Evaluation Study on 'To Review the Unreasonable Increasing Trend of Power Subsidies being provided to Agriculture Sector'

A

Report

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By

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Contents		
Sr. No.	Particulars	Page No.
Evaluation Study on Unreasonable Increasing Trends in Power Subsidies being provided to Agriculture Sector		**1-59**
	Acknowledgement	
	Contents	i
	List of Tables	ii-iii
	List of Graphs	iii
Chapter I	**Introduction**	**1-6**
	1.1 Background	1-4
	1.2 Objectives of the Study	4
	1.3 Research Methodology and Data Base	4-6
Chapter II	**Technical Performance of Haryana Power System**	**7-18**
	2.1 Milestones of Power Sector Reforms in Haryana	7-8
	2.2 Technical Performance of the Power System in Haryana	9-14
	2.3 Electricity Consumption Pattern in Haryana	14-15
	2.4 Transmission and Distribution Losses in Haryana	15-17
	2.5 Fatal & Non Fatal Accidents in Haryana	18
	2. 6 Conclusion	18
Chapter III	**Pricing Policy and Financial Performance of Haryana Power System**	**19-23**
	3.1: Pricing Policy and Financial Performance	19-21
	3.2 Implications of Agriculture Power Subsidy to State Finances	22-23
	3.3 Conclusion	23
Chapter IV	**Perception of Agricultural Households regarding Agriculture Power Subsidy**	**24-43**
	4.1 Classification of Sampled Households and their Cropping Pattern	24-29
	4.2 Estimation of Wasteful Consumption of Resources	29-30
	4.3 Impact of Electric Tube well Utilisation on Production and Productivity of the Crops	30-32
	4.4 Environmental Impacts of Electric Tube well Utilisations	32-35
	4.4 Impact of Electric Tube well Utilisation on Cost of Production	35-36
	4.5 Awareness, Preferences, Problems and Suggestions in relation to Electric Tube well Utilisations	37-42
	4. 6 Conclusion	42-43
Chapter V	**Summary, Conclusions and Policy Recommendations**	**44-57**
	References and Bibliography	58-59

List of Tables

List of Graphs

Chapter I
Introduction

1.1: Background

The Indian energy sector is today at a crucial juncture of development. With growing economy, the aspiration of people for improved energy services in terms of availability, accessibility, quality and affordable power have been raised in a big way.

Under various Five Year Plans, power sector was provided the highest priority amongst all the sectors of the economy in relation to the resource allocation. The share of energy sector in total plan allocation was about thirty percent and its more than two-third was allocated to the power sector.

It is well accepted proposition that adequate supply of energy is a pre-requisite for successful implementation of any economic development strategy and electricity is the most versatile form of energy. India's electric power sector is in a serious financial crisis. Despite impressive achievements in terms of physical expansion and its contribution in making energy available for various economic activities, it could not generate adequate financial resources to meet even a part of its investment requirements. Presently, the Central and State governments are also expressing helplessness to spare financial resources for investment in the power sector.

Electricity as infrastructure is of key importance to accelerate the process of economic development, it was realised that power should be made available at a reasonable price. It has to be noted that the power sector exerts a critical influence on the performance of the agricultural sector in India as it influences farmers' access to and use of electricity for a variety of agricultural operations, particularly for pumping groundwater. The price of electricity supplied to agriculture sector in most of the states is heavily subsidized. These subsidies have contributed to the financial crisis in the state utility, reducing its ability to undertake required investments to respond to rising local demand and to maintain a smooth and reliable service. For the agricultural sector, the supply of electricity has been characterized by rationing, frequent power interruptions, and voltage fluctuations that raise the real cost of electricity to farmers and affect their production activities in several ways.

As a result of overall shortages, power supply to agriculture is heavily rationed in Haryana particularly. The three-phase power supply required to operate electric pumps is typically ostered amongst the various electricity feeders for a specified number of hours during the day and night. Given this situation, the following two aspects of power supply are likely to be important from the farmers' perspective. First, the total number of hours of actual availability of power (both during scheduled and unscheduled period), on an average at the farm level, every day during each season. This aspect will be referred to as the "availability" of power supply. The second aspect relates to the "unreliability" of actual supply and will be defined as the total duration of power cuts during the scheduled hours of power supply. An important reason for power cuts during scheduled periods of power supply is frequent transformer burnouts. Poor quality increases farmers' costs for three reasons. First, low voltage implies that water delivered by the pump per unit of time is reduced, other things remaining the same. Second, poor quality also leads to motor burnouts. Apart from the costs of getting the motor rewound, production activities need to be readjusted and there is potential loss of output in the time period it takes to get the motor reinstalled. Poor quality of supply may also cause the electricity transformer to fail, further interrupting the supply of power until the time it takes to repair it. Third there is also some evidence to suggest that given the poor quality of supply, farmers tend to select robust motors that have thicker armature.

Agrarian transformation in Punjab & Haryana under the Green Revolution strategy generated tremendous demand for power in agriculture sector. Despite that Haryana being close to Delhi, the national capital, industrialisation and urbanisation spread in areas located in the national capital region at relatively faster pace. Punjab & Haryana is based on peasant proprietorship and therefore, increase in production and productivity in agriculture has enhanced the purchasing power of almost all the sections of the society which gave a boost to the commercial activities in the States. The accelerated growth in the wide range of economic activities was made possible by a very high growth in energy consumption by various categories of consumers.

Overtime, with society acquiring higher levels of Industrial development, now the major share of electricity consumption in the society is in industry and agriculture where it is used as energy input. Use of energy as a factor of production is a commercial proposition. Obviously, this use should be governed by the sound economic principles as its supply involve resource use, which cost money for which someone has to pay. Who pays and who should pay must be made transparent.

Since early seventies, the state governments adopted certain policies like highly subsidised supply of electricity to the farmers for irrigation in the agricultural sector at a flat rate. The electricity was usually not metered. These two policies, the subsidised supply at a flat rate and unmetered supply played havoc with financial management and administration of the power sector. The political leadership indulged in competitive populism and announced and provided highly subsidized or free supply of electricity to the farmers. The major share of benefits has been cornered by the big landlords and the kulaks who were highly influential and controlled the rural vote banks.

Due to unmetered supply to agriculture, energy accounting system became ineffective and in fact collapsed. In such a state of affairs when more than half of the electricity supply was not metered, it was impossible to estimate the actual technical T&D losses and the pilferage of power. Obviously, the beneficiaries of the unmetered supply had developed a vested interest in the system to remain unaccountable. A major part of pilferage and theft of electricity was shown as consumption in the agricultural sector. The Planning Commission insisted in 1980s that the SEBs must cut their transmission and distribution losses by say one per cent each year to be entitled to certain incentive schemes and grants, it was conveniently done on paper by manipulating the data. When in early 1990s wind of change in policy regime was under consideration, the same government departments/agencies and officers from the next year started showing T&D losses as much as 30 per cent to 50 per cent in comparison to 18 to 20 per cent in the previous years (Planning Commission, 2002). It was conveniently done to provide justification for privatisation as state government in its management of the SEBs was inefficient. No questions were asked, no accountability was fixed! The 'fresh' wind of change wrapped everything under the carpet.

It needs to be noted that one of the major reasons for undertaking power sector reforms in Haryana was the very poor technical and financial performance of the distribution system. As a large number of stake holders are involved in the process, analysis requires a careful consideration. Distribution of electricity now is being managed in Haryana by the state through two wholly government owned corporations Uttar Haryana Bijli Vitran Nigam Limited (UHBVNL) and Dakshin Haryana Bijli Vitran Nigam Limited (DHBVNL). They are supposed to be managed like independent companies under the company law.

Under reformed regime, it is not expected that the state government will interfere in day to day functioning of the power system, but there is close nexus among power utility/ies, state government and Regulatory Commission in the state, which has serious implications for the financial health of power utilities as well as the state government. The power utilities in Haryana are providing electricity at highly subsidized rates particularly to agricultural consumers on the directions of the state government and consequently the financial burden of agriculture power subsidies on public exchequer of the state government has aggravated over the period, which hampered the growth of various social and economic sectors.

1.2: Objectives of the Study

The proposed evaluation study on unreasonable increasing trends of power subsidies being provided to agriculture sector tended to highlight the implications of the subsidized power supply to agriculture sector in the state. The study will focus broadly on three major aspects, technical efficiency, pricing policy and perception of households regarding agriculture power subsidies which are very crucial to analyse the issue of increasing trends in agriculture power subsidies. The major objectives of the study are as follow:

- To examine whether the power subsidy to agriculture sector leads to wasteful consumption of power.
- To study the environmental impact of power subsidy to agriculture sector.
- To work out the Economic and Social Cost-Benefits analysis of power subsidy.
- To find out whether the burden of power subsidy to agriculture sector can be minimised without curtailing the benefits to the farmers.
- To find out suitable alternatives to power subsidy to agriculture sector.

1.3: Research Methodology and Data Base

The study is based on primary as well as secondary data. For primary data collection, we have adopted multi-stage random sampling technique for selection of agriculture households. Initially, we collected data on operational circle wise number of agriculture connections with connected load (BHP) from both the power utilities Uttar Haryana Bijli Viteran Nigam Limited (UHBVNL) and Dakshin Haryana Bijli Viteran Nigam Limited (DHBVNL). Then on the basis of agriculture pump-set connections per thousand hectare net sown area, we selected three operational circles one (Karnal) from Uttar Haryana Bijli Viteran Nigam Limited (UHBVNL) and Two (Jind and Bhiwani) from Dakshin Haryana Bijli Viteran Nigam Limited comprising one circle each from the category of the highest, average and the lowest agriculture connections per thousand hectare net sown area. Thereafter, we have collected information from each selected operational circles regarding sub-division wise and feeder wise number of agriculture connections with connected load. After selection of sub-division and AP feeders, we have collected information from selected AP feeders regarding village wise number of agriculture connections with connected load. Finally we have made selection of three villages, having the highest number of agriculture connections from each selected AP feeders from each selected sub- division and operational circle for survey. A sample size of 540 households was drawn selecting 180 households from each operational circle. The ultimate agricultural households were selected at random. Care was taken to include farmers from different categories of land holding so as to nullify the discrimination effect. The selected households have been classified into five categories on the basis of land holdings i.e. Marginal farmer (upto 2.5 acres), Small farmers (2.51 to 5.0 acres); Semi-medium farmers (5.1 to 10 acres), Medium farmer (10.1 to 25.0 acres) and Large farmers (more than 25 acres). The sample size consisted 28 (5.19 %) Marginal farmers, 131 (24.26 %) Small farmers, 166 (30.74 %) Semi-medium farmers, 159 (29.44 %) Medium farmers and 56 (10.37 %) large farmers. The data from households was collected with the help of well designed questionnaire.

Secondary data was collected from various publications of Government of Haryana, Haryana Electricity Regulatory Commission (HERC), Haryana Power Utilities, Central Electricity Authority (CEA), Planning Commission and Power Finance Corporation, Government of India.

- To estimate wasteful consumption, we looked into crop wise water requirement in terms of number of times a crop is to be irrigated and number of times it is irrigated by the farmer.
- To study environmental impact, broadly, we have examined the changes in water table and soil degradation during a specific period of time.
- To conduct cost benefit analysis of power subsidy, we compared average cost of supply with average revenue realised. We further estimated total amount of subsidy and its impact on the financial position of the state government.
- To find out alternative to reduce the impact of agriculture power subsidy without curtailing benefits to farmers, we studied the existing pattern of subsidy and thereby examined the justification for subsidisation to big farmers.

The study has been organised into five chapters. The Chapter one deals with introduction including objectives and research methodology of the study. In Chapter two, we have discussed the technical performance of Haryana power utility on the basis of certain technical parameters. The Chapter three analyses the financial performance of the Haryana power utility with respect to pricing policy. The Chapter four focussed on perception of households regarding agricultural power subsidies. The Chapter five highlights the major findings, conclusion and policy recommendations.

Chapter II

Technical Performance of Haryana Power System

Haryana State came into existence with the reorganisation of the State of Punjab as on November 1, 1966. Haryana State Electricity Board (HSEB) was created in May 1967 by bifurcating the Punjab State Electricity Board (PSEB). HSEB was incorporated as an integrated utility to discharge the generation, transmission and distribution functions in the State. Haryana was the second state in India after Odisha to adopt and implement power sector reforms under the Haryana Electricity Reforms Act 1997 (HERA), enacted in 1997 and which came into force on 14th August, 1998.

2.1: Milestones of Power Sector Reforms in Haryana

Event	Date
Haryana Electricity Reform Bill passed by Haryana Assembly	22.07.1997
Reform Bill Received the Assent of the President of India	20.02.1998
Gazette Notification of the Haryana Electricity Reform Act	10.03.1998
Haryana Electricity Reforms Act came into Force Haryana Electricity Regulatory Commission (HERC) & Two Corporations (HPGC and HVPNL) were created	14.08.1998
HERC issued two licenses to HVPNL to carry out Transmission and Bulk Supply (License 1 of 1999) and Distribution and Retail Supply (License 2 of 1999)	04.02.1999
Second transfer scheme, transmission business and distribution were separated HVPNL was retained as transmission company while two distribution companies were created, namely i) Uttar Haryana Bijli Vitran Nigam Limited (UHBVN) ii) Dakshin Haryana Bijli Vitran Nigam (DHBVN)	01.07.1999
HERC issued two separate licenses to HVPN to carry on distribution business on Behalf of the two distribution companies namely UHBVN & DHBVN	21.04.1999
Both distribution companies applied for grant of independent regular license	20.07.1999.
HERC issued first order on Annual Revenue Requirement for FY 1999-2000 of HVPNL for the Transmission and Distribution Business	26.11.1999
HVPNL was declared State Transmission Utility (STU) and entrusted with operating SLDC	10.12.2003
Granted Licenses to UHBVN and DHBVN to carry out the business independently in Northern and Southern regions of the state respectively	04.11.2004
Terms and Conditions for Open access for Intra-state Transmission and distribution system (2005)	19.05.2005
Transferred the rights relating to procurement and bulk supply of electricity or Trading of electricity from HVPNL to HPGCL	11.04.2008
Haryana Government transferred the rights relating to procurement of	15.04.2008

electricity/UI drawls/dispatches or Trading of electricity from HPGCL to UHBVNL and DHBVNL	
Terms and Conditions for determination of tariff from renewable energy sources and Renewable purchase obligations	03.02.2011
HERC issued its 15th Tariff order on ARR of UHBVNL & DHBVNL for their D&RS Business for FY 2013-14 and Distribution &Retail Supply Tariffs for FY 2013-14	30.03.2013
HERC issued its 16th Tariff order on ARR of UHBVNL & DHBVNL for their D&RS Business under MYT Framework for the control period FY 2014-15 to 2016-17 and Distribution &Retail Supply Tariffs for FY 2014-15	29.05.2014

The Haryana Electricity Regulatory Commission was established in August 1998 to regulate power sector in the State. After enforcement of HERA, two statutory Transfer Schemes were notified by the Government of Haryana for restructuring the HSEB. Through the First Transfer Scheme Rules, 1998, the Generation business (undertakings, assets, liabilities, proceeds and personnel) was separated from Transmission and Distribution businesses and vested in a separate company viz. Haryana Power Generation Corporation Ltd. (HPGCL). The Transmission and Distribution businesses were transferred to and vested in Haryana Vidyut Prasaran Nigam Ltd. (HVPNL). Thereafter, through the Second Transfer Scheme Rules 1999, the Transmission undertaking and business was separated from the Distribution undertakings and business. The former was retained in HVPNL as the Transmission Company, while the latter was further segregated into and vested in two successor Distribution companies i.e. Uttar Haryana Bijli Vitran Nigam Ltd (UHBVNL) and Dakshin Haryana Bijli Vitran Nigam Ltd (DHBVNL). UHBVNL was vested with the Distribution business in the North Zone of Haryana comprising Ambala, Yamuna Nagar, Karnal, Kurukshetra, Jind, Rohtak and Sonepat circles. The DHBVNL was vested with the Distribution business in the southern zone of Haryana comprising of Bhiwani, Faridabad, Gurgaon, Hisar, Narnaul and Sirsa circles. However, in July 2013, Jind circle has been transferred to DHBVNL.

