



International Journal Of Core Engineering & Management (IJCEM)
Volume 2, Issue 12, March 2016

POWER SECTOR IN PUNJAB - AN EVALUATION

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ABSTRACT

Development of Power Sector is the key to the economic development. The power sector in India has undergone significant progress after Independence. The Punjab State Electricity Board was constituted as an integrated power utility under the Electricity (Supply) Act 1948. It continued discharging the generation, transmission and distribution functions up to April 2010. It was necessary for the Punjab government to unbundle the Punjab State Electricity Board (PSEB) under the provisions of the Electricity Act 2003. The Punjab Government vide its notification dated 16.4.2010 issued the Punjab Power Sector Reforms and Transfer Scheme, 2010 and has formed two entities i.e. PSPCL & PSTCL of the erstwhile PSEB. The Punjab State Power Corporation Limited (PSPCL) is delegated with the functions of generation, distribution, wheeling and retail supply of electricity in the state. The function of transmission of electricity in the State, including functions of State Load Dispatch Centre (SLDC) was assigned to the other entity; the Punjab State Transmission Corporation Limited (PSTCL). The objective of the study is to analyse the technical & financial performance of PSEB/PSPCL in the light of regulatory observations made by PSERC during the last six years and to suggest measures for improvement in the performance. The analysis found that Poor technical and financial performance was the main problems faced by PSEB/PSPCL in the pre-reforms period. The Plant load factor of the plants operated by PSEB was very low. Whereas, the auxiliary consumptions and energy losses were very high. Further, distorted tariff structure for various consumer categories compounded the problems. The tariff was kept too low to recover the cost of supplying power. As a result, the gap between revenue and cost has increased which further resulted into the financial crisis of the PSEB/PSPCL.

Key words: *Power, Generation, Transmission, Distribution, Unbundle, Performance*

I. INTRODUCTION

Development of Power Sector is the key to the economic development. Since the planning commission began in 1950, the power Sector has been receiving adequate priority. The power sector in India has undergone significant progress after Independence. When India became

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independent in 1947, the country had a power generating capacity of **1,362 MW**. The main sources of generating electricity are Hydro power and coal based thermal power. Generation and distribution of electrical power was carried out primarily by private utility companies. At the time of independence power was available only in a few urban areas whereas rural areas and villages did not have electricity. The power generation, transmission and distribution came under the purview of State and Central government agencies after 1947. In the Constitution of India “Electricity” is a subject that falls within the concurrent jurisdiction of the Centre and the States. Nuclear power development was introduced, in late sixties at very slower pace.

In nineties Government of India has promulgated Electricity Regulatory Commission Act, 1998 for setting up of Independent Regulatory bodies both at the Central level and at the State level viz. The Central Electricity Regulatory Commission (CERC) and the State Electricity Regulatory Commission (SERCs) at the Central and the State levels respectively. To regulate the tariff of generating companies the CERC was assigned with the main function of determining the tariff of generating companies owned or controlled by the Central Government. The main functions of the SERC would be to determine the tariff for electricity wholesale bulk, grid or retail, to determine the tariff payable for use by the transmission facilities to regulate power purchase and procurement process of transmission utilities and distribution utilities, to promote competition, efficiency and economy in the activities of the electricity industries etc. Subsequently, as and when each State Government notifies, other regulatory functions would also be assigned to SERCs.

The Power Sector has been getting 18-20% of the total Public Sector outlay in initial plan periods. Remarkable growth and progress have led to extensive use of electricity in all the sectors of economy in the successive five years plans. In the field of Rural Electrification and pump set energisation, country has made a tremendous progress. About 85% of the villages have been electrified except far-flung areas in North Eastern states, where it is difficult to extend the grid supply. In spite of the overall development that has taken place, the power supply industry has been under constant pressure to bridge the gap between supply and demand.

During the post-independence period, the various States played a predominant role in the power development. Most of the States have established State Electricity Boards. In some of these States separate corporations have also been established to install and operate generation facilities. In the rest of the smaller States and UTs the power systems are managed and operated by the respective electricity departments. In a few States private licensees are also operating in certain urban areas.

Under Power sector reforms, the Central Electricity Act of 2003 prohibits state electricity boards (SEBs) from functioning as integrated power utilities. It makes it mandatory to divide them into separate entities for handling transmission, generation, distribution and trading functions. Under the



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Act, there is no restriction on generation, distribution and trading of power, but it is mandatory that transmission is handled by a state-funded entity that is neutral to all players in the power field. States can opt for their own model. Most states such as Haryana, Orissa, Andhra Pradesh, Karnataka and UP have unbundled their electricity boards into separate companies for power generation, transmission and distribution, while some like Rajasthan have divided the board into five companies — one each for generation and transmission, and three for distribution. A part of power sector reforms, unbundling was made mandatory as most state electricity boards were functioning as loss-making entities with high outstanding dues, owing to basic inefficiencies in their functioning. Restructuring these boards is aimed at promoting greater efficiency by streamlining operations of distribution, transmission, generation and trading, while also promoting transparency and accountability.

