0	0	0	2	4	4	0	2	2	0	2	2	4	2	2	1.7
Communications among workers	4	2	4	0	0	4	4	4	4	4	4	3.4	2	0	0	0	4	4	4	4	4	4	4	4	4	4	4	3.1
Remote communications to corporate	4	2	2	0	4	2	3.2	3.2	3.2	3.2	3.2	3.1	0	3.2	0	3.2	0	4	4	4	4	4	4	4	4	4	4	3.1
Performance monitoring	4	4	4	2	4	4	4	4	4	4	0	3.4	2	2	0	2	2	4	0	3.2	3.2	0	3.2	4	4	2	2	2.2
Financial calculations (real-time economic information)	4	2	4	3.2	4	4	2	2	2	2	3.2	2.7	2	0	4	4	4	0	3.2	2	0	4	0	0	0	0	0	1.5
Network management (in-plant like Fieldbus, external like Internet, etc.)	4	4	2	0	4	4	4	4	4	4	0	3.4	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0.3
Total	**100**	**70**	**70**	**39.8**	**80**	**79**	**84**	**80**	**70**	**72**	**40**	**72.2**	**15**	**39**	**18**	**48**	**49**	**55**	**40**	**35**	**39**	**26**	**37**	**40**	**61**	**36**	**38**	**38.4**