It becomes pertinent to analyse technical performance of power system in Haryana on the basis of certain technical parameters in post reform period to find out the efficiency improvement, if any.

2.2: Technical Performance of the Power System in Haryana

The time when HSEB came into existence it had a generation capacity of 383 MW. The Haryana state neither owns any significant share of natural energy resources like coal, petroleum etc. nor it has any significant hydropower potential, so it has to depend upon the thermal power plants for meeting its power needs. The coal is being imported from the other States of the country like Madhya Pradesh, Bihar, Uttar Pradesh etc. Up till now, development of thermal power plants was the only option to the State for meeting its power requirements. Now nuclear option is also being explored.

The state government has allocated large share of its annual budget to power sector in total plan expenditure all these years. It is shown in the Table 2.1.

Table 2.1: Haryana Plan Expenditure on Energy Sector (Rs. in crore)

S. No	Particular	Total Plan Expenditure	Expenditure on Energy	% share of Energy
1.	4th Five Year Plan (1967-74)	358.26	87.53	24.43
2.	5TH Five Year Plan (1974-79)	677.34	260.01	38.39
3.	Annual Plan (1979-80)	202.95	56.40	27.79
4.	6th Five Year Plan (1980-85)	15995.47	491.62	30.81
5.	7th Five Year Plan (1985-90)	2510.64	639.03	25.45
6.	Annual Plan (1990-91)	615.02	155.92	25.35
7.	Annual Plan (199-92)	699.39	182.97	36.16
8.	8th Five Year Plan (1992-97)	4889.89	1197.68	24.49
9.	9th Five Year Plan (1997-2002)	11600.00	3305.00	28.49
10.	10th Five Year Plan (2002-2007)	12979.64	1988.79	15.32
11.	11th Five Year Plan (2007-2012)	35000.00	4687.00	13.39

Source: (i) Statistical Abstracts of Haryana (various Issues). (ii) Five Year Plan Documents, Government of Haryana (various Issues)

The Table 2.1 brings out that the share of expenditure on energy has been very significant and above 25% in various plan periods up to 9th Five Year Plan. However, the outlays of 10th FYP and 11th FYP drastic decrease was reported in the relative share of the plan outlay for the power sector. This may be due to policy change after the initiation of reform process. Since after unbundling, all the corporations have been incorporated under the Indian Company Act 1956. Now these corporations are entitled to raise required finances from the market directly according to their requirements. Private sector initiatives were also encouraged. The other reason may be the direct grant provided by Ministry of Power under the Accelerated Power Development and Reforms Programme (APDRP) and Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY). It may be noted that the most of the expenditure allocated for energy was expended on the development of the power sector. The funds were invested in installing generation capacity and network expansion for transmission as well as distribution purposes. Thus, it shows that development of power sector was given a high priority during the different plans.

Table 2.2: Generation Installed Capacity (MW) of Power in Haryana (as on 31-01-2013)

State/UT (Utilities)	Source Wise Break up							Total	%age Share
	Thermal				Hydro	Nuclear	RES		
	Coal	Gas	Diesel	Total					
State Sector	3160	25	4	3189	885	0	70	4144	40.77
Central Sector	1174	535	0	1709	479	109	0	2297	29.73
Private Sector	1620	0	0	1620	0	0	53	1673	29.50
Total	5954	560	4	6518	1363	109	123	8114	100
%age Share	73.38	6.90	0.05	80.33	16.80	1.34	1.53	100	

Source: Central Electricity Authority, Monthly Report, January, 2013
Note: MW- Mega Watt

Graph 2.1: Percentage Share of Various Sources

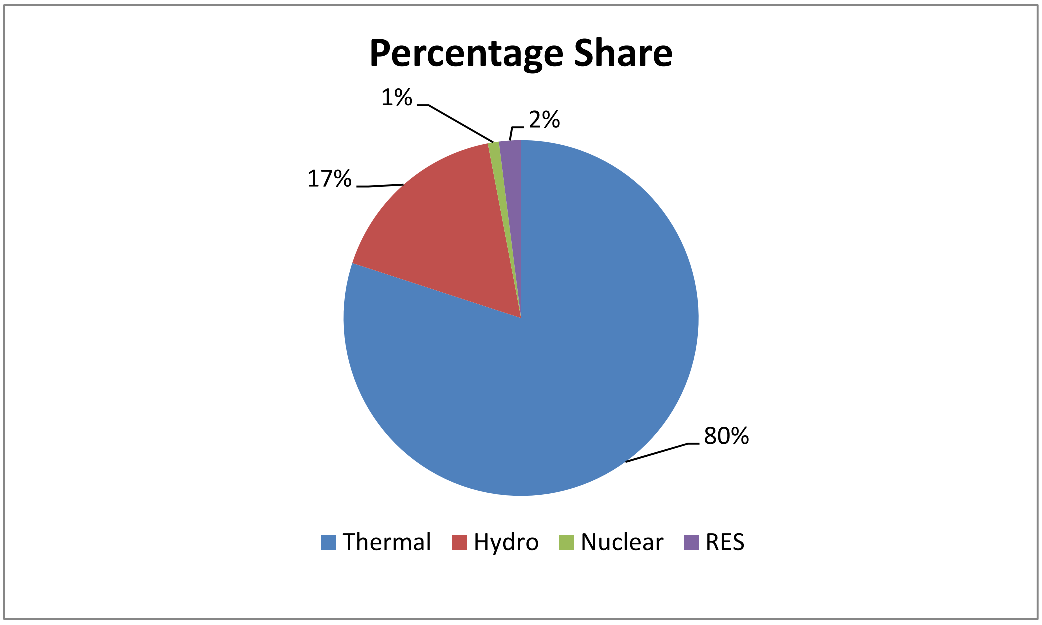

Table 2.2 and Graph 2.1 present the composition of total generation capacity in Haryana. The total installed generation capacity was estimated as 8114 MW as on 31.01.2013, out of which 80 per cent and 17 per cent was sourced from Thermal and Hydro

power plants respectively. The share of Nuclear was 1 per cent and Renewable Energy Sources (RES) 2 per cent.

Due to quite an impressive expansion in the electricity supply system, the availability of electricity has increased significantly over the years though supply did not keep pace with electricity demand. It has in fact revolutionised economic development and the green revolution in the state. However, due to relatively poor technical and financial performance, it had to be restructured. Haryana state's own generating capacity is 5300.50 MW (as on 31.01.2013), out of which 98.83 percent is coal based thermal and 1.17 percent is hydro. Besides the own generating capacity, it also has dedicated shares in the power plants managed and operated by Bhakra Beas Management Board (BBMB) and Central Power Undertakings (CPUs) such as NTPC, NHPC and NPC.

Table 2.3: Demand and Supply Scenario in Haryana

Particulars	Energy			Peak Demand		
	Available (MU)	Demand (MU)	Deficit (%)	Available (MW)	Demand (MW)	Deficit (%)
2007-08	25652	29353	12.6	4821	4956	2.7
2008-09	26625	29085	8.5	4791	5511	13.1
2009-10	32028	33441	4.2	5678	6133	7.4
2010-11	32626	34552	5.6	5574	6142	9.2
2011-12	NA	NA	NA	NA	NA	NA
2012-13	38209	41407	7.7	6725	7432	9.5

Source: Central Electricity Authority- Annual Reports
Note: NA- Not Available, MU- million units, MW- Mega Watt

The Table 2.3 clearly shows that demand exceeds availability of power in the state both in energy as well as peak demand during most of the period.

Indicators used to evaluate the technical performance of HPGCL are: Plant Load Factor (PLF), Auxiliary Consumption, Oil consumption per unit of electricity, Station heat rate in relation to the norms of efficiency fixed by the Central Electricity Authority (CEA) and Haryana Electricity Regulatory Commission (HERC).

Plant Load Factor (PLF) is considered an important indicator for measuring the operational efficiency of the thermal generating plants. The average PLFs of Panipat thermal power system and Faridabad thermal power system have been presented in Table 2.4. In a state like Haryana which is an electricity deficit state, overall PLF should not be less than 80% (norms set by CERC & HERC).

Table 2.4: Performance of HPGCL (2007-08 to 2012-13)

Particulars	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Installed Capacity (MW)	2187.70	2085.50	2085.50	3230.50	3230.50	5300.50
PLF (%)	78.94	75.01	82.93	76.28	71.75	65.39
Auxilliary Consumption (%)	9.93	9.66	9.77	10.06	9.06	8.96
Oil Consumption (ml/kWh)	1.66	2.87	1.61	3.08	2.47	1.78

Source: Tariff order HPGCL 2014-15

Table 2.5: Station-wise Operational Performance (Plant Load Factor)

Particulars	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Panipat Phase I (Units I-IV)	59.41	57.89	68.38	53.37	63.71	50.82
Panipat Phase II (Units V-VIII)	93.60	91.30	93.40	89.10	89.50	86.09
FARIDABAD THERMAL POWER STATION (165 MW)	49.25	42.61	55.7	-	-	-
DCRTPP, YAMUNANAGAR	-	69.05	81.35	73.85	61.45	18.33
HPGCL Overall	78.94	75.01	82.93	76.28	66.60	53.65

Source: Tariff order HPGCL 2014-15

By this norm, except for the year 2009-10, the performance may be charaterised as unsatisfactory during the period 2007-08 to 2012-13. Despite huge investment on renovation and modernization of PTPS, unsatisfactory state of performance is a matter of concern. Yamuna Nagar plant has not yet achieved desirable level of performance.

Auxiliary Consumption for a generating station depends on quality of coal it receives at the feeding point, number of frequent start-ups and shut downs it encompasses and the ageing of equipment.

Average auxiliary consumption during 2007-08 to 2012-13 consistently declined from 9.93 per cent to 8.96 per cent. Except for 2010-11 (10.06 per cent), it remained less that 10%. Table 2.6 shows that auxiliary consumption at Panipat Station (Units I-IV) was between the range 11.40 per cent to 12.62 per cent, which is very high by any standards during 2007-08 to 2012-13. Steps need to be taken to reduce auxiliary consumption, below 8 percent for the new plants and up to 10 percent for old plants.

Table 2.6: Station-wise Auxiliary Consumption (Percentage of Gross Generation)

Particulars	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Panipat Phase I (Units I-IV)	12.13	11.48	11.40	12.00	12.54	12.62
Panipat Phase II (Units V-VIII)	8.81	8.8	9.13	9.66	9.80	9.80
FARIDABAD THERMAL POWER STATION (165 MW)	14.82	16.32	16.07	-	-	-
DCRTPP, YAMUNANAGAR	-	9.33	9.29	9.73	9.34	10.46
HPGCL Overall	9.93	9.66	9.77	10.06	9.06	8.96

Source: Tariff order HPGCL 2014-15

It was observed from the Table 2.7 that the Specific Oil Consumption of PTPS Units 1 - 4 has been very high compared to the norms, due to frequent start up and shut down of plants as there have been multiple cases of breaking down of the plants. The higher specific oil consumption has been attributed by HPGCL to frequent start/ stop operations due to increase in number of tripping. Oil support also necessitated due to receipt of wet coal.

Table 2.7: Station-wise Oil Consumption (ml/kWh)

Particulars	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Panipat Phase I (Units I-IV)	2.93	3.33	2.44	5.80	5.56	5.81
Panipat Phase II (Units V-VIII)	0.59	0.80	1.05	2.68	1.25	0.84
FARIDABAD THERMAL POWER STATION (165 MW)	-	-	-	-	-	-
DCRTPP, YAMUNANAGAR	-	6.32	1.70	2.35	2.24	2.71
HPGCL Overall	1.66	2.87	1.61	3.08	2.47	1.78

Source: Tariff order HPGCL 2014-15

Normal oil consumption may be one or two ml per unit of electricity generated. By this norm, oil consumption of PTPS (Units I to IV) and DCRTPP have been very high.

HERC in its recent Tariff Order dated 29.05.2014 has highlighted that Station Heat Rate per kWh of electricity generated in Haryana was very high in comparison to the norms.

The usage of poor quality of coal has led to an increase in the station heat rate as can be seen in the trend of the past years.

Table 2.8: Station-wise Station Heat Rate (Kcal/kWh)

Particulars	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Panipat Phase I (Units I-IV)	3470	3425	3225	3349	3211	3126
Panipat Phase II (Units V-VIII)	-	2574	2561	2679	2662	2538
FARIDABAD THERMAL POWER STATION (165 MW)						
DCRTPP, YAMUNANAGAR	2571	2450	2387	2479	2414	2395
HPGCL Overall	1916	2762	2684	2728	2686	2608

Source: Tariff order HPGCL 2014-15

It is a matter of great concern that technical efficiency of various thermal power stations in Haryana was below the norms. A close analysis of tariff orders issued by the Regulatory Commission clearly highlighted that the average cost of supply from own generating stations in Haryana was much higher than the average cost of power purchase from the other sources. This shows that restructuring of the power sector has not made any significant change or improvement in the performance of the generation system in Haryana.

2.3: Electricity Consumption Pattern in Haryana

Haryana being close to Delhi, the national capital, industrialisation and urbanization has spread at a relatively rapid pace particularly in the areas located in the National Capital Region (NCR). The accelerated rate of growth in a wide range of economic activities afforded a relatively high growth in energy consumption by various categories of consumers. The consumption of electricity in Haryana grew at a quite high rate. The Table 2.9 reveals the composition of electricity consumption by various categories of consumers in the state during the period 2007-08 to 2012-13.