The Punjab State Electricity Board was constituted as an integrated power utility under the Electricity (Supply) Act 1948. It continued discharging the generation, transmission and distribution functions up to April 2010. It was necessary for the Punjab government to unbundle the Punjab State Electricity Board (PSEB) under the provisions of the Electricity Act 2003. However, under the pressure from certain political interests and employees' unions, it deferred the restructuring process of PSEB for many years. Ultimately, the state government had to unbundle the PSEB into separate generation, transmission and distribution companies. The Punjab Government vide its notification dated 16.4.2010 issued the Punjab Power Sector Reforms and Transfer Scheme, 2010 and has formed two entities i.e. PSPCL & PSTCL of the erstwhile PSEB. The Punjab State Power Corporation Limited (PSPCL) is delegated with the functions of generation, distribution, wheeling and retail supply of electricity in the state. The function of transmission of electricity in the State, including functions of State Load Dispatch Centre (SLDC) was assigned to the other entity; the Punjab State Transmission Corporation Limited (PSTCL). It may be noted that reform process was initiated with formation of the regulatory commission in 1999. However, the generation, transmission and distribution functions continued to be vested in the Punjab State Electricity Board, a single entity. The PSEB was reorganized quite recently on 16.04.2010 in to two separate companies, one for generation and distribution functions and the other for transmission and load dispatch centre which was a statutory requirement. Therefore, Punjab study is an exercise in examining the changes in performance of the under the direction of the regulatory commission (PSERC) during the last 6 years i.e. from 2007-08 to 2012-13. In this paper we analysed the performance of the utility taking into consideration some performance parameters such as plant load factor, energy losses, commercial losses etc.

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Sr.No	Key Development	Date
1	The Punjab State Electricity Board(PSEB) was a statutory body formed	01.02.1959
2	Re-organization of the erstwhile State of Punjab under the Punjab Re-organization Act 1966.	01.05.1967
3	PSERC was constituted under the provisions of Electricity Regulatory Commissions Act, 1998.	03.03.1999
4	MoU on power sector reforms signed between Ministry of Power ,Govt of India and Govt of Punjab	30.03.2000
5	The Commission passed its first(detail) tariff order on the proposal of PSEB	06.09.2002
6	Submission of the Report of the Expert Group on Power Sector Reforms in Punjab (Gajendra Haldea Report)	06.03.2003
7	These Regulations may be called the Punjab State Electricity Regulatory Commission (Conduct of Business) Regulations,2005	07.03.2005
8	Punjab State Electricity Regulatory Commission (Forum and Ombudsman) Regulations, 2005.	17.08.2005
9	Unbundling of Punjab State Electricity Board (PSEB)	16.04.2010
10	PSPCL has filed its first ARR Petition for FY 2011-12	30.11.2010

In the view of above developments, the present paper is an attempt to examine

- The technical performance of PSEB/PSPCL in the light of regulatory observations made by PSERC during the last six years.
- The financial performance of PSEB/PSPCL during the last six years.
- To suggest measures for improvement in the performance

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II. TECHNICAL PERFORMANCE OF PSEB/PSPCL

1. Demand and Supply Gap: Generally, PSEB/PSPCL does not undertake any demand/supply forecasting exercise for making future energy projections in the state. However, the demand projections were made on the basis of availability of power supply because there is a shortage of power in the state. It is assumed all power available would be consumed by various categories of consumers. The demand supply scenario in the state is given in the Table 1 as follows:

Table: 1

PSEB/PSPCL's Electricity Demand and Supply for Period April 2003-March 2016								
Year	Energy				Peak			
	Supply (MU)	Demand (MU)	Deficit (MU)	%age	Demand (MW)	Demand Met (MW)	Deficit	%age
2003-04	30520	31420	-900	-2.86	5922	5622	300	5.07
2004-05	30383	33393	-3010	-9.01	7122	5559	1563	21.95
2005-06	32591	35682	-3091	-8.66	7731	6158	1573	20.35
2006-07	34839	38641	-3802	-9.84	8971	6558	2413	26.90
2007-08	38795	42372	-3577	-8.44	8672	7340	1332	15.36
2008-09	37238	41635	-4397	-10.56	8690	7309	1381	15.89
2009-10	39408	45731	-6323	-13.83	9786	7407	2379	24.31
2010-11	42934	45889	-2955	-6.44	9399	7857	1542	16.41
2011-12	43792	45191	-1399	-3.19	10471	8701	1770	16.90
2012-13	46119	48724	-2605	-5.65	11520	8751	2769	24.04
2013-14	47342	42738	-4604	-9.72	10141	8903	-1238	-12.21
2014-15	48834	48351	-483	-0.99	11534	10155	-1379	-11.96
2015-16	51268	53864	2596	5.06	11900	10344	-1556	-13.08

Source: Monthly Report of Central Electricity Authority of India.

