Vol. 42, No. 3, pp 328-333, 2014
Indian Journal of Soil Conservation
Online URL:http://indianjournals.com/ijor.aspx?target=ijor:ijsc&type=home

Feasibility of flat and metered electricity tariff system for operating tube wells in Uttarakhand - A case study

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ARTICLE INFO

Article history :
Received : July, 2013
Revised : September, 2014
Accepted : October, 2014

Key words :
Crop production,
Electricity tariff,
Energy reforms,
Ground water,
Irrigation

ABSTRACT

This study analyzed the flat and metered tariff electrical system to understand the feasibility of both the systems from farmer's as well as electricity consumption and ground water exploitation point of view. It has been found that with average pumping hours of 850, if metered tariff increased from present ₹ 0.7 to ₹ 2.5 unit^{-1}, the farmers would be paying equivalent to flat charge (₹ 126 HP^{-1} + ₹ 20) among 5, 7.5, 10 and 12.5 HP capacity pump users. It means at flat charge, farmers are paying more than the metered charge of ₹ 0.70 unit^{-1}, still they are not willing to switch over to metered tariff systems because the government is not equipped with required manpower and machinery to install and monitor the system which may lead to corruption and also there is a risk of safety of the systems in the field. It also suggests