It is pertinent to note that total electricity sale in the state has increased over the period of time. The Table (2.9) shows that total electricity sale (approved) increased from 17992 MU in 2007-08 to 29218 MU in 2012-13. The domestic and agricultural consumers, which enjoyed subsidised power supply, jointly captured 49.13 per cent of total electricity sale in 2012-13 as against 53.14 per cent in 2007-08. The relative share of industrial, commercial and other sectors was 29.92 percent, 12.72 percent and 8.23 percent respectively during the year 2012-13. It is also clear from the data that there was a significant difference between the projection made by the utilities and sale approved by the Regulatory Commission that needs to look into.

Table2.9: Electricity Consumption Pattern in Haryana for the year 2013-14 (MU)

Particulars		Domestic	Commercial	Industrial	Agricultural	Others	Total
2007-08	Utilities	3575 (19.83)	1065 (5.91)	4689 (26.01)	7214 (40.02)	1483 (8.23)	18026 (100)
	HERC	3923 (21.80)	1349 (7.50)	5401 (30.02)	5639 (31.34)	1680 (9.34)	17992 (100)
2008-09	Utilities	3642 (18.71)	1286 (6.61)	5753 (29.56)	6016 (30.91)	2768 (14.22)	19465 (100)
	HERC	4765 (22.65)	1679 (7.98)	6544 (31.11)	4789 (22.76)	3261 (15.50)	21038 (100)
2009-10	Utilities	4115 (18.95)	1520 (7.00)	5056 (23.29)	8722 (40.18)	2297 (10.58)	21710 (100)
	HERC	4055 (19.88)	1395 (6.84)	5722 (28.06)	7474 (36.65)	1749 (8.58)	20395 (100)
2010-11	Utilities	5649 (19.50)	1948 (6.72)	8485 (29.29)	8624 (29.77)	4262 (14.71)	28968 (100)
	HERC	5338 (21.01)	1828 (7.19)	8249 (32.47)	7473 (29.41)	2519 (9.91)	25407 (100)
2011-12	Utilities	-	-	-	-	-	-
	HERC	5950 (21.15)	2071 (7.36)	10286 (36.56)	6787 (24.12)	3044 (10.82)	28138 (100)
2012-13	Utilities	7438 (22.19)	4316 (12.88)	9524 (28.41)	9769 (29.14)	2472 (7.37)	33519 (100)
	HERC	6835 (23.39)	3716 (12.72)	8742 (29.92)	7520 (25.74)	2405 (8.23)	29218 (100)
Growth Rate of sale approved by HERC (2007-08 to 2012-13)		**11.74**	**22.47**	**10.11**	**5.93**	**7.44**	**10.18**

Source: HERC-Tariff Orders of various years.

Note: Utilities- Sale projections, HERC- Sale approved. We measure electricity consumption on the basis of sales approved by the Haryana Electricity Regulatory Commission.

It is also observed that the demand of electricity for industrial sector grew at a growth rate 10.11 per cent which is less than that of domestic (11.74 per cent) and commercial (22.47 per cent) sectors. It happened mainly due to non-availability of quality power at reasonable prices along with uncertain power cuts. Hence, the industrialists were forced to fall back more and more upon captive plants to continue production in a smooth manner.

The actual estimation of agriculture sector was not possible due to un-metered supply. The data regarding agricultural consumption should be used with caution.

2.4: Transmission and Distribution Losses (T&D losses)

Energy losses consist of technical losses and commercial losses. Technical losses occur due to inherent characteristics of the generation, transmission and distribution system whereas the commercial losses are the result mainly of power theft &pilferage and poor recovery rates of billed sales revenue from the consumers.

The 2.10 presents total distribution losses as a proportion of energy available for sale in distribution companies. It is necessary to underline that the figures of Transmission & Distribution losses were remained on higher side which is a matter of concern.

Table 2.10: Utility-wise Distribution losses in the utilities (%age)

Year	UHBVNL	DHBVNL
2007-08	28.56	27.54
2008-09	27.02	25.19
2009-10	25.92	26.97
2010-11	33.30	22.95
2011-12	31.20	23.71
2012-13	31.26	22.01

Source: HERC -Tariff Order for distribution business for FY 2013-14
Note: UHBVNL- Uttar Haryana Bijli Vitran Nigam Limited, DHBVNL- Dakshin Haryana Bijli Vitran Nigam Limited.

The data highlights that distribution losses were consistently at higher levels. There was a little progress in case of DHBVNL in reducing the losses. However, it may be noted that none of the company has completed 100% metering at consumer ends. Unless all the electricity supply including supply to agricultural sector is fully metered, authentic estimates of T&D losses are difficult to make.

In the post- reforms period the Commission has put pressure on the power distribution companies to estimate power consumption in agriculture sector on the basis of realistic average running hours of irrigation per pump-sets. The Commission has also highlighted that the power distribution companies neither have data on the actual energy consumption nor the correct BHP rating of the pumps as no instrument was placed to record the same. Therefore, it may be pointed out that the figures shown in official records were only an 'intelligent' guess and not the accurate data as more than 60 per cent electricity supply to agriculture sector was un-metered. In the tariff order issued for the year 2010-11, the Commission has observed that both of the distribution companies have failed in reducing the distribution losses within acceptable limits.

While supplying electricity to a consumer it is expected that it will be metered and the consumer will be asked to pay as per the tariff approved by the HERC. There may always be some unscrupulous elements who may temper with the meters or have direct supply from the lines and indulge in pilferage & theft of power. In mid 1970s, it was decided not to meter supply to agriculture consumers as installation of meters and recording of consumption was a problem and there will be no revenue loss if electricity is supplied at a flat rate. But non-metering of electricity opened a flood gate of corruption and non accountability. Thereafter, nobody could know how much was the actual consumption and how much was the theft in the agriculture sector.

Now various stakeholders have developed a vested interest not to let full metering take place despite HERC repeated directives to do the needful as early as possible. Many a times, dead lines have been violated. It may be noted that there is no dearth of resources to accomplish the task. There is an active nexus among the influential farmers who do not want to install meters to continue being unaccountable, corrupt employees and the political patronage.

The Commission, in its tariff order for the year 2013-14, clearly mentioned with serious concern that despite claims of the Distribution Licensees that they were making huge capital investments to reduce distribution losses, the position has not improved much from the inception of these companies.

Both the Discoms had segregated their agricultural supply feeders in the year 2009-10. As such their AP consumption for FY 2011-12 & FY 2012-13, was estimated by the Commission on the basis of actual consumption recorded on segregated AP feeders during FY 2010-11 and FY 2011-12, after adjusting a loss factor of 16 per cent. It is felt that the increase in AP sale should be commensurate with the increase in connected load. The Commission observesd that this mismatch could be because of the following reasons:-

- The claim of the Discoms that 100% feeders have been segregated into AP feeders does not seem to be true.
- The claim of UHBVNL that there is no load other than the AP load on segregated AP feeders does not appear to be correct. Similarly the quantum of non-AP load connected on segregated AP feeders, intimated by the DHBVNL also seems to be an under estimation. It clearly indicates that there are non-AP load on segregated AP feeders which is increasing at an exorbitant rate every year. This is one of the reasons for very high growth in AP sales year after year (Tariff order 2013-14).

2.5 Fatal & Non Fatal Accidents in Haryana

Fatal and non fatal accidents have also tended to increase cost of supply. In this section we have tried to examine the status of fatal and non fatal accidents.

Table 2.11: Fatal and Non fatal Accidents in Haryana

Sr.No.	FY	Human Beings		Animals		Total	
		Fatal	Non-fatal	Fatal	Non-fatal	Fatal	Non-fatal
1	2007-08	95	138	142	0	237	138
2	2008-09	133	160	226	2	359	162
3	2009-10	124	146	205	0	329	146
4	2010-11	125	134	174	0	299	134
5	2011-12	138	127	141	0	279	127

Source: Tariff Order 2013-14

The Table 2.11 shows that the number of accidents has been unacceptably high. The HERC has argued that high incidents of accidents not only results in loss of human and animal life but also causes financial loss to the utility in the shape of avoidable compensation payable to victims and legal expenses. It tends to increase in cost of supply and also adversely affects the moral and confidence of the workmen.

2.6: Conclusion

It may be argued that over the period the state government has devoted a significant amount of funds for the growth of power sector in the state. Despite the impressive expansion of the sector, the technical performance was not satisfactory. There is an urgent need to improve technical efficiency of power utilities through ensuring transparency, accountability and public participation. The utilities must ensure 100 per cent metering at consumer ends, particularly agricultural consumers on priority basis so that precise estimation of electricity consumption and level of transmission & distribution losses may be made. In the absence of proper metering in agriculture sector, the actual amount of subsidy cannot be precisely estimated.

Chapter III

Pricing Policy and Financial Performance of Haryana Power System

In this Chapter we have examined the exiting pricing policy and financial performance of the power sector in Haryana.

3.1: Pricing Policy and Financial Performance

As per existing tariff policy in Haryana, various categories of consumers were being charged tariff at different rates (Tariff Order for the FY 2013-14). Moreover, the tariff structure was not uniform across the categories of consumers. The tariff structure for domestic consumers has a slab system on the basis of electricity consumption. There were three slabs: the first slab covered the electricity consumption upto 40 units per month. The second slab covered the consumption levels between 40 units to 300 units per month and third slab was applicable for the consumption above 300 units per month. The industrial power supply has been classified into two groups, L.T. and H.T. In the case of agricultural supply, tariff structure has two options, per unit charges for metered supply and flat rate system as Rs. /BHP/ month for unmetered supply.

It may also be highlighted that some consumer categories (commercial and industrial) were being charged tariff rates consistently at higher rates than the domestic & agriculture consumers without any socio-economic rationale. Charging certain consumer categories at a price which was significantly less than its cost of supply encourages wasteful consumption and loss of revenue to the power utilities. Due to lower revenue realisation, there were regular hikes in tariffs of both subsidising and subsidised categories of consumers. With the tariff hike for the power supplied to subsidising category particularly industrial consumers, they move towards alternative power supply provisions such as captive power generation or power purchase using open access mechanism. This implies that tariff rates do not have any systematic relationship with the cost of supply. Socio- economic and political considerations appear to have played crucial role in the formation of tariff structure. Obviously, State Governments compelled the power utilities to follow certain pricing policy but it abdicated from its responsibility to compensate the utilities keeping them in a perpetual financial crisis (Surinder Kumar, 1999). This requires a reconsideration of the relationship between electricity undertakings and the state governments on the one side and the rationale for a pricing policy and subsidisation of certain consumers on the other. Irrational pricing policy has its serious implications for the utility/ies as well as the state economy. To ensure financial viability of the system, the tariff rates must reflect cost of supply.

The World Bank (2001)[1] found that most poor farmers in Haryana would agree to a rise in power tariff if accompanied by the improvement in the quality of power supply. Secondly, it was doubtful whether power subsidies have had a specific effect on poverty reduction. The study pointed out that providing highly subsidized but poor quality power to agriculture was an impediment to agricultural and income growth. Due to the erratic electric power, farmers' costs – particularly in the purchase of unnecessarily high-powered electric pumps and back-up or alternate diesel pumps and in the repair of pumps that burn out – were notably higher than they would be if supply were reliable and voltage steady. Indirect costs also flow from the time lost in repairing equipment and the timeliness lost in getting water to crops when it was needed most. Moreover, power subsidy was mis-targetted as it benefitted much more the large farmers who used groundwater for irrigation as compared to small farmers. The present pricing regime based on a flat rate structure results in higher electricity prices for the small farmers compared to large farmers because of their lower level of consumption. The electricity subsidy exclusively benefits electric pump owning farmers, especially the semi- medium to large farmers, as they predominantly own the electric pumps and account for the larger share of electricity consumption.

It has been observed from a close analysis of tariff orders issued by the Haryana Electricity Regulatory Commission (HERC) that the Commission has failed to work out a realistic and progressive tariff structure reflecting consumer category wise cost of supply that may target a reduction of cross-subsidy.

In order to bring out the extent of subsidisation or surplus, we have carried out a comparative analysis of the average cost of supply and average revenue realised for the period 2007-08 to 2012-13.

[1] World Bank. 2001. *India: Power Supply to Agriculture*, Washington D.C.: World Bank

Table 3.1: Average Cost of Supply and Average Revenue Realised in Haryana

Items	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Average Cost (Paise/ kWh)	463.03	543.14	578.46	533.64	527.42	533.19
Average Revenue Realised (Paise/ kWh)	274.73	323.02	337.90	336.12	398.41	340.13
Per Unit gap (Paise/ kWh)	188.3	220.12	240.56	197.52	129.01	193.06
Cost Recovery Ratio (%)	59.33	59.47	58.41	62.99	75.54	63.79
Average Revenue realised from Agriculture (Paise/ kWh)	37.72	40.18	35.84	35.03	37.69	31.99
Cost Recovery From Agriculture (%)	8.15	7.40	6.20	6.56	7.15	6.00
Per Unit subsidy for agriculture (Paise/ kWh)	425.31	502.96	542.62	498.61	489.73	501.20
Total Agriculture Subsidy paid (Rs. in crore)	2560	2999	2771	2940	3577	3974*

Source: HERC- Tariff orders for various years, PFC- Report on the performance of state power utilities for the years 2004-05 to 2006-07 and 2008-09 to 2010-11.
Note: *-Based on average cost of supply 562 paise/kWh

The Table 3.1 presents the average cost of supply and average revenue realised in Haryana. Average cost of supply (combined) increased from 463.03 paise per unit in 2007-08 to 578.46 paise in 2009-10 and it reduced to 533.19 paise per unit in 2012-13. Whereas the average revenue realized from consumers increased from 274.73 paise per unit to 337.90 paise per unit and further to 340.13 paise per unit during the corresponding period. Meanwhile, the cost recovery through revenue realisation continued to be low. It was 59.33 percent in 2007-08 that increased to 75.54 percent in 2011-12, but it perceptibly reduced to 63.79 percent in 2012-13. It shows that the revenue realised per unit of electricity did increase over the time but it was inadequate to meet the cost, whereby the average revenue realised was consistently lower than the cost of supply. There was not even a single year in which the average revenue was greater than the average cost of supply.

The Table 3.1 further highlights that average revenue realised from agricultural consumers was 37.75 paise in 2007-08 which reduced to 31.99 paise in 2012-13. During the period under consideration average revenue realised from agricultural consumers remained less than even 41 paise per unit. Consequently, the amount of per unit subsidy to agricultural consumers has increased from 425.31 paise per unit in 2007-08 to 542.62 paise per unit in 2009-10 and further reduced to 501.20 paise per unit in 2012-13. In fact recovery of user cost from agricultural sector significantly reduced from 8.15 percent in 2007-08 to 6.00 percent in 2012-13. As a result, the amount of total subsidy for agricultural consumers has significantly increased from Rs. 2560 crore in 2007-08 to Rs. 3974 crore in 2012-13, which has serious implications for the state economy.

3.2: Implications of Agriculture Power Subsidy to State Finances

The analysis of pricing policy and financial performance of electricity distribution companies (DISCOMs) in Haryana present a very contrasting picture. There is hardly any relationship between cost of supply and average revenue realised. It may be pointed out that the reform process did not lead to improve recovery of cost which was one of the important objectives of the reforms. Increasing amount of subsidisation on account of almost free supply of electricity to the agricultural consumers has serious implications for the state finances.