Table 1 indicates that Punjab is power deficit state where state is facing on an average 8 per cent deficit demand during the period of study i.e. 2003-04 to 2015-16. Further, the analysis showed that there was significant change in reduction of demand supply gap during the PSPCL period from 2010-11 to 2015-16. During this period the Demand Supply Gap was reduced from -6.44% to during 2010-11 to +5.06% during 2015-16. The analysis also showed that the Punjab is also facing Peak Demand Deficit during the period of study i.e. 2003-04 to 2015-16. The peak demand deficit was highest at 24.31% during 2006-07 and lowest at 5.07% during the year 2003-04.

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2. Generation Mix: The major Sources of power in Punjab are Power from Thermal, Hydel Projects, Share from Common Pool Projects and Purchase from outside Parties/States. The thermal projects in Punjab are Guru Nanak Dev Thermal Plant (GNDTP) Bathinda, Guru Gobind Singh Super Thermal Plant (GGSSTP) Ropar, and Guru Hargobind Thermal Plant (GHTP) Lehra Mohabat. The major Hydro projects of PSEB/PSPCL are Anandpur Sahib Hydel Project (ASHP) Anandpur sahib, Shanan Hydel Project Joginder Nagar, Upper Bari Doab Canal Hydro Electric Project (UBDC) Pathankot, Ranjit Sagar Power Project (RSPP) Shapurkandi and Mukerian Hydel Project (MHP) Mukerian. The state Punjab has also power availability from common pool projects like Bhakra Beas Management Board (BBMB) etc. The deficit demand is met from the power purchase from outside parties like NTPC, NHPC etc. The share of different sources in power availability in Punjab is shown in table 2 as under:

Table: 2

PSEB/PSPCL's Power Availability for Period April 2003-March 2016												
Year	Thermal		Hydel		Own Generation		BBMB Share		Power Purchase		Total Power Available	
	Units (Mus)	%age	Units (Mus)	%age	Units (Mus)	%age	Units (Mus)	%age	Units (Mus)	%age	Units (Mus)	%age
2003-04	14236	45.26	4395	13.97	18630	59.23	4638	14.75	8184	26.02	31452	100
2004-05	14384	45.18	3243	10.19	17627	55.37	3425	10.76	10783	33.87	31836	100
2005-06	14834	42.64	5005	14.39	19839	57.03	4663	13.40	10285	29.57	34787	100
2006-07	15435	41.28	4405	11.78	19839	53.06	3978	10.64	13572	36.30	37389	100
2007-08	16457	39.02	4586	10.87	21042	49.90	4326	10.26	16803	39.84	42172	100
2008-09	18066	43.64	4175	10.09	22242	53.72	4473	10.80	14685	35.47	41399	100
2009-10	20296	46.61	3389	7.78	23685	54.39	3819	8.77	16042	36.84	43545	100
2010-11	18326	41.44	4568	10.33	22894	51.76	4571	10.33	16764	37.90	44228	100
2011-12	19068	42.55	4910	10.95	23978	53.50	4896	10.92	15944	35.57	44819	100
2012-13	18013	39.93	4254	9.43	22268	49.36	3837	8.51	19004	42.13	45108	100
2013-14	16306	35.14	4286	9.24	20592	44.37	4377	9.43	21440	46.20	46409	100
2014-15	11692	24.00	4426	9.09	16118	33.08	3860	7.92	28740	58.99	48719	100
2015-16	8012	16.39	4643	9.50	12655	25.89	4290	8.78	31935	65.33	48879	100

Source: Electricity Statistics of Punjab.

Table 2 indicates that Thermal Plants are major source of Power in Punjab as it contributed on an average of 38.70 per cent towards total power available in Punjab during the period of study. Further the analysis of above table showed that percentage share of Hydro Power generation in total Power availability declined from 13.97 per cent (2003-04) to 9.50 per cent in (2015-16). Further, it can be

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noted that power purchase from outside parties is also a major constituent of total power availability in Punjab as it contributes on an average 40.31 per cent toward total power availability. The analysis also showed that percentage share of BBMB power in total power availability had continuously declined from 14.75 per cent (2003-04) to 8.78 per cent (2015-16). During the period of study the total power availability in Punjab had increased from 31452.02 MUs (2003-04) to 48879 (2015-16) at an EGR of 4.51 per cent. The power generation from Thermal stations had declined from 14235.5 MUs (2003-04) to 8012 MUs (2015-16). The power generation from Hydel stations had increased at an EGR of per cent. The power availability from purchase from outside parties had increased significantly from 8183.5 MUs (2003-04) to 31935 MUs (2015-16) at an EGR of per cent.