Table 3.2: Total Agriculture Power Subsidy paid and as a share of TRR, OTR and GSDP in Haryana

Year	Total Subsidy Paid (Rs. in crore)	Subsidy as %age of TRR	Subsidy as %age of OTR	Subsidy as %age of GSDP
2007-08	2560	12.96	22.03	1.69
2008-09	2999*	16.25	25.73	1.64
2009-10	2771	13.20	20.96	1.24
2010-11	2940	11.50	17.51	1.12
2011-12	3577	11.71	17.54	1.17
2012-13	3974 **(7.60)****	10.51	16.36	1.13

Source: CAG: Annual reports for various years. RBI: State Finances: A study of Budgets for various years.
Note: TRR- Total Revenue Receipts, OTR- Own Total Receipts, GSDP- Gross State Domestic Product,*: including the amount of rural electrification, **- annual compound growth rate.

Table 3.2 presents the amount of total power subsidy paid by the state government and its relation with some crucial financial indicators during the period 2007-08 to 2012-13. The total amount of power subsidy to agriculture increased from Rs. 2560 crore in 2007-08 to Rs. 3974 crore in 2012-13 representing a growth rate of 7.60 percent per annum. Subsidy as a share of Total Revenue Receipts of the state was 12.96 per cent in 2007-08 which increased significantly to 16.25 per cent in 2008-09 mainly due to increase in the amount of rural electrification. After the year 2008-09, the share of agricultural subsidy in total revenue receipts has declined to 10.51 per cent in 2012-13, however in absolute amount it has been continuously increasing. It may be pointed out that higher amount of subsidy leaves smaller amount of revenue with the state government for meeting developmental and other socio-economic responsibilities. The share of total own tax revenue cornered by agriculture power subsidy was more than 16 per cent during most of the period under consideration. For the year 2012-13, the share of agriculture subsidy in total own tax revenue was 16.36 per cent. Similarly, the share of subsidy in Gross State Domestic Product (GSDP) remained in range of 1.13 per cent to 1.69 per cent during the period 2007-08 to 2012-13.

Table 3.3: Share of Expenditure on Power Subsidy and Social Sectors in GSDP

(per cent)

Year	Power Subsidy	Medical and Public Health Welfare	Water Supply and Sanitation
2007-08	1.69	0.35	0.30
2008-09	1.64*	0.40	0.36
2009-10	1.24	0.46	0.33
2010-11	1.12	0.41	0.33
2011-12	1.17	0.36	0.44
2012-13	1.13	0.49	0.33

Source: CAG: Annual reports for various years. RBI: State Finances: A study of Budgets for various years.
Note: GSDP- Gross State Domestic Product,*: including the amount of rural electrification.

Table 3.3 presents expenditure on power subsidy and social sectors as a proportion of GSDP during the period 2007-08 to 2012-13. It is very interesting to reveal that the share of agriculture power subsidy was much higher than that of expenditure on medical services and the supply of clean water & sanitation. It implies that agricultural power subsidy has been financed at the cost of crucial social sectors. Failure to target health and sanitation services was probably the main cause for lower Human Development Indices in Haryana.

3.3: Conclusion

On the basis of above analysis, it may be pointed out that power has been supplied to agricultural consumers at highly subsidised rates without any socio-economic rationale. Such an irrational pricing policy has adversely affected the financial position of the utilities/ DISCOMs as well as the state government. In wake of insufficient availability of resources, power utilities were forced to raise loans from the market at higher interest rates for meeting its working capital expenditure which in turn enhanced the future liabilities of DISCOMs on account of interest payment and repayment of loans. This burden has been borne by non-agriculture consumers in terms of regular tariff hikes. Moreover, the amount of power subsidy has been increasing continuously which enlarged the bill of committed expenditure at the cost of social sectors. Higher amount of committed expenditure leaves lesser resources for making quality expenditure in the hands of the government that reflected in terms of poor HDI indices on the one hand and rising levels of Revenue Deficit and Fiscal Deficit on the other.

Chapter IV

Perception of Agricultural Households regarding Agricultural Power Subsidy

In this chapter, we have analysed the perceptions of agricultural households regarding various aspects in relation to agricultural power subsidy.

4.1: Classification of Sampled Households and their Cropping Pattern

Table 4.1: Classification of Households on the basis of Operational Land holdings

Particulars	No. of Households
Marginal Farmer (upto 2.5 Acres)	28 (5.19)
Small Farmer (2.51 to 5.0 Acres)	131 (24.26)
Semi- Medium Farmer (5.1 to 10.0 Acres)	166 (30.74)
Medium Farmer (10.1 to 25.0 Acres)	159 (29.44)
Large Farmer (more than 25 Acres)	56 (10.37)
Total	540 (100)

Source: Field Survey, 2014
Note: Figures in brackets indicate percentage to total

The Table 4.1 presents the composition of the households on the basis of operational land holdings. The total sample size of 540 households was selected comprising 28 (5.19 per cent) marginal, 131 (24.26 per cent) small, 166 (30.74 per cent) semi-medium, 159 (29.44 percent) medium and 56 (10.37 percent) large farmers. The majority of households were in the categories of semi-medium and medium farmers (5.1 to 25 acres) which presents more than 60 per cent stake. The share of marginal and small farmers in total sample size was 29.44 per cent whereas that of medium & large farmers was 70.56 per cent.

Table 4.1a: Category-wise Percentage Distribution of Land Holdings All India and Haryana

Particulars	Marginal (≤ 2.5) acres	Small (2.5 -5.0) acres	Semi- medium (5.0 -10.0) acres	Medium (10.0 - 25.0) acres	Large (>25) acres
All India	67.10	17.91	10.04	4.25	0.70
Haryana	48.11	19.47	17.55	12.04	2.83
Beneficiaries of agriculture power subsidy in our sample*	**5.19**	**24.26**	**30.74**	**29.44**	**10.37**

Source: Agriculture Census 2010-11
Note: *- The classification of beneficiaries was the composition of our sample size of 540.

The Table 4.1a highlights that the combined share of marginal and small land holdings was 85.01 per cent for all India and 67.58 per cent for Haryana whereas that of 29.45 per cent in our sample. It has been clearly indicated that main beneficiaries of agriculture power subsidy in Haryana are Medium & Large farmers who occupied 70.55 per cent share in total sample size (540).

Table 4.2: Cropping Pattern for Sampled Households

S.No	Pre Tube-well Installation		Post Tube-well Installation	
	Kharif Season			
	Crop	Area (acre)	Crop	Area (acre)
1	Paddy	4183.75	Paddy	4188.25
2	Cotton	646.00	Cotton	766.50
3	Bajra	582.50	Bajra	582.50
4	Fodder	266.25	Fodder	266.25
5	Gwari	478.50	Gwari	478.50
6	Pulses	28.00	Pulses	28.00
7	Maize	2.00	Maize	2.00
8	Total	6187.00	Total	6312.00
Rabi Season				
1	Crop	Area (acre)	Crop	Area (acre)
2	Wheat	5038.50	Wheat	5171.00
3	Oilseeds	624.50	Oilseeds	742.50
4	Sugarcane	290.50	Sugarcane	290.50
5	Fodder	235.50	Fodder	235.50
6	Pulses	123.00	Pulses	123.00
7	Barley	5.00	Barley	38.00
8	Vegetable	2.00	Vegetable	2.00
9	Total	6319.00	Total	6602.50

Source: Field survey, 2014

Table 4.2 exhibits the cropping pattern during Kharif and Rabi seasons for the sampled households. The major crops in Kharif season were paddy, cotton, gawari, bajra and fodder. Whereas wheat, oilseeds, sugarcane, pulses and fodder were the main crops in Rabi season. It needs to be noted that wheat paddy rotation is prominently prevailing in Haryana, except southern districts. The area under cotton cultivation perceptibly increased after installation of tube-well whereas there was marginal increase in the area under paddy cultivation.

During Rabi season two crops, wheat and oilseeds, also showed an increase in area under cultivation after installation of tube-well. It needs to be highlighted that the cropping pattern during Kharif and Rabi seasons remained more or less the same even after installation of tube-well in the study area whereas only an increase in area under cultivation of some specific crops appeared.

District-wise category-wise cropping pattern has been presented in Tables 4.3 and 4.4.

Table 4.3: District-wise category-wise Cropping Pattern in Kharif Season

Particulars	Marginal Farmers				
	Paddy	Cotton	Bajra	Gawari	Fodder
Bhiwani			√	√	√
Jind	√	√			√
Karnal	√				√
	Small Farmers				
Bhiwani		√	√	√	√
Jind	√	√			√
Karnal	√				√
	Semi- Medium				
Bhiwani		√	√	√	√
Jind	√	√			√
Karnal	√				√
	Medium				
Bhiwani		√	√	√	√
Jind	√	√	√		√
Karnal	√				√
	Large				
Bhiwani		√	√	√	√
Jind	√	√	√		√
Karnal	√				√

Source: Field Survey, 2014

The Table (4.3) reveals that bajra, cotton, fodder and gawari are the major crops in district Bhiwani. Paddy and fodder were the main crops in district Karnal whereas in district Jind paddy, cotton, bajra and fodder remained the major crops during kharif season across the categories. It is well established proposition in literature that crop diversification took place with size of land holdings. In district Bhiwani, cotton and gawari cultivation increased with size of land holdings. In district Jind cotton and bajra cultivation appeared as the size of land holdings increased. In case of district Karnal the cropping pattern remained the same and only area under the cultivation increased with the size of land holdings.

Table 4.4: District-wise category-wise cropping pattern in Rabi Season

Particulars	Marginal Farmers					
	Wheat	Oilseeds	Sugarcane	Pulses	Fodder	Barley
Bhiwani	√	√			√	
Jind	√				√	
Karnal	√				√	
	Small Farmers					
Bhiwani	√	√			√	√
Jind	√				√	
Karnal	√				√	
	Semi- Medium					
Bhiwani	√	√			√	√
Jind	√				√	
Karnal	√				√	

	Medium					
Bhiwani	√	√		√	√	√
Jind	√		√		√	
Karnal	√		√		√	
	Large					
Bhiwani	√	√		√	√	√
Jind	√		√		√	
Karnal	√		√		√	

Source: Field Survey, 2014

Table 4.4 clearly exhibits that wheat and fodder were the main crops during Rabi season across districts and farmer categories. Sugarcane cultivation was adopted by only medium and large farmers in districts Jind and Karnal. In district Bhiwani, medium and large farmers adopted oilseeds and pulses cultivation along with wheat and fodder.

Table 4.5: Category-wise Cropping Pattern in Kharif Season (acre)

Particulars	Pre Tube-well Installation		Post Tube-well Installation	
	Crops	Area (acre)	Crops	Area (acre)
Marginal	Paddy	25.25	Paddy	25.25
	Cotton	17.00	Cotton	17.00
	Bajra	5.50	Bajra	5.50
	Gawari	4.00	Gawari	4.00
	Fodder	3.00	Fodder	3.00
Small	Paddy	353.50	Paddy	358.00
	Cotton	67.00	Cotton	81.50
	Bajra	56.00	Bajra	56.00
	Gawari	20.00	Gawari	20.00
	Fodder	28.75	Fodder	28.75
	Pulses	4.00	Pulses	4.00
Semi Medium	Paddy	707.00	Paddy	707.00
	Cotton	184.00	Cotton	218.00
	Bajra	204.00	Bajra	204.00
	Gawari	132.50	Gawari	132.50
	Fodder	76.50	Fodder	76.50
	Pulses	3.00	Pulses	3.00
Medium	Paddy	1567.00	Paddy	1567.00
	Cotton	270.00	Cotton	303.00
	Bajra	225.00	Bajra	225.00
	Gawari	246.00	Gawari	246.00
	Fodder	105.50	Fodder	105.50
	Pulses	4.00	Pulses	4.00
	Maize	2.00	Maize	2.00
Large	Paddy	1531.00	Paddy	1531.00
	Cotton	108.00	Cotton	147.00
	Bajra	92.00	Bajra	92.00
	Gawari	76.00	Gawari	76.00
	Fodder	52.50	Fodder	52.50
	Pulses	17.00	Pulses	17.00

Source: Field survey, 2014

The data presented in Table 4.5 clearly indicates that there was no change in cropping pattern across farmers' categories during Kharif season. There was nominal increase in area under cotton cultivation after tube-well installation in most of the farmers' categories, except marginal farmers, where it remained intact. Area under paddy cultivation was increased only by 5 acres in the category of small farmers during post- tube-well installations.

Table 4.6: Farmer Category-wise Cropping Pattern in Rabi Season

Particulars	Pre Tube-well Installation		Post Tube-well Installation	
	Crops	Area (acre)	Crops	Area (acre)
Marginal	Wheat	42.25	Wheat	42.25
	Oilseeds	11.00	Oilseeds	11.00
	Fodder	1.50	Fodder	1.50
Small	Wheat	436.25	Wheat	461.25
	Oilseeds	49.00	Oilseeds	60.00
	Fodder	23.50	Fodder	23.50
	Sugarcane	2.00	Sugarcane	2.00
	Barley	0.00	Barley	0.50
	Pulses	3.00	Pulses	3.0
Semi Medium	Wheat	960.50	Wheat	996.50
	Oilseeds	216.50	Oilseeds	246.00
	Sugarcane	20.00	Sugarcane	20.00
	Pulses	23.50	Pulses	23.50
	Fodder	68.00	Fodder	68.00
	Vegetable	2.00	Vegetable	2.00
	Barley	0.00	Barley	5.00
Medium	Wheat	1948.00	Wheat	1993.50
	Oilseeds	249.00	Oilseeds	291.50
	Sugarcane	97.00	Sugarcane	97.00
	Pulses	56.50	Pulses	56.50
	Fodder	96.50	Fodder	96.50
	Barley	5.00	Barley	14.50
Large	Wheat	1651.50	Wheat	1677.50
	Oilseeds	99.00	Oilseeds	134.00
	Sugarcane	171.50	Sugarcane	171.50
	Pulses	40.00	Pulses	40.00
	Fodder	46.00	Fodder	46.00
	Barley	0.00	Barley	18.00

Source: Field survey, 2014

The Table 4.6 presents cropping pattern during pre and post tube-well installation period in Rabi season. The data shows that there was slight change in the cropping pattern. After tube-well installation barley cultivation came into scene in the categories of small, semi-medium and large farmers. Otherwise, there was only increase in area under wheat and oilseeds cultivation across the categories, except the category of marginal farmers, after tube-well installation. It implies that due to increase in irrigation facilities, after having an electric tube-well, the farmers started to grow wheat and oilseeds on more acreage.

4.2: Estimation of Wasteful Consumption of Resources

To estimate wasteful consumption of electricity, we have tried to compare the optimum number of times crop-wise irrigation was required (estimated by agricultural experts) with actual number of times irrigation took place in the selected districts. It is pertinent to reveal that depth and number of irrigations depends on many factors such as weather conditions, especially the intensity and frequency of rainfall during the crop season, type of soil (sandy, clay, sandy loan etc.), irrigation methods to be adopted (flood, sprinkle etc.) and other management practices being followed.

Table 4.7: Crop-wise details of Number of times Irrigation Required and Number of times of Actual Irrigation with Electric Tube-well per acre in Kharif Season

S. No	Crops	Area (acre)	No. of times irrigation required *	No. of times of actual irrigation with Electric Tube-well
1	Paddy	4188.25	20-25	41.82
2	Cotton	766.50	3-4	4.60
3	Bajra	582.50	2-3	5.22
4	Fodder (Jawar)	266.25	5-7	7.39
5	Gawari	478.50	2-3	3.83
6	Pulses (Arhar)	28.00	3-4	3.25

Source: 1.Field Survey, 2014
2. Report on Efficient Management of Irrigation Water in Haryana (2009) by A.S. Dhindwal, V.K. Phogat and M.S. Dahiya, CCS Haryana Agricultural University, Hisar.

Note: *: Number of times irrigation required as estimated by the experts are for a normal weather and soil conditions.

The Table 4.7 presents the comparison of crop wise optimum number of times of irrigation was required and number of times of actual irrigation with tube-well per acre during Kharif season. The data clearly shows that average number of times of actual irrigation is significantly higher than optimum number of times of irrigation was required in most of the Kharif crops, except pulses. In case of paddy, being a highly water intensive crop, the estimated optimum number of times of irrigation is between 20-25 per acre but actual average number of times of irrigation was 41.82 which amounts about double against the optimum number of times of irrigation required. It clearly indicates towards over utilisation of ground water.

Similar trends have also been observed in most of the Rabi crops, except wheat and fodder, from the data presented in the Table (4.8). The average number of times of actual irrigation (5.80) for wheat was in the specified range of optimum number of times of irrigation. The average actual number of times of irrigation for sugarcane (26.03) and barley

(7.20) was perceptibly higher than the respective optimum number of times of irrigation (12-16 and 2-3).

Table 4.8: Crop-wise details of Number of times Irrigation Required and Number of times of Actual Irrigation with Electric Tube-well per acre in Rabi Season

S. No.	Crops	Area (acre)	No. of times irrigation required *	No. of times of actual irrigation with Electric Tube-well
1	Wheat	5171.00	5-6	5.80
2	Oilseeds	742.50	2-3	4.97
3	Sugarcane#	290.50	12-16	26.03
4	Fodder (barseem)	235.50	12-15	7.08
5	Pulses (gram)	123.00	1-3	4.00
6	Barley	38.00	2-3	7.20

Source: 1.Field Survey, 2014
2. Report on Efficient Management of Irrigation Water in Haryana (2009) by A.S. Dhindwal, V.K. Phogat and M.S. Dahiya, CCS Haryana Agricultural University, Hisar.
Note: *: No. of irrigations estimated by the experts are for a normal weather and soil conditions. #- Annual crop

There were hardly any efforts from the state government to motivate farmers for efficient utilisation of electricity and ground water. There is an urgent need to ensure metered supply at consumer ends, particularly the agriculture connections, on priority basis. It will promote efficiency and add to viability in the power supply. Unmetered power supply promotes inefficiency in electricity consumption and utilisation of ground water. The power utilities claimed 100 % metering at agriculture feeders but it has a significant amount of load of non-agriculture sector, particularly domestic. In the absence of proper metering at consumer ends, the precise estimation of actual electricity consumption by agricultural consumers and level of transmission & distribution losses is not possible.

4.3: Impact of Electric Tube-well Utilisation on Production and Productivity of the Crops

The Tables 4.9 and 4.10 show the impact of tube-well utilisation on total production and productivity of major crops for the sampled households during Kharif and Rabi seasons. The data shows that the area under cultivation of main Kharif crops remained more or less the same, except cotton during the period of pre and post installation of electric tube-well. But total production of all the Kharif crops has increased. Consequently, productivity (yield) per acre of all the corresponding crops also increased. The highest increase in productivity was observed in paddy during post tube-well installation period (from 17.61 quintals per acre to 22.54 quintals per acre). It may partially be attributed to extension of irrigation facilities from electric tube-wells. It needs to be noted that use of High Yielding Varieties (HYVs) seeds, chemical fertilisers and pesticides has gone up with extension of irrigation facilities.

Table 4.9: Impact of Tube-well Utilisation on Production and Productivity of Major Crops for the Sampled Households in Kharif Season

Particulars	Area (acre)		Total Production (quintal)		Productivity per acre (quintal)	
	Pre Tube-well Installation	Post Tube-well Installation	Pre Tube-well Installation	Post Tube-well Installation	Pre Tube-well Installation	Post Tube-well Installation
Paddy	4183.75	4188.25	73707.50	94436.50	17.62	22.55
Cotton	646.00	766.50	4195.50	6417.50	6.49	8.37
Bajra	582.50	582.50	2894.50	4008.25	4.97	6.88
Gawari	478.50	478.50	1532.00	2214.00	3.20	4.63
Pulses	28.00	28.00	72.00	100.00	2.57	3.57

Source: Field Survey, 2014

Similar trends have been observed in Rabi crops. The increase in productivity of sugarcane was the highest from 258.38 quintals per acre in pre tube-well installation to 304.54 quintals per acre in post tube-well installation period. The increase in productivity of wheat was second highest from 16.07 quintals per acre to 19.69 quintals per acre during the corresponding period.

Table 4.10: Impact of Tube-well Utilisation on Production and Productivity of Major Crops for the Sampled Households in Rabi Season

Particulars	**Area (acre)**		**Total Production (quintal)**		**Productivity per acre (quintal)**	
	Pre Tube-well Installation	Post Tube-well Installation	Pre Tube-well Installation	Post Tube-well Installation	Pre Tube-well Installation	Post Tube-well Installation
Wheat	5038.50	5171.00	80966.25	101859.75	16.07	19.70
Oilseeds	624.50	742.50	3464.00	5308.00	5.55	7.15
Sugarcane	290.50	290.50	75060.00	88470.00	258.38	304.54
Pulses	123.00	123.00	566.00	781.50	4.60	6.35
Barley	5.00	38.00	44.00	376.50	8.80	9.12

Source: Field Survey, 2014

The analysis of impact of tube-well utilisation on production and productivity of major crops for the sampled households during Kharif and Rabi seasons clearly indicates that the extension of irrigation facility through installation of tube-well has largely promoted the utilisation of High Yielding Varieties (HYVs) seeds, pesticides and chemical fertilisers which in turns led to a significant growth in productivity of the crops. The net sown area under cultivation of paddy and wheat has remained more or less the same. But the total production of these crops (paddy and wheat) for the sampled households has increased from 73707.50 quintals and 80966.25 quintals during pre tube-well installation to 94436.50 quintals and 101859.75 quintals respectively during post tube-well installation. Correspondingly, productivity has gone up from 17.62 quintals per acre to 22.54 quintals per acre for paddy and from 16.07 quintals per acre to 19.70 quintals per acre for wheat.

We have also tried to find out major factors responsible for increase in productivity of major crops. The Table 4.11 presents major factors, as per households' responses, responsible for increase in productivity of the crops per acre.

Table 4.11: Major Factors Responsible for Increase in Productivity of the Crops per acre as given by the Households (multiple response)

Particulars	Irrigations	HYVs	Chemical Fertilizers	Pesticides	Mechanisation	other
Marginal 28	28 (100)	23 (82.14)	26 (92.86)	6 (21.43)	5 (17.86)	0
Small 131	131 (100)	105 (80.15)	102 (77.86)	62 (47.33)	37 (28.24)	0
Semi-medium 166	166 (100)	128 (77.11)	125 (75.30)	57 (34.34)	19 (11.45)	0
Medium 159	159 (100)	126 (79.25)	122 (76.73)	66 (41.51)	21 (13.21)	2 (1.26)
Large 56	56 (100)	45 (80.36)	37 (66.07)	29 (51.79)	10 (17.86)	1 (1.79)
Total 540	540 (100)	427 (79.07)	412 (76.03)	220 (40.79)	92 (17.04)	3 (0.56)

Source: Field Survey, 2014
Note: Figures in brackets indicate percentage to their respective total

The data reveals that extension of irrigation facilities through tube-well installation was one of the major factors responsible for increase in productivity. With the increase in irrigation facilities the use of High Yielding Varieties (HYV) seeds, chemical fertilisers and pesticides have also contributed to increase productivity as 79.07 per cent, 76.03 per cent and 40.79 per cent households respectively pointed out. Besides these factors, mechanisation was also a factor responsible for an increase in productivity of crops during both the cropping seasons Kharif and Rabi as 17.04 per cent households revealed.

4.4: Environmental Impacts of Electric Tube-well Utilisations

It clearly indicates that tube-well irrigation has played a significant role in agricultural growth in terms of increase in total production and productivity. However, over-utilisation of ground water has caused the problems of decline in water table, degradation of soil fertility etc. This fact has also been substantiated by Joydeb Sasmal, 2014.

The Table 4.12 presents information on category-wise purpose-wise tube-well utilisation by the households. The data exhibits that only 13.15 per cent households utilised tube-well for own domestic purposes apart from own irrigations. The utilisation of tube-well for commercial activities was not found during the field survey.

Table 4.12: Category-wise Purpose-wise Tube-well Utilisation by the Sampled Households (multiple response)

Particulars	Own Irrigation	Own Domestic use
Marginal Farmers 28	28 (100)	7 (25.00)
Small Farmers 131	131 (100)	11 (8.40)
Semi-Medium Farmers 166	166 (100)	26 (15.66)
Medium Farmers 159	159 (100)	23 (14.47)
Large Farmers 56	56 (100)	4 (7.14)
Total 540	540 (100)	71 (13.15)

Source: Field Survey, 2014
Note: Figures in brackets indicate percentage to respective total

It may be noted that the households who reported to utilise tube-well for domestic purposes were in district Bhiwani. The households pointed out that there was no alternate mean to meet domestic water requirements as most of them live in Dhanis (a small group of households who built houses in their fields). There was not a single household who was involved in commercial activities associated with tube-well water including selling water to other farmers even for irrigation purposes in the study area. However, there were some cases in district Jind where farmers exchanged tube-well water as and when it was needed to meet irrigation requirements on mutual basis only.

Haryana and Punjab have successfully implemented the green revolution technology in 1960s and 1970s, now these states are found to be worst affected by excessive ground water utilisation/ extraction and intensive farming (Joydeb Sasmal, 2014**)**. The Table 4.13 presents environmental impacts of electric tube-well utilisation as highlighted by the households.

Table 4.13: Environmental Impacts of Tube-well Utilisation as given by the Sampled Households (multiple response)

Particulars	Water Table Depletion	Soil Degradation
Marginal 28	10 (35.71)	26 (92.86)
Small 131	52 (39.69)	102 (77.86)
Semi Medium 166	68 (40.96)	125 (75.30)
Medium 159	63 (39.62)	122 (76.73)
Large 56	26 (46.43)	37 (66.07)
Total 540	219 (40.56)	412 (76.30)

Source: Field Survey, 2014
Note: Figures in brackets indicate percentage to respective total.

The data reveals that majority of the households irrespective of categories observed that soil degradation was one of major problems associated with excessive utilisation of tube-well. They argued that to maintain and/ or increase productivity of the crops during both the seasons, Kharif and Rabi, higher amount/doses of chemical fertilisers and pesticides are required. Excess utilisation of chemical fertilisers and pesticides led to deteriorate fertility of land over the period. After tube-well installation the problem of water table depletion was also appeared in the study area as 40.56 per cent households revealed.

The responses of the households regarding main reasons leading to water table depletion are presented in the Table 4.14.

Table 4.14: Reasons for Water Table Depletion as given by the Sampled Households (multiple response)

Particulars	Insufficient Rain	Over utilisation of Ground Water	Closeness of Tube-well
Marginal 28	9 (32.14)	5 (17.86)	4 (14.29)
Small 131	43 (32.82)	15 (11.45)	14 (10.69)
Semi Medium 166	65 (39.16)	15 (09.04)	17 (10.24)
Medium 159	58 (36.48)	6 (03.77)	24 (15.09)
Large 56	22 (39.29)	3 (05.36)	8 (14.29)
Total 540	197 (36.48)	44 (08.15)	67 (12.41)

Source: Field Survey, 2014
Note: Figures in brackets indicate percentage to respective total

The data clearly shows that the highest number of the households (36.48 per cent) pointed out insufficient rain as a major reason for water table depletion in the region. The responses of 12.41 per cent households' revealed closeness of tube-wells as an important reason for the problem. It is very surprising to note that only 8.15 per cent households pointed out over utilisation of tube-well as a major factor responsible for water table depletion. It clearly indicates that the awareness level among farmers regarding the implications of excess utilisation of ground water is very limited. Therefore, there is an urgent need to make farmers aware about the problems associated with excess use of ground water for sustainable growth of agriculture sector in the state.

The Table 4.15 reveals main reasons responsible for soil degradation. The data clearly shows that a huge number of households (76.30 per cent) reported excess use of chemical fertilisers as a major factor leading to soil degradation in the study area. Another important factor responsible for soil degradation was excess use of pesticides as 40.74 per cent households pointed out.

Table 4.15: Reasons for Soil Degradation as given by the Sampled Households (multiple response)

Particulars	Excess use of Pesticides	Excess use of Chemical Fertilisers	Others
Marginal 28	6 (21.43)	26 (92.86)	0
Small 131	62 (47.33)	102 (77.86)	0
Semi Medium 166	57 (34.34)	125 (75.30)	0
Medium 159	66 (41.51)	122 (76.73)	2 (1.26)
Large 56	29 (51.79)	37 (66.07)	1 (1.79)
Total 540	220 (40.74)	412 (76.30)	3 (0.56)

Source: Field Survey, 2014
Note: Figures in brackets indicate percentage to respective total

The available literature also clearly spelt out that over utilisation of ground water has caused salinity and arsenic problems in water, depletion of water table and degradation of soil fertility in many parts of the country (Joydeb Sasmal, 2014). Haryana is not except to it.

The state government has adopted hardly any mechanism to regulate use of ground water, which is a matter of serious concern. The practices of excess extraction of ground water by farmers have probably happened on account of power supply to the agriculture sector at flat rate, which is also very nominal in Haryana. Flat rate system has also promoted the farmers to install in-efficient pump sets that used excessive electricity and led to wastage of electricity.

4.4: Impact of Electric Tube-well Utilisation on Cost of Production

In this section, we have also tried to examine the impact of electric tube-well installation on total cost per acre and average cost of production of major Kharif and Rabi crops for the sampled households.