3. Auxiliary Consumption: Auxiliary consumption means the quantum of energy consumed by the auxiliary equipment of the project inclusive of Transformation losses from Generation Voltage to Transmission Voltage. As per the targets fixed by PSERC the Auxiliary Consumption (including the transformation losses) shall not exceed 11% in case GNTDP Bathinda and 8.50% in case of GGSSTP Ropar and GHTP Lehra and 1% of the energy generated in case of Hydel Projects. The plant wise and year wise Auxiliary consumption is shown in Table no.3 as follows:

Table No. 3

Plant-wise Auxiliary Consumption at Thermal Plants of PSEB/PSPCL for Period April 2003-March 2013 (In %age)						
Year	GNDTP	GGSTP	GHTP	Thermal Projects	Hydel Projects	Overall
2003-04	9.54	8.33	8.91	8.68	0.21	6.68
2004-05	12.23	8.57	9.42	9.27	1.91	7.92
2005-06	12.36	8.51	8.97	9.19	1.47	7.03
2006-07	11.49	8.83	8.80	8.91	1.17	7.2
2007-08	11.46	8.50	8.87	9.1	1.25	7.39
2008-09	11.57	8.34	8.71	8.94	1.05	7.46
2009-10	11.36	8.14	7.88	8.47	1.19	7.43
2010-11	11.78	8.11	8.08	8.46	1.05	6.98
2011-12	11.18	8.45	7.87	8.49	0.96	6.95
2012-13	10.77	8.37	7.92	8.39	0.97	7.01
2013-14	11.19	8.44	8.21	8.62	3.66	7.59
2014-15	11.17	8.53	8.66	8.91	3.93	7.54
2015-16	11.26	8.97	9.05	9.27	3.85	7.28

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Source: Electricity Statistics of Punjab.

Table 3 reveals that total auxiliary consumption has shown increased from 6.68 in 2003-04 to 7.28 in 2015-16. The auxiliary consumption in case of GNDTP Bathinda was remained higher than the target of 11% fixed by PSERC except during the years 2003-04(9.54) and 2012-13(10.77). The auxiliary consumption in case of GGSSTP Ropar was remained lower or close to the target of 8.5% fixed by PSERC during the period of study (2003-04 to 2015-16). The auxiliary consumption in case of GHTP Lehra was remained higher than the target of 8.5% fixed by PSERC during the period of study except 2009-10 to 2013-14 Further, auxiliary consumption in case of Hydel projects remained less than 1 in 2003-04 (0.21), 2011-12 (0.96) and 2012-13 (0.97).

4. Plant Load Factor: A plant load factor is a measure of average capacity utilization. In the electricity industry, load factor is a measure of the output of a power plant compared to the maximum output it could produce. A power plant with low load factors will be less efficient. Therefore, a higher load factor usually means more output and a lower cost per unit, which means an electricity generator can sell more electricity at a higher spark spread.

Table No.4

Plant wise Plant Load Factor of Thermal Plants of PSEB/PSPCL for Period April 2003-March 2016 (In %age)				
Year	GNDTP	GGSTP	GHTP	Hydel
2003-04	66.01	75.02	91.63	43.73
2004-05	51.69	82.28	89.94	32.36
2005-06	57.8	84.52	85.51	49.94
2006-07	56.8	88.52	93.58	43.95
2007-08	77.83	88.54	95.1	45.63
2008-09	73.83	87.07	94.89	41.66
2009-10	70.66	91.11	96.44	33.82
2010-11	46.06	88.04	84.79	45.61
2011-12	48.72	86.41	94.31	48.86
2012-13	64.68	83.05	89.53	42.45
2013-14	54.91	72.53	82.70	42.77
2014-15	37.40	52.11	55.93	44.16
2015-16	22.73	35.77	38.79	46.33

Source: Electricity Statistics of Punjab.

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Table 4 indicates the plant wise Plant Load Factor (PLF). The PLF for GNTDP was 56.08 percent on an average. It was highest at 77.83 percent during 2007-08 and lowest at 22.73 during 2015-16. The PLF for GGSTP was 78.07 percent on an average. It was highest at 91.11 percent during 2009-10 and lowest at 35.77 during 2015-16. The PLF for GHTP was 84.09 percent on an average. It was highest at 96.44 percent during 2009-10 and lowest at 38.79 during 2015-16. Further' the PLF for Hydel Projects was 43.17 percent on an average. It was highest at 49.94 percent during 2005-06 and lowest at 32.36 during 2004-05.