The Table 4.16 highlights impact of electric tube-well installation on crop wise total cost per acre and average cost of production of major crops during Kharif season. The data reveals that total production per acre of major crops in Kharif season has increased from 13.92 quintals in pre tube-well installation to 17.73 quintals in post tube-well installation. The increase in total production of the major crops for the sampled households has happened on account of increase in area under cultivation of cotton and paddy on the one hand and excessive use of HYVs seeds, chemical fertilisers and pesticides with the extension in irrigation facilities after electric tube-well installation on the other. Consequently, total and average cost of production for the sampled households has tended to increase. Total cost of production per acre of major Kharif crops has increased to Rs. 15439.45 in post electric tube-well installation as against Rs. 10712.52 in pre electric tube-well installation. Overall average cost of production in Kharif season for the sampled households has gone up from Rs.769.83 per quintal in pre tube-well installation to Rs. 870.64 in post tube -well installation. It reveals that use of excess amount of chemical fertilisers and pesticides to enhance productivity of the crops along with inflationary pressure on input prices led to increase in total cost per acre and consequently average cost of production.

Table 4.16: Impact of Tube-well Utilisation on Total Cost per acre and Average Cost of Production of Major Crops for the Sampled Households in Kharif Season

Particulars	Total Production per acre (quintal)		Total Cost per acre (Rs.)		Average Cost of Production (Rs./quintal)	
	Pre Tube-well Installation	Post Tube-well Installation	Pre Tube-well Installation	Post Tube-well Installation	Pre Tube-well Installation	Post Tube-well Installation
Paddy	17.62	22.55	13210.16	19139.32	749.83	848.83
Cotton	6.49	8.37	7586.69	10347.55	1168.16	1235.90
Bajra	4.97	6.88	3245.41	4787.12	653.12	695.69
Gwari	3.20	4.63	2731.97	4923.72	853.30	1064.14
Pulses	2.57	3.57	1357.14	2714.29	527.78	760.00
Total	13.92	17.73	10712.52	15439.45	769.46	870.64

Source: Field Survey, 2014

The trend of increase in total cost per acre and average cost of production in Rabi season during post tube-well installation has also been observed, like Kharif season, from the data presented in the Table 4.17.

Table 4.17: Impact of Tube-well Utilisation on Total Cost per acre and Average Cost of Production of Major Crops for the Sampled Households in Rabi Season

Particulars	Production per acre (quintal)		Total Cost per acre (Rs.)		Average Cost of Production (Rs./quintal)	
	Pre Tube-well Installation	Post Tube-well Installation	Pre Tube-well Installation	Post Tube-well Installation	Pre Tube-well Installation	Post Tube-well Installation
Wheat	16.07	19.70	6368.69	10124.15	396.32	513.96
Oilseeds	5.55	7.15	3833.47	5751.52	691.11	804.54
Sugarcane#	258.38	304.54	20695.35	27939.76	80.10	91.74
Pulses	4.60	6.35	2798.78	4422.76	608.22	696.10
Barley	8.80	9.12	3200.00	6684.21	363.64	733.04
Total	26.33	30.91	6717.90	10296.47	255.18	333.07

Source: Field Survey, 2014
Note: #- Annual Crop

Overall average cost of production of major crops in Rabi season for the sampled households has increased from Rs. 255.18 in pre tube-well installation to Rs. 333.07 per quintal in post tube-well installation. During post tube-well installation, average cost of production of the major crops has also increased.

4.5: Awareness, Preferences, Problems and Suggestions in relation to Electric Tube-well Utilisations

It has been observed that farmers were using electric motors with difference capacity in terms of British Horse Power (BHP) in the study area.

Table 4.18: Motor Capacity-wise Average Expenses of Electric Tube-well Connection for the Sampled Households

Particulars	No. of Connections	Average Expenses (Rs.)
Load up to 5 BHP	67	96641.79
Load 5.1 to 10 BHP	137	130190.69
Load 10.1 to 15 BHP	276	176215.83
Load 15.1 to 25 BHP	60	204075.00
Total	540	157761.50

Source: Field Survey, 2014

The Table 4.18 shows capacity wise average expenses of installing electric tube-well for the sampled households. The average expenses in getting electric connection comprises security amount, expenses on electric poles, file charges and commission to contractor (middleman), if any. It needs to be noted that the employees of the power utilities have developed a mechanism of contractor (middleman) between farmers and the utilities. To avoid harassment and pendency of electric tube-well connections, farmers generally approached to contractor for getting tube-well connection at the earliest and contractors do the needful in collusion with concerned employees. The contractor charges lump-sum amount from the farmers taking into account total costs involved in releasing electric tube-well connection at the consumer ends including security amount, expenses on electric poles, file charges and their own commission. The households were not aware about the amount of commission charged by the contractor in this process. It was observed that average expenses for tube-well installation have tended to increase with BHP load. For the capacity of 15-25 BHP, the average expenses were Rs. 2, 04,075 as against Rs. 96,641.79 for capacity up to 5 BHP. Average cost per tube-well for the sampled households was Rs. 1, 57,761.50 which may not be affordable to marginal and small farmers. There is an urgent need to speed up the process for earlier release of electric tube-well connections to the farmers so that contractorship could be eliminated and exploitation of the farmers may be avoided. The existence of contractorship in the process has burdened the households unnecessarily in terms of increase in cost of tube-well connection.

The households have also pointed out some major issues in relation to electric tube-well connections during field survey, which are presented in the Table 4.19.

Table 4.19: Major Issues in Relation to Electric Tube-well as given by the Sampled Households (multiple response)

Particulars	High Cost of Tube- well Installation	Lengthy Process in getting Connection	Inadequate Power Supply
Marginal 28	26 (92.86)	18 (64.29)	24 (85.71)
Small 131	126 (96.18)	66 (50.38)	107 (81.68)
Semi-Medium 166	158 (95.18)	76 (45.78)	121 (72.89)
Medium 159	148 (93.08)	65 (40.88)	116 (72.96)
Large 56	52 (92.86)	16 (28.57)	38 (67.86)
Total 540	510 (94.44)	241 (44.63)	406 (75.19)

Source: Field Survey, 2014

Note: Figures in brackets indicate percentage to respective total.

The data reveals that the major issue has been related with cost of installation of electric tube-well which was very high. Marginal and small farmers have faced difficulty to afford the cost of installing electric tube-well in their fields. More than 94 per cent households highlighted this problem. Second major problem was associated with inadequate power supply as 75.19 per cent households pointed out. The households argued that the state government has fixed duration of 8 hours per day for power supply to agriculture sector. However, the supply remained interrupted and irregular during most of the period. The time schedule has also been changed frequently and at some occasion the duration of 8 hours was divided in different quarters. Such type of activities has led to inefficiency and wastage of ground water as well as electricity. It puts negative impacts on agriculture production & productivity. There should be regularity in power supply to agriculture sector. Lengthy process in getting electric tube-well connections was also one of the major problems in the state as 44.63 per cent households revealed. In a routine process, on an average one connection takes at least one and a half year to get released. To avoid pendency and harassment, farmers have approached to contractor to get released an electric tube-well connection at the earliest date. But it has enhanced average cost of tube-well connection correspondingly.

As earlier discussion revealed that average cost of electric tube-well installation was high. Therefore, farmers generally prefer local branded motor as it was relatively cheaper and extract more ground water. The data presented in the Table 4.20 clearly shows that more than 80 per cent households used local branded motors for their tube-wells. It is pertinent to note that use of local inefficient motors particularly on account of flat rate system led to over utilisation of ground water and excess consumption of electricity, which has its implications for sustainable agricultural growth and financial viability of the power utilities.

Table 4.20: Category-wise Awareness regarding Technological Innovation for Electricity Saving and Water Harvesting among the Sampled Households

Particulars	Brand of Motor Used		Use of Iron Pipes	Use of Plastic Pipes
	Company	Local		
Marginal 28	4 (14.29)	24 (85.71)	3 (10.71)	25 (89.29)
Small 131	35 (26.72)	96 (73.28)	12 (09.16)	119 (90.84)
Semi-Medium 166	31 (18.67)	135 (81.33)	25 (15.06)	141 (84.94)
Medium 159	27 (16.98)	132 (83.02)	29 (18.24)	130 (81.76)
Large 56	8 (14.29)	48 (85.72)	6 (17.71)	50 (82.29)
Total 540	105 (19.44)	435 (80.56)	75 (13.89)	465 (86.11)

Source: Field Survey, 2014
Note: Figures in brackets indicate percentage to respective total.

The Table (4.20) further shows that more than 86 per cent households were using plastic pipes instead of iron pipes. The plastic pipes were economical and have least frictions. The category wise data also reflected the preference of farmers towards use of plastic pipes. There was hardly any household who used capacitor to boost up voltage to run tube-well efficiently.

The Table 4.21 clearly highlights that all the households were interested only in existing pattern of agricultural power subsidy in which they were getting power supply at highly subsidised rates. They felt that other modes of subsidy payment may force them to ensure metered supply for tube-well in which they have no interest to avoid accountability. There is an urgent need to make them aware about the benefits of other alternate modes of agriculture power subsidy payment and motivate them to install meters at their tube-wells.

Table 4.21: Category-wise Preferences for Mode of Agriculture Power Subsidy as given by the Sampled Households (multiple response)

Particulars	Existing Pattern	Direct Cash Payment	Payment through Banks	Any other form
Marginal Farmers 28	28 (100)	-	-	-
Small Farmers 131	131 (100)	-	-	-
Semi-Medium Farmers 166	166 (100)	-	-	-
Medium Farmers 159	159 (100)	-	-	-
Large Farmers 56	56 (100)	-	-	-
Total 540	540 (100)	-	-	-

Source: Field Survey, 2014
Note: Figures in brackets indicate percentage to respective total.

The Table 4.22 presents category-wise preferences for electricity bill payment. The data clearly highlights that more than 53 per cent of total households have their preference in flat rate billing system. It is very interesting to note that more than 2/3rd marginal and small farm households were interested in metered supply billing system whereas majority of big farm households (60 per cent) have their interest in flat rate billing system.

Table 4.22: Category-wise Preferences for Electricity Bill Payment System as given by the Sampled Households

Particulars	Metered Supply Bill	Flat Rate Supply Bill
Marginal Farmers 28	14 (50.00)	14 (50.00)
Small Farmers 131	92 (70.23)	39 (29.77)
Semi-Medium Farmers 166	64 (38.55)	102 (61.45)
Medium Farmers 159	68 (42.77)	91 (57.23)
Large Farmers 56	15 (26.79)	41 (73.21)
Total 540	253 (46.85)	287 (53.15)

Source: Field Survey, 2014

Note: Figures in brackets indicate percentage to respective total

It was also observed that big farm households extract more ground water with inefficient electric motors (local branded), which consume relatively more electricity, to meet their irrigation requirements on large farms size. Therefore, they have developed their vested interests in flat rate system and avoid installing meters at their tube-wells. It clearly established that big farm households captured major chunk of benefits of agriculture power subsidy. A significant proportion of marginal and small farmers are not covered under agricultural power subsidy net due to non-possession of electric tube-well connections.

It may be argued on the basis of available data/ information that big farm households were the major beneficiaries of power supply at subsidised rates mainly because of non-possession of tube-wells by a significant proportion of marginal and small farmers. Therefore, there is an urgent need to ensure power supply at subsidised rates to the targeted households. Big farmers, being in a better financial position, may charge full cost of supply so that the burden of agriculture power subsidy can be reduced on the one hand and the environmental impacts may be controlled/ reduced on the other. It was also observed that the farmers were ready to pay higher tariffs provided the regular and sufficient power supply to their tube-wells. The state government should take initiatives to make the farmers aware about the benefits of metered power supply and ensure metering at consumer ends particularly for agricultural consumes on priority basis.

In a power deficit scenario, solar system may be used an alternate source of irrigation. The Table 4.23 presents category wise awareness/ preferences of the sampled households regarding solar irrigation system. The data shows that only 34.26 per cent households were aware about solar system which reflects a poor level of awareness. However, there was no solar irrigation system in the study area. There is an urgent need to generate awareness among households regarding alternative sources of energy. The state government should provide a amount of capital subsidy on solar pump sets at initial stage and later on it may be recovered from the beneficiaries. Moreover, awareness about energy conservation and water harvesting was also very limited that needs to be enhanced on priority basis.

Table 4.23: Category-wise Awareness / Preferences as given by the Sampled Households about Solar Irrigation System

Particulars	Awareness/Preferences
Marginal Farmers 28	11 (39.29)
Small Farmers 131	33 (25.19)
Semi-Medium Farmers 166	64 (38.55)
Medium Farmers 159	54 (33.96)
Large Farmers 56	23 (41.07)
Total 540	185 (34.26)

Source: Field Survey, 2014

Note: Figures in brackets indicate percentage to respective total.

It has been observed that irregular & insufficient power supply, lengthy & tiring process in getting tube-well connections, existence of contractorship between farmers and the power utilities are the major problems in the study area. To deal with these problems the sampled households have given some important suggestions.

Table 4.24: Category-wise Major Suggestions as given by the Sampled Households (multiple response)

Particulars	Regular Power Supply	Increase in Hours of Power Supply	Specified Time Frame for Getting Agriculture Power Connection	Elimination of Contractor	Repair of Canal System	Adequate MSP of Non-water Intensive Crops
Marginal Farmers 28	24 (85.71)	11 (39.29)	10 (35.71)	18 (64.29)	5 (17.86)	0 (00.00)
Small Farmers 131	107 (81.68)	42 (32.06)	31 (23.66)	66 (50.38)	20 (15.27)	12 (9.16)
Semi-Medium Farmers 166	121 (72.89)	66 (39.76)	50 (30.12)	76 (45.78)	16 (9.64)	19 (11.45)
Medium Farmers 159	116 (72.96)	58 (36.48)	46 (28.93)	65 (40.88)	16 (10.06)	24 (15.09)
Large Farmers 56	38 (67.86)	20 (35.71)	13 (23.21)	16 (28.57)	6 (10.71)	16 (28.57)
Total 540	406 (75.19)	197 (36.48)	150 (27.78)	241 (44.63)	63 (11.67)	71 (13.15)

Source: Field survey, 2014

Note: Figures in brackets indicate percentage to respective total

The major suggestions of the sampled households regarding electric tube-wells are presented in the Table 4.24. A significant proportion of the sampled households (75.19 per cent) suggested that the state government should ensure sufficient and regular power supply to meet their irrigation requirements, which is one of the major problems. The power utilities should also ensure to release electric tube-well connections at the earliest date such that contractorship could be eliminated and exploitation of the farmers may be avoided. Another important suggestion was regarding crop diversification. The state government should increase Minimum Support Price (MSP) of non- water intensive crops such that the farmers may be motivated to shift their cropping pattern in favour of non-water intensive crops. This will help to reduce the pressure on natural ground water and electricity consumption. Some households have also suggested repairing the canals system regularly such that they may use canal water to meet irrigation requirements to some extent.

4.6: Conclusion

On the basis of analysis above, it may be pointed that with the increase in size of land holdings, the farmers have changed their cropping behaviour from subsistence to commercial farming. The wheat-paddy rotation is, predominantly, prevailing in the state except southern districts. As there has been little change in cropping pattern, it means it has stabilised for some time now. Over the period, the irrigations facilities have increased on account of installation of electric tube-wells and consequently the area under cultivation of major crops, i.e. cotton in kharif season and oilseeds in rabi season, has gone up. Due to excess utilisation of ground water in some major crops the problems of soil degradation and water table depletion were appeared in the study area. With the extension of irrigation facilities, the use of HYVs seeds, chemical fertilisers and pesticides was increased to enhance and /or to maintain productivity of the crops. It was also observed that after installation of electric tube-well, average cost of production of all the cultivated crops for the sampled households has increased which may be attributed to the utilisation of excess chemical fertilisers, pesticides and HYVs seeds on the one hand and inflationary pressure on input prices on the other. To extract more ground water, majority of the households are using local branded inefficient electric motors which consume relatively more electricity. The majority of the households are using plastic pipes for tube-well irrigations taking into account only financial aspects as these pipes are relatively cheaper. However, the households have very little awareness about the water harvesting and energy savings techniques. The households were also unaware about the implications of excess utilisation of precious ground water for sustainable growth in agriculture. In case of excessive dependence on ground water irrigation, rain water harvesting and crop diversification in favour of less water intensive crops have been suggested as alternative policy options for sustainable growth in agriculture.

It may be highlighted that majority of marginal and small farm households were interested in metered supply billing system whereas more than 60 per cent of big farm households favoured the flat rate billing system due to vested interests. It is also interesting to highlight that most of the benefits of subsidised power supply to agriculture sector was accrued by big farm households only. A majority of marginal and small farmers were getting a little bite of cake in the state due to non - possession of electric tube-wells. Moreover, most of the sampled households were interested in existing pattern of power subsidy in which power is supplied to agricultural consumers at highly subsidised rates. They feared that alternate mode of power subsidy payment may force them to ensure metered supply for their tube-wells in which they have no interest to remain unaccountable. There is an urgent need to make the farmers aware about the benefits of alternate modes of subsidy payments. The major problem regarding electric tube-wells was irregular and insufficient power supply in the study area. The lengthy & tiring process in getting electric tube-well connections was also reported which in turn forced the farmers to approach the contractor for getting electric tube-well connection at the earliest date. The concerned employees in the utilities have also developed their vested interests in releasing tube-well connections to the farmers through contractor. The contractor charged lump-sum amount, without indicating the amount of commission, from the agricultural households for the job. This practice should be dismantled by the state government on priority basis. The power utilities should release tube-well connections at the earliest. The state government should also increase minimum support price (MSP) of non water intensive crops to motivate farmers to change their cropping pattern from water intensive crops so that the unnecessary pressure on ground water and electricity consumption may be reduced. Consequently, the burden of power subsidy on budget exchequer will also go down. Efforts should also be made to provide regular and sufficient power supply to agricultural farmers subjected to 100 per cent metering at consumer ends. The farmers, further, should be motivated to adopt solar irrigation system through providing capital subsidy at the initial stage of tube-well installation and later the amount of subsidy may be recovered from the beneficiaries.

Chapter V

Summary, Conclusions and Policy Recommendations

The Indian energy sector is today at a crucial juncture of development. With growing economy, the aspiration of people for improved energy services in terms of availability, accessibility, quality and affordable power have been raised in a big way.

Electricity as infrastructure is of key importance to accelerate the process of economic development, it was realised that power should be made available at a reasonable price. It has to be noted that the power sector exerts a critical influence on the performance of the agricultural sector in India as it influences farmers' access to and use of electricity for a variety of agricultural operations, particularly for pumping groundwater. The price of electricity supplied to agriculture sector in most of the states is heavily subsidized. These subsidies have contributed to the financial crisis in the state power utilities, reducing its ability to undertake required investments to respond to rising local demand and to maintain a smooth and reliable service. For the agricultural sector, the supply of electricity has been characterized by rationing, frequent power interruptions, and voltage fluctuations that raise the real cost of electricity to farmers and affect their production activities in several ways.

Overtime, with society acquiring higher levels of industrial development, now the major share of electricity consumption in the society is in industry and agriculture where it is used as energy input. Use of energy as a factor of production is a commercial proposition. Obviously, this use should be governed by the sound economic principles as its supply involve resource use, which cost money for which someone has to pay. Who pays and who should pay must be made transparent.

One of the pertinent problems with power sector rests on highly subsidized and unmetered power supply to some consumer categories, particularly agriculture on the discretion of state government without any socio-economic justification.

Due to unmetered supply to agriculture, energy accounting system became ineffective and in fact collapsed. In such a state of affairs when more than half of the electricity supply was not metered, it was impossible to estimate the actual technical Transmission & Distribution losses and the pilferage of power. Obviously, the beneficiaries of the unmetered supply had developed a vested interest in the system to remain unaccountable. A major part of pilferage and theft of electricity was shown as consumption in the agricultural sector. When in early 1990s wind of change in policy regime was under consideration, the same government departments/agencies and officers from the next year started showing T&D losses as much as 30 per cent to 50 per cent in comparison to 18 to 20 per cent in the previous years. It was conveniently done to provide justification for privatisation as state government in its management of the SEBs was inefficient. No questions were asked, no accountability was fixed! The 'fresh' wind of change wrapped everything under the carpet.

The power utilities in Haryana are providing electricity at highly subsidized rates particularly to agricultural consumers on the directions of the state government and consequently the financial burden of agriculture power subsidy on public exchequer of the state government has aggravated over the period.

The evaluation study on unreasonable increasing trends of power subsidies being provided to agriculture sector have tended to highlight the implications of the subsidized power supply to agriculture sector in the state.

Objectives of the study

- To examine whether the power subsidy to agriculture sector leads to wasteful consumption of power.
- To study the environmental impacts of power subsidies to agriculture sector.
- To work out the economic and social Cost-Benefits analysis of power subsidies.
- To find out whether the burden of power subsidies to agriculture sector can be minimised without curtailing the benefits to the farmers.
- To find out suitable alternatives to power subsidies to agriculture sector.

Research Methodology and Data Base

The study is based on primary as well as secondary data. For primary data collection, we have adopted multi-stage random sampling technique for selection of agriculture households. Initially, we collected data on operational circle wise number of agriculture connections with connected load (BHP) from both the power utilities Uttar Haryana Bijli Viteran Nigam Limited (UHBVNL) and Dakshin Haryana Bijli Viteran Nigam Limited (DHBVNL), then on the basis of agriculture pump-set connections per thousand net sown area, we selected three operational circles one (Karnal) from Uttar Haryana Bijli Viteran

Nigam Limited (UHBVNL) and Two (Jind and Bhiwani) from Dakshin Haryana Bijli Viteran Nigam Limited comprising one circle each from the category of the highest, average and the lowest agriculture connections per thousand net sown area. Thereafter, we have collected information from each selected operational circles regarding sub-division wise and feeder wise number of agriculture connections with connected load. After selection of sub-division and AP feeders, we have collected information from selected AP feeders regarding village wise number of agriculture connections with connected load. Finally we have made selection of three villages, having the highest agriculture connections from each selected AP feeders from each selected sub- division and operational circle for survey. A sample size of 540 households was drawn selecting 180 households from each operational circle. The ultimate agricultural households were selected at random. Care was taken to include farmers from different categories of land holding so as to nullify the discrimination effect. The selected households have been classified into five categories on the basis of land holdings i.e. Marginal farmers (upto 2.5 acres), Small farmers (2.51 to 5.0 acres); Semi-medium farmers (5.1 to 10 acres), Medium farmer (10.1 to 25.0 acres) and Large farmers (more than 25 acres). The sample size (540) consisted of 28 (5.18 %) Marginal, 131 (24.21 %) Small, 166 (30.87 %) Semi-medium, 159 (29.39 %) Medium and 56 (10.35 %) Large farmers. The data from households was collected with the help of well designed questionnaire.

The secondary data was collected from various publications of Government of Haryana, Haryana Electricity Regulatory Commission, Haryana Power Utilities, Central Electricity Authority, CCS Haryana Agriculture University, Hisar, Planning Commission and Power Finance Corporation, Government of India.

- To estimate wasteful consumption, we looked into crop wise water requirement in terms of number of times a crop is to be irrigated and number of times it is irrigated by the farmer.
- To study environmental impact, broadly, we have examined the changes in water table, soil degradation during a specific period of time.
- To conduct cost benefit analysis of power subsidies, we compared average cost of supply with average revenue realised. We further estimated total amount of subsidy and its impact on the financial position of the state.

- To find out alternative to reduce the impact of agriculture power subsidies without curtailing benefits to farmers, we studied the existing pattern of subsidy and thereby examined the justification for subsidisation to big farmers.

The study has focused on three aspects i.e. technical efficiency of power utilities, pricing policy and perception of households regarding agriculture power subsidy which are very much relevant to evaluate increasing trends in agriculture power subsidies and its implications.

Haryana State came into existence with the reorganisation of the State of Punjab as on November 1, 1966. Haryana State Electricity Board (HSEB) was created in May 1967 by bifurcating the Punjab State Electricity Board (PSEB). HSEB was incorporated as an integrated utility to discharge the generation, transmission and distribution functions in the State. Haryana was the second state in India after Orissa to adopt and implement power sector reforms under the Haryana Electricity Reforms Act 1997 (HERA), enacted in 1997 and which came into force on 14^{th} August, 1998.

The Haryana Electricity Regulatory Commission was established in August 1998 to regulate power sector in the State. After enforcement of HERA, two statutory Transfer Schemes were notified by the Government of Haryana for restructuring the HSEB. Through the First Transfer Scheme Rules, 1998, the Generation business (undertakings, assets, liabilities, proceeds and personnel) was separated from Transmission and Distribution businesses and vested in a separate company viz. Haryana Power Generation Corporation Ltd. (HPGCL). The Transmission and Distribution businesses were transferred to and vested in Haryana Vidyut Prasaran Nigam Ltd. (HVPNL). Thereafter, through the Second Transfer Scheme Rules 1999, the Transmission undertaking and business was separated from the Distribution undertakings and business. The former was retained in HVPNL as the Transmission Company, while the latter was further segregated into and vested in two successor Distribution companies i.e. Uttar Haryana Bijli Vitran Nigam Ltd (UHBVNL) and Dakshin Haryana Bijli Vitran Nigam Ltd (DHBVNL). UHBVNL was vested with the Distribution business in the North Zone of Haryana comprising Ambala, Yamuna Nagar, Karnal, Kurukshetra, Jind, Rohtak and Sonepat circles. The DHBVNL was vested with the Distribution business in the southern zone of Haryana comprising of Bhiwani, Faridabad, Gurgaon, Hisar, Narnaul and Sirsa circles. However, in July 2013, Jind circle has been transferred to DHBVNL.

The Haryana state neither owns any significant share of natural energy resources like coal, petroleum etc. nor it has any significant hydropower potential, so it has to depend upon the thermal power plants for meeting its power needs. The coal is being imported from the other States of the country like Madhya Pradesh, Bihar, Uttar Pradesh etc. Up till now, development of thermal power plants was the only option to the State for meeting its power requirements. Now nuclear option is also being explored. The state government has started to establish a nuclear power station at Gorkhpur Hisar having a capacity of 2800 MW.

A huge amount of funds was invested in installing generation capacity and network expansion for transmission as well as distribution purposes. Thus, it shows that development of power sector was given a high priority during the different five year plans.

The total installed generation capacity was estimated at 8114 MW as on 31.01.2013, out of which 80 per cent and 17 per cent was sourced from Thermal and Hydro power plants respectively. The share of Nuclear was 1 per cent and Renewable Energy Sources (RES) 2 per cent.

Haryana state's own generating capacity is 5300.50 MW (as on 31.01.2013), out of which 98.83 percent is coal based thermal and 1.17 percent is hydro. Besides the state's own generating capacity, it also has dedicated shares in the power plants managed and operated by Bhakra Beas Management Board (BBMB) and Central Power Undertakings (CPUs) such as NTPC, NHPC and NPC.

In a state like Haryana which is an electricity deficit state, overall PLF should not be less than 80%. By this norm, except for the year 2009-10, the performance may be charaterised as unsatisfactory during the period 2007-08 to 2012-13. Despite huge investment on renovation and modernization of Panipat Thermal Power Stations (PTPS), unsatisfactory state of performance is a matter of concern. Yamuna Nagar plant has not yet achieved desirable level of performance.

It was observed that the specific oil consumption of PTPS Units 1 - 4 has been very high compared to the norms, due to frequent start up and shut down of plants as there have been multiple cases of breaking down of the plants. The higher specific oil consumption has been attributed by HPGCL to frequent start/ stop operations due to increase in number of tripping. Oil support also necessitated due to receipt of wet coal.

It is a matter of great concern that technical efficiency of various thermal power stations in Haryana was below the norms. A close analysis of tariff orders issued by the Regulatory Commission clearly highlighted that the average cost of supply from own generating stations in Haryana was much higher than the average cost of purchase from the other sources. This shows that restructuring of the power sector has not made any significant change or improvement in the performance of the generation system in Haryana.

It is clear from the available data that there was a significant difference between the projections made by the utilities and sales approved by the Regulatory Commission that needs to look into.

It is also observed that the demand of electricity for industrial sector grew at a growth rate 10.11 percent which is less than that of domestic (11.74 percent) and commercial (22.47 percent) sectors during the period 2007-08 to 2012-13. It happened mainly due to non-availability of quality power at reasonable prices along with uncertain power cuts. Hence, the industrialists were forced to fall back more and more upon captive plants to continue production in a smooth manner.

The distribution loss level shows the constantly higher trend without any significant improvement. There is a little progress in case of DHBVNL in reducing the losses. However, it may be noted that none of the distribution company has completed 100% metering at consumer ends. So, it is difficult to remark any observation on this trend.

In the post- reforms period the Commission has put pressure on the power distribution companies to estimate power consumption in agriculture sector on the basis of realistic average running hours of irrigation per pump-sets. The Commission has acknowledged in tariff orders that the power distribution companies neither have data on the actual energy consumption by the agriculture consumers nor the correct BHP rating of the pumps as no instrument is placed to record the same. Therefore, it may be pointed out that the figures of agriculture consumption and T&D losses shown in official records were only an 'intelligent' guess and not the accurate data as more than 60 per cent electricity supply to agriculture sector is un-metered. In the tariff order issued for the year 2010-11, the Regulatory Commission has observed that both of the distribution companies have failed in reducing the distribution losses.

While supplying electricity to a consumer it is expected that it will be metered and the consumer will be asked to pay as per the tariff approved by the HERC. Unmetered electricity supply to agriculture has opened a flood gate of corruption and non accountability. Thereafter, nobody could know how much is the actual consumption and how much is the theft.

Now various stakeholders have developed political vested interests not to let full metering to avoid accountability despite HERC repeated directives to do the needful as early as possible. It may be noted that there is no dearth of resources to accomplish the task. There is an active nexus among the influential farmers, who do not want to install meters to continue being unaccountable, corrupt employees and the political patronage.