5. Aggregate Technical and Commercial Losses: Due to lack of adequate investment on Transmission & Distribution works, the Transmission & Distribution losses have been consistently on higher side, and reached to the level of 32.86% in the year 2000-01. The reduction of these losses was essential to bring economic viability to the State Utilities. As the T&D loss was not able to capture all the losses in the network, concept of Aggregate Technical and Commercial (AT&C) loss was introduced. AT&C loss captures technical as well as commercial losses in the network and is a true indicator of total losses in the system. High technical losses in the system are primarily due to inadequate investments over the years for system improvement works, which has resulted in unplanned extensions of the distribution lines, overloading of the system elements like transformers and conductors, and lack of adequate reactive power support. The commercial losses are mainly due to low metering efficiency, theft & pilferages. This may be eliminated by improving metering efficiency, proper energy accounting & auditing and improved billing & collection efficiency. With the initiative of the Government of India and Punjab Government, the Accelerated Power Development & Reform Programme (APDRP) was launched in 2001, for the reduction in AT&C losses. The main objective of the programme was to bring Aggregate Technical & Commercial (AT&C) losses below 15% in five years in urban and in high-density areas. The programme, along with other initiatives of the Government of India and of the States, has led to reduction in the overall AT&C losses. The year wise AT&C losses are shown in Table no.5 as follows:

Table: 5

AT&C Losses of PSEB/PSPCL During Period April 2003-March 2013			
Year	Transmission & Distribution Losses	Collection Efficiency	AT&C Losses
2003-04	25.35	99.21	25.55
2004-05	24.27	99.61	24.37
2005-06	25.07	98.01	25.58
2006-07	23.92	97.66	24.49

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2007-08	22.53	100.44	22.43
2008-09	19.91	93.63	21.26
2009-10	20.12	98.44	20.44
2010-11	17.96	100.65	17.84
2011-12	17.42	100.55	17.32
2012-13	16.78	99.77	16.82
2013-14	16.95	99.87	17.08
2014-15	15.19	99.05	16.05
2015-16	14.63	98.28	16.16

Source: Electricity Statistics of Punjab.

Table 5 indicates that Transmission and Distribution losses were on an average 20.00 percent during the period of study (2003-04 to 2015-16). The analysis shows that Transmission and Distribution losses consistently declined from 25.35 percent in 2003-04 to 14.63 percent during 2015-16. The collection efficiency was on average 98.86 percent over the period of study. It was highest at 100.65 percent during 2011-12 and lowest at 97.66 percent during 2006-07. Further, The Aggregate Technical and Commercial losses (AT&C) were declined consistently during the period of study. It declined to 16.16 percent (2015-16) from 25.55 percent (2003-04). The study also found that there was significant reduction in AT&C losses immediately after unbundling of PSEB during 2010.

III. FINANCIAL PERFORMANCE OF PSEB/PSPCL

1. Power Sold: In Punjab the consumers of power are divided in various categories such as Domestic, Commercial, Industrial, agricultural, Public lighting and Railways etc. The share of various categories in total power sold in Punjab over the period of last ten years is shown in Table no. 6 as follows:

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Table 6

Sr. No	Description	Unit	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
1	Domestic	Mus	5139	5064	5286	5662	6349	6459	7008	7915	8636	9285	10344	11138	11859
		%	23.03	22.23	21.6	21.27	20.99	21.67	21.94	24.18	25.18	25.62	27.70	27.57	28.69
2	Commercial(NRS)	Mus	1235	1275	1410	1591	1827	1868	2013	2361	2592	2689	2941	3146	3390
		%	5.54	5.60	5.76	5.98	6.04	6.27	6.30	7.21	7.56	7.42	7.88	7.79	8.20
3	Small Power	Mus	652	622	611	627	642	631	657	717	749	753	753	755	791
		%	2.92	2.73	2.50	2.36	2.12	2.12	2.06	2.19	2.18	2.08	2.02	1.87	1.91
4	Medium Supply	Mus	1312	1272	1279	1307	1375	1332	1406	1545	1620	1598	1684	1776	1890
		%	5.88	5.58	5.23	4.91	4.55	4.47	4.40	4.72	4.72	4.41	4.51	4.40	4.57
5	Large Supply	Mus	6561	6758	7308	7863	8515	8448	8545	8410	8759	9363	9484	10869	9854
		%	29.41	29.67	29.87	29.54	28.15	28.34	26.76	25.69	25.54	25.83	25.39	26.90	23.84
6	Agricultural Supply	Mus	6243	6468	7314	8230	10022	9325	10469	10117	10249	10779	10224	10641	11514
		%	27.98	28.40	29.89	30.92	33.14	31.28	32.78	30.90	29.88	29.74	27.37	26.34	27.86
7	Public Lighting	Mus	252	286	298	318	334	329	340	358	369	405	427	444	462
		%	1.13	1.26	1.22	1.19	1.10	1.10	1.06	1.09	1.08	1.12	1.14	1.10	1.12
8	Bulk & Grid Supply	Mus	441	545	551	562	585	588	627	659	676	701	739	781	807
		%	1.98	2.39	2.25	2.11	1.94	1.97	1.96	2.01	1.97	1.93	1.98	1.93	1.95
9	Others	Mus	475	490	414	457	595	829	870	658	646	669	751	852	763
		%	2.13	2.15	1.69	1.72	1.97	2.78	2.72	2.01	1.88	1.85	2.01	2.11	1.85
10	Total	Mus	22310	22779	24470	26617	30243	29810	31934	32740	34295	36242	37347	40403	41330
		%	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Electricity Statistics of Punjab.

2. Revenue from Sale of Power: The revenue from sale of power in Punjab is split into various categories such as Domestic, Commercial, Industrial, agricultural, Public lighting and Railways etc. The share of various categories in sale of power in Punjab over the period of last ten years is shown in Table 7.

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Table No 7

Sr. No	Description	Unit	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
1	Domestic	Rs Crores	1385.9	1326.9	1511.2	1562.4	1628.2	1758.4	2107.5	2604.2	3030.1	3611.6	4462.88	4993	4811
		%	24.14	23.23	24.36	24.5	24.03	24.35	25.61	27.53	30.24	29.65	29.08	30.39	31.30
2	Commercial (NRS)	Rs Crores	578	569.3	656.2	733.7	818	884.5	1040.2	1258.4	1430.9	1639	2097.9	2155	2166
		%	10.07	9.97	10.58	11.51	12.07	12.25	12.64	12.64	13.3	14.28	13.67	13.12	14.09
3	Small Power	Rs Crores	235	226	239	249	255	271	305	339	379	434	547.98	554	558
		%	4.09	3.96	3.85	3.9	3.76	3.75	3.71	3.58	3.79	3.56	3.57	3.37	3.63
4	Medium Supply	Rs Crores	536.1	507.2	563.7	572.7	589.1	625.8	710.7	802.2	869.5	959	1234.79	1267	1225
		%	9.34	8.88	9.09	8.98	8.69	8.67	8.64	8.48	8.68	7.87	8.05	7.71	7.97
5	Large Supply	Rs Crores	2436.3	2436.3	2762	2957.5	3178.8	3372	3712.7	3541.6	3898.5	5060.1	6227.83	6737	5906
		%	42.44	42.65	44.52	46.38	46.91	46.69	45.12	37.43	38.91	41.54	40.59	41.00	38.42
6	Agricultural Supply	Rs Crores	329	392	203	24	18	0	0	521	2	3	-0.79	0	1
		%	5.78	6.86	3.28	0.38	0.27	0.00	0.00	5.5	0.02	0.03	-0.01	0.00	0.01
7	Public Lighting	Rs Crores	46.2	46.8	52	57	60.4	72.2	69.1	84	81.8	97.8	122.85	120	115
		%	0.8	0.82	0.84	0.89	0.89	1	0.84	0.89	0.82	0.8	0.80	0.73	0.75
8	Bulk & Grid Supply	Rs Crores	161	159	168	173	180	181	211	237	261	299	514.36	491	484
		%	2.8	2.78	2.7	2.72	2.66	2.5	2.56	2.5	2.6	2.45	3.35	2.99	3.15
9	Railway Traction	Rs Crores	32	49	50	47	49	58	73	75	67	79	92.38	99	107
		%	0.56	0.86	0.8	0.73	0.73	0.8	0.89	0.79	0.67	0.64	0.60	0.60	0.70
10	Others	Rs Crores	181	141	252	420	890	1496	110	203	178	143	44.13	15	0
		%	3.16	2.47	4.06	6.59	13.13	20.71	1.34	2.15	1.78	1.18	0.29	0.09	0.00
11	Total	Rs Crores	5740	5712	6204	6376	6777	7222	8229	9461	10019	12181	15344	16431	15373
		%	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 7 indicates that industrial category consumers are major source of revenue from Sale of Power as it contributed on an average of 52.75% towards total revenue from Sale of Power in Punjab during the period of study. The percentage share of Revenue from Sale of Power from industrial category was least at 49.49% during 2010-11 and maximum at 59.35% during 2007-08. Further the analysis of above table showed that percentage share in Revenue from Domestic Consumer was increased from 24.14 (2003-04) to 26.80 (2015-16).

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3. Average Cost and Revenue Per unit Sold: The current tariff structure of PSEB/PSPCL is built on principles of cross subsidization with certain categories of consumers (commercial and large industry) subsidizing other categories (agricultural pump sets, domestic). The average cost of supply and average realization over the last ten years as reported by the Board is given in Table 8 as follows:

Table: 8

Average Cost and Revenue Per Unit Sold BY PSEB/PSPCL During the Period April 2003-March 2013			
Year	Revenue Per Unit Sold (in Paise)	Cost Per Unit Sold (in Paise)	Margin Per Unit Sold (in Paise)
2003-04	267	296	-30
2004-05	266	337	-71
2005-06	274	328	-55
2006-07	255	375	-121
2007-08	246	395	-149
2008-09	276	397	-121
2009-10	255	412	-157
2010-11	279	469	-190
2011-12	293	473	-180
2012-13	341	536	-195
2013-14	409	574	-165
2014-15	401	584	-183
2015-16	NA	606	NA

Source: Electricity Statistics of Punjab.

Table 8 indicates that PSEB (PSPCL consistently suffered a loss of on an average 135 paise per unit). The revenue per unit realised increased from 267 paise (2003-04) to 401 paise (2015-16). Further the cost per unit sold had increase significantly from 296 paise (2003-04) to 606 paise (2015-16). Consequently the loss per unit sold has continuously increasing over the period of study from 30 paise (2003-04) to 183 paise per unit (2014-15).