The analysis of pricing policy and financial performance of electricity distribution companies (DISCOMs) in Haryana present a very contrasting picture. There is hardly any relationship between cost of supply and average revenue realised. It may be pointed out that the reform process did not lead to improve recovery of cost which was one of the important objectives of the reforms. Increasing amount of power subsidy on account of electricity supply at highly subsidised rates to the untargeted agricultural consumers has serious implications for the state finances as well.

Charging certain consumer categories at a price which was significantly less than its cost of supply encourages wasteful consumption and loss of revenue to the power utilities. Due to lower revenue realisation, there were regular hikes in tariffs of both subsidising and subsidised categories of consumers. With the tariff hike for the power supplied to subsidising category particularly industrial consumers, they move towards alternative power supply provisions such as captive power generation or power purchase using open access mechanism. This implies that tariff rates do not have any systematic relationship with the cost of supply. Socio- economic and political considerations appear to have played a crucial role in the formation of tariff structure. This requires a reconsideration of the relationship between power utilities and the state government on the one side and the rationale for a pricing policy and subsidisation of certain consumers on the other. Irrational pricing policy has its serious implications for the utility/ies as well as the state economy. To ensure financial viability of the system, the tariff rates must reflect cost of supply. There is an urgent requirement to work out a realistic and progressive tariff structure reflecting consumer category wise cost of supply.

Agriculture power subsidy as a share of Total Revenue Receipts of the state was 12.96 per cent in 2007-08 which increased significantly to 16.25 per cent in 2008-09 mainly due to increase in the amount of expenditure on rural electrification. After the year 2008-09, the share of agricultural subsidy in total revenue receipts has declined to 10.51 per cent in 2012-13, however in absolute terms it has been continuously increasing. It may be pointed out that higher amount of subsidy leaves lesser resources with the state government for meeting developmental and other socio-economic responsibilities. The amount of total own tax revenues cornered by agriculture power subsidy was more than 16 per cent during most of the period under consideration. For the year 2012-13, the share of agriculture subsidy in total own tax revenue was 16.36 percent. Similarly, the share of subsidy in Gross State Domestic Product (GSDP) remained in range of 1.13 per cent to 1.69 per cent during the period 2007-08 to 2012-13.

It is very interesting to reveal that the share of power subsidy in state's GSDP was much higher than that of expenditure on medical services and the supply of clean water & sanitation. It implies that agricultural power subsidy has been financed at the cost of crucial social sectors. Failure to target health and sanitation services was probably the main cause for lower Human Development Indices in Haryana.

The analysis of perception of households regarding agriculture power subsidy, based on field survey, presented very interesting results. The major crops in Kharif season were paddy, cotton, gawari, bajra and fodder. Whereas wheat, oilseeds, sugarcane, pulses and fodder were the main crops in Rabi season. It needs to be noted that wheat paddy rotation is prominently prevailing in the state, except southern districts.

It is pertinent to be highlighted that the cropping pattern during Kharif and Rabi seasons remained more or less the same even after installation of tube-well in the study area whereas only an increase in area under cultivation of some specific crops like cotton, wheat and oilseeds was observed. In other words as there has been little change in cropping pattern it means it has stabilised for some time now. The crop diversification took place with the increase in the size of land holdings in the study areas.

It is evident from the data that ground water was excessively extracted in the study area. Average actual number of times of irrigation was significantly higher than optimum number of times of irrigation required in most of the Kharif and Rabi crops, except a few crops. In case of paddy, being a highly water intensive crop, the estimated optimum number of times of irrigation required is between 20-25 per acre but actual average number of times of irrigation with electric tube-well was 41.82 which amounts about double against the optimum number of times of irrigation.

The analysis of impact of tube-well utilisation on production and productivity of major crops for the sampled households during Kharif and Rabi seasons clearly indicates that the extension of irrigation facilities through installation of tube-well has largely promoted the utilisation of High Yielding Varieties (HYVs) seeds, pesticides and chemical fertilisers, which resulted in a significant growth in productivity of the crops. The net sown area under cultivation of paddy and wheat, which are major crops, has remained more or less the same. But the total production of these crops has increased from 73707.50 quintals and 80966.25 quintals during pre-installation of tube-well to 94436.50 quintals and 101859.75 quintals respectively during post-tube-well installation. Correspondingly, productivity has gone up from 17.62 quintals per acre to 22.54 quintals per acre for paddy and from 16.07 quintals per acre to 19.70 quintals per acre for wheat.

The data has clearly indicated that tube-well irrigation has played a significant role in agricultural growth in terms of increase in total production and productivity of the crops. However, over-utilisation of ground water has caused the problems of decline in water table and degradation of soil fertility in the study area.

The data regarding tube-well utilization for the sampled households has clearly spelt out that only 13.15 per cent households utilised tube-well for own domestic purposes apart from own irrigations. It may be noted that the households who reported to utilise tube-well for domestic purposes were in district Bhiwani. The households pointed out that there was no alternate mean to meet their domestic water requirements as most of them live in Dhanis (a small group of households who built houses in their fields). No household was involved in commercial activities associated with tube-well utilisation including selling water to other farmers for irrigation purposes in study area. However, there were some cases in district Jind where farmers exchanged tube-well water as and when it was needed to meet irrigation requirements on mutual basis only.

The majority of households irrespective of categories highlighted soil degradation as one of the major problems associated with excessive utilisation of tube-well. Over utilisaiton of ground water has caused salinity and arsenic problems in water and consequently degradation of soil fertility. They argued that to maintain and/ or to increase in productivity of crops during both the seasons Kharif and Rabi, higher amount/doses of chemical fertilisers and pesticides are required. Excess utilisation of chemical fertilisers and pesticides has led to deteriorate fertility of land over the period. Another major problem associated with excessive tube-well utilisation was water table depletion in the region as 40.56 per cent households revealed.

The level of awareness among the sampled households regarding excessive utilisation of tube-well was very limited. The highest number of households (36.48 per cent) pointed out insufficient rain as a major reason for water table depletion in the region. The responses of 12.41 per cent households' revealed closeness of tube-wells as an important reason for the problem. It is very surprising to note that only 8.15 per cent households revealed over utilisation of tube-well as a major factor responsible for water table depletion. It clearly indicates that the awareness level among farmers regarding the implications of over-utilisation of ground water is very limited. Therefore, there is an urgent need to make farmers aware about the problems associated with excessive use of ground water for sustainable growth of agriculture sector in the state.

The state government has hardly adopted any strategy to regulate over extraction of ground water, which is a matter of serious concern. The practices of excess extraction of ground water by farmers have probably happened on account of power supply to the agriculture sector at flat rate, which is also very nominal in Haryana. Flat rate billing system has also promoted the farmers to install in-efficient pump sets that led to excessive electricity consumption and overutilization of ground water.

The study further highlighted that cost of production per acre as well as per quintal for the sampled households has increased during post tube-well installation. It may be attributed to excessive use of chemical fertilisers and pesticides to maintain and/or to enhance productivity of the crops along with inflationary pressure on input prices.

The households were using electric motors with different capacity (BHP) in different regions depending upon the availability of ground water. It is pertinent to reveal that the employees of utilities have developed a mechanism of contractor between the farmers and power utilities. To avoid harassment and pendency of electric tube-well connections, farmers generally have approached to contractor for getting tube-well connection at the earliest date and contractors do the needful in collusion with concerned employees. The contractor charges lump-sum amount from the consumers taking into account total costs involved in releasing electric tube-well connection at the consumer ends including security amount, expenses on electric poles, file charges and their own commission. The households were not aware about the amount of commission charged by the contractor in this process. It was observed that average expenses for tube-well installation have tended to increase with BHP load. For the capacity of 15-25 BHP, the average expenses were Rs. 2, 04,075 as against Rs. 96,641.79 for capacity up to 5 BHP. Average cost per tube-well for the sampled households was Rs. 1, 57,761.50 which is very high and unaffordable to marginal and small farmers. There is an urgent need to speed up the process for the earliest release of electric tube-well connections to the farmers such that contractorship may be eliminated. The existence of contractorship in the process has burdened the farmers unnecessarily in terms of increase in the cost of tube-well connection.

High cost of tube-well installation is one of the major issues as more than 94 per cent households pointed out. Marginal and small farmers have faced difficulty to afford the cost of installing electric tube-well in their fields. Second major problem was associated with inadequate power supply as 75.19 per cent households revealed. The households argued that the state government has fixed duration of 8 hours per day for power supply to agriculture sector. However, the supply remained interrupted and irregular during most of the period. The schedule of power supply has also been changed frequently and at some occasions the duration of 8 hours has been divided into different quarters. Such type of activities may lead to inefficiency and wastage of ground water as well as electricity that in turn exerts negative impacts on agriculture production and productivity. There should be regularity in power supply to agriculture sector. Lengthy process in getting electric tube-well connections was also one of the major problems in the state as 44.63 per cent households pointed out. In a routine process, on an average one electric tube-well connection takes at least one and half year to get released.

Due to high average cost of electric tube-well installation, farmers generally prefer local branded motor for their tube-wells as it was relatively cheaper and extract more ground water. It is pertinent to note that use of local branded inefficient motors has led to over utilisation of ground water and excess electricity consumption, which has its implications for sustainable agricultural growth and financial viability of the power utilities.

All the sampled households were interested only in existing pattern of agricultural power subsidy in which they are getting power supply at highly subsidised rates. They felt that other modes of subsidy payment may force them to ensure metered supply for their tube-well in which they have no interest to avoid accountability. There is an urgent need to make them aware about the benefits of other alternate modes of agriculture power subsidy payment and motivate them to install meters at their tube-wells.

The data clearly highlights that more than 53 per cent of total households have their preference in flat rate billing system. It is very interesting to note that more than 2/3rd marginal and small farm households were interested in metered supply billing whereas majority of big farm households (60 per cent) have their vested interest in flat rate billing system.

The big farm households extract more ground water with inefficient electric motors (local branded) to meet their irrigation requirements on large farms. Therefore, they have developed their interests in flat rate system and avoid installing meters at their tube-wells to remain unaccountable. It clearly established that big farm households captured major chunk of benefits of agriculture power subsidy mainly because of non-possession of electric tube-well connections by a significant proportion of marginal and small farmers.

There is an urgent need to ensure targeted power supply at subsidised rates. Big farmers, being in a better financial position, may charge full cost of supply so that the burden of agriculture power subsidy can be reduced on the one hand and the environmental impacts may be controlled/ reduced on the other. It was also observed that the farmers were ready to pay higher tariffs provided the regular and sufficient power supply to their tube-wells. The state government should take initiatives to make the farmers aware about the benefits of metered supply and ensure metering at consumer ends on priority basis.

There is an urgent need to generate awareness among households regarding alternative sources of energy also. The state government should provide an amount of capital subsidy on solar pump sets at initial stage and later on it may be recovered from the beneficiaries. Moreover, awareness about energy conservation and water harvesting among the farmers is also very limited that needs to be enhanced on priority basis.

In nutshell, it may be argued that over the period the state government has devoted a significant amount of funds for the growth of power sector in the state. Despite the impressive expansion of the sector, the technical performance was not satisfactory. There is an urgent need to improve technical efficiency of power utilities through ensuring transparency, accountability and public participation. The utilities must ensure 100 per cent metering at consumer ends, particularly agricultural consumers on priority basis so that precise estimation of electricity consumption and level of transmission & distribution losses may be made. In the absence of proper metering in agriculture sector, the actual electricity consumption and the amount of agriculture power subsidy cannot be precisely estimated.

The prevailing tariff structure does not have any systematic relationship with the cost of supply. Highly subsidised and unmetered power supply to agriculture households have led to excessive electricity consumption and over utilisation of ground water. Consequently, serious environmental impacts in terms of soil degradations and water table depletions have appeared in the study area. Moreover, a major chunk of agriculture power subsidy has been cornered by the big farmers due to non- possession of tube-well connections by a significant proportion of marginal and small farmers. All the power supply must be metered and flat rate system be abolished.

The amount of agriculture power subsidy has been increasing continuously which enlarged the bill of committed expenditure at the cost of social sectors. Higher amount of committed expenditure leaves fewer resources for making quality expenditure in the hands of the government that reflected in terms of poor HDI indices on the one hand and rising levels of Revenue Deficit and Fiscal Deficit on the other. There is an urgent need to work out a realistic and progressive tariff structure reflecting consumer category-wise cost of supply.

The state power utilities should ensure to release tube-well connections at the earliest date such that contractorship could be eliminated and exploitation of the farmers may be avoided. Efforts should also be made to provide regular and sufficient power supply to agricultural farmers subjected to 100 per cent metering at consumer ends. Big farmers, being in a better financial position, may charge full cost of supply so that the burden of agriculture power subsidy can be reduced on the one hand and the environmental impacts may be controlled/ reduced on the other. The power supply at subsidized rates should be targeted. The farmers, further, should be motivated to adopt solar irrigation system through providing capital subsidy at the initial stage of tube-well installation and later the amount of subsidy may be recovered from the beneficiaries.

Policy Recommendations:

- The technical efficiency of the power system must be improved so that average cost of supply can be reduced which in turn may reduce the pressure of agriculture power subsidies on public exchequer.
- The state government must ensure 100 per cent metering at consumer ends on priority basis to estimate precisely actual electricity consumption and amount of subsidy and to make system transparent and accountable.

- Serious efforts are required from Regulatory Commission to work out a realistic and progressive tariff structure reflecting consumer category wise cost of supply.
- Subsidised power supply should be targeted to marginal and small farmers. Blind subsidy is a matter of serious concern. Subsidy to big farmers must be slowly phased out, at least it should be made transparent to begin with.
- Special awareness drives against power theft, energy conservation and energy efficiency must be launched.
- DISCOMs should be managed professionally by the professional managers like BHEL/NTPC etc.
- The state government should devise on priority an effective, accountable and transparent system to regulate utilisation of ground water. It may also be done through promoting awareness among the farmers to use optimum number of times of irrigation.
- To regulate excess use of ground water and electricity for paddy crop diversification may be promoted through increasing minimum support price of non-water intensive crops.
- There is an urgent need to devise a mechanism with transparency and accountability to release tube-well connections within a specified time period so that contractorship system may be eliminated to avoid exploitation of the farmers. DISCOMs should switch over to on line submission of applications and release of electric tube-well connections in a time bound manner.
- The policy of Direct Benefit Transfers (DBT) may be explored in power subsidy which will require proper metering at consumer ends.
- The farmers should be motivated to adopt solar irrigation system through providing capital subsidy at the initial stage of tube-well installation and later the amount of subsidy be recovered from the beneficiaries. This will reduce the burden of power subsidy on public exchequer in long run.
- The efforts should be made to generate awareness among farmers regarding rain water harvesting, watershed development, dry land farming and crop diversification in favour of protein rich less water intensive crops and energy saving techniques.

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