4. Connections Released: PSEB/PSPCL released connections in Punjab to various categories such as Domestic, Commercial, Industrial, agricultural, Public lighting and

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Railways etc. The share of various categories over the period of last ten years is shown in Table No. 9 as follows:

Table No. 9

Category wise Number of Connections Released by PSEB/PSPCL During the Period April 2003-March 2016					
Year	General	Industrial	Agricultural	Others	Total
2003-04	174019	3525	22886	121	200551
2004-05	201415	3387	31212	145	236159
2005-06	166977	3468	17422	135	188002
2006-07	197794	4194	38523	204	240715
2007-08	170588	4088	11058	174	185908
2008-09	235974	3096	50791	168	290029
2009-10	249148	4443	72670	239	326500
2010-11	409153	4960	36087	195	450395
2011-12	315404	5524	15201	226	336355
2012-13	321291	4289	21981	246	347807
2013-14	281494	3848	31081	303	316726
2014-15	283107	3974	0	198	287279
2015-16	283533	3628	15110	198	302469

Source: Electricity Statistics of Punjab.

Table 8 indicates that total number of connections released during a year increased from 200551 (2003-04) to 302469 (2015-16). The number of connection released to general category (Domestic and commercial) had increased from 174019 connections (2003-04) to 283533 connections (2015-16). Further, the number of connection released to industrial units and Agricultural unit has also increased at an EGR of has also increased.

5. Status of Manpower: The Power sector is a capital and technology intensive sector requiring large number of engineers, technicians and other skilled workers. Power projects require specialised technical manpower during the project construction phase as well as the Operation and Maintenance (O&M) phase. Due to the technology intensive nature of the business, technical and managerial competency is critical in ensuring timely implementation of projects and optimum performance upon commissioning. On the other hand, employee cost is responsible for poor financial performance of PSEB/PSPCL over the last ten years. The employee cost burden is increasing year after year. The high

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employee cost was due to overstaffing in PSEB/PSPCL. The status of manpower is shown in Table No.9 as follows:

Table 9

Status of Manpower of PSEB/PSPCL During the Period April 2003- March 2013					
Year	Sanctioned Strength		Actual Deployment		Percentage of Actual Manpower deployed over Sanctioned Posts
	No. of Employees	Percentage Change	No. of Employees	Percentage Change	
2003-04	84944	-	84961	-	100.02
2004-05	84605	-0.40	79826	-6.04	94.35
2005-06	83802	-0.95	76853	-3.72	91.71
2006-07	83648	-0.18	73432	-4.45	87.79
2007-08	83357	-0.35	70767	-3.63	84.90
2008-09	83322	-0.04	66886	-5.48	80.27
2009-10	83445	0.15	64308	-3.85	77.07
2010-11	76872	-7.88	55547	-13.62	72.26
2011-12	77561	0.90	53557	-3.58	69.05
2012-13	77607	0.06	49082	-8.36	63.24
2013-14	77286	-0.41	46323	-5.62	59.94
2014-15	76794	-0.64	43123	-6.91	56.15
2015-16	76743	-0.07	40370	-6.38	52.60

Source: Electricity Statistics of Punjab.

Table 9 indicates that number of employees deployed has declined significantly from 84961 (2003-04) to 40370 (2015-16) at an average declined rate of 5.97% every year. Further the percentage of manpower deployed over sanctioned posts has significantly declined from 100.02% (2003-04) to 52.60 (2015-16).

6. Analysis of Manpower: The total manpower in the power sector at the end of 10th plan was approximately 9.5 lakhs as per the report of the Planning Commission's Working Group on Power for 11th Plan. Even in a scenario where employee productivity is projected to increase leading to decreasing Man/MW ratio. The various ratios such as Manpower per MU of Energy Sold, Manpower per Rs One Lac Revenue, Manpower Per thousand Connections, Manpower per MU of Generation, Manpower Per MW of Connected Load are shown in Table No. 10 as follows:

Table No. 10

Analysis of Manpower of PSEB/PSPCL During The Period April 2003-March 2013					
Year	Manpower Per MU of Energy Sold	Manpower Per Rs One Lac Revenue	Manpower Per thousand Connections	Manpower Per MU of Generation	Manpower Per MW of Connected Load
2003-04	3.70	0.14	14.89	2.70	4.94
2004-05	3.44	0.13	13.54	2.50	4.25
2005-06	3.05	0.11	12.73	2.21	3.90
2006-07	2.63	0.11	11.78	1.95	3.48
2007-08	2.20	0.09	11.10	1.67	3.16
2008-09	2.05	0.07	10.09	1.60	2.82
2009-10	1.89	0.07	9.30	1.47	2.48
2010-11	1.55	0.06	7.59	1.25	2.03
2011-12	1.47	0.05	7.04	1.19	1.87
2012-13	1.29	0.04	6.22	1.08	1.65
2013-14	1.17	0.03	5.71	0.99	1.50
2014-15	1.02	0.03	5.18	0.88	1.35
2015-16	NA	NA	NA	NA	NA

Source: Electricity Statistics of Punjab.

Table 10 indicates that overall productivity of manpower has shown a significant improvement over the period or study. The manpower per MU of energy sold has declined from 3.70 (2003-04) to 1.02 (2014-15). Similarly, the manpower per MW of connected load has consistently declined from 4.94 (2003-04) to 1.35 (2014-15). Further, manpower per thousand connections had declined from 14.89 (2003-04) to 5.18 (2014-15). The manpower per rupees one lakh revenue was also declined from 0.14 (2002-03) to 0.03 (2014-15) employees. The manpower per MU of generation has also declined from 2.70 MU (2002-03) to 0.88 (2014-15).

7. Financial Performance of PSEB/PSPCL

PSEB/PSPCL keeps their accounts on cash basis. The cash basis of accounting recognizes transactions and events only when cash (including cash equivalents) is received or paid by the entity. The Revenue Receipts, Revenue expenditures and Profit/Loss after adjusting interest, Depreciation & subsidy during the last ten years are shown in Table No. 11

Table No. 11

Financial Performance of PSEB/PSPCL During the Period April 2003- March 2013 (In Rs Crores)							
Year	Revenue Receipts	Revenue Expenditure	Gross operating Surplus/Deficit	Depreciation	Interest	Prior Period Items	Profit/ Loss
2003-04	7121.24	5071.04	2050.20	562.50	1130.38	-182.40	174.92
2004-05	7167.56	6231.75	935.81	574.73	1000.00	47.74	-591.18
2005-06	8335.46	6726.16	1609.30	583.40	941.60	-50.64	33.66
2006-07	8706.68	8858.23	-151.55	604.52	884.62	16.45	-1624.24
2007-08	11082.06	11194.19	-112.13	665.77	713.61	111.38	-1380.13
2008-09	11915.19	11035.05	880.14	693.73	1119.90	-107.60	-1041.09
2009-10	12191.47	11238.02	953.45	796.85	1301.20	-74.74	-1219.34
2010-11	12532.20	11764.52	767.68	665.38	1767.37	-192.59	-1857.66
2011-12	16210.64	13553.95	2656.69	705.24	2163.33	-241.35	-453.23
2012-13	19874.13	16476.79	3397.34	762.26	2379.04	-32.52	223.52

Source: Management Information Report of PSPCL.

Table 11 indicates that PSEB/PSPCL has continuously incurred losses except during the financial year 2003-04, 2005-06 and 2012-13. The financial results of PSEB/PSPCL had shown an improvement after the unbundling as loss in 2011-12 was significantly decline to Rs.453.23 crores and then resulting into profit of Rs.223.52 crores during the F/Y 2012-13.

IV. CONCLUSION

Poor technical and financial performance was the main problems faced by PSEB/PSPCL in the pre-reforms period. The Plant load factor of the plants operated by PSEB was very low. Whereas, the auxiliary consumptions and energy losses were very high. Further, distorted tariff structure for various consumer categories compounded the problems. The tariff was kept too low to recover the cost of supplying power. As a result, the gap between revenue and cost has increased which further resulted into the financial crisis of the PSEB/PSPCL. Punjab was observed as one of the states initiating power sector reforms relatively late. Punjab State Electricity Regulatory Commission (PSERC) was constituted to regulate the power sector in the state. However, unbundling of PSEB which was due under the provisions of the Electricity Act 2003 was deferred for many



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years. It was only in 2010 when PSEB was unbundled. The transmission business is separated from the generation as well as distribution business. The overall objective of power sector reform is to restore financial viability of the electricity utilities improving the quality of service at the consumer ends. In this regard, the role of respective regulatory body is crucial. Apart from promoting economic efficiency, the interest of consumers needs to be protected. The analysis shows that the power sector in the state has shown some improvements on certain parameters such as plant load factor, loss level and recovery of dues. However, still the utility is suffering from the shortage of funds.

The Punjab is among a very few states in the country providing free power supply to agriculture. Agriculture sector consumes about 30% of the total energy in the states. Consequently, the dependency of the utility on state government has been increasing. The state government is not providing adequate subsidy in the form of cash. The committed subsidy is adjusted by converting the past loan taken by PSEB into grants. This practice does not provide any financial liquidity to the company. Another important issue is un-metered power supply to agriculture. The poor metering is a major barrier in the accurate estimation of energy consumption by agriculture sector and the overall T&D losses in the state. Therefore, it is suggested that sincere efforts should be made comply various provisions of the Electricity Act 2003 as well as National Electricity Policy. The power supply to all consumers should be fully metered so that the accountability is fixed in the system. The government should pay full compensation in cash on account of free power supply provided to agricultural sector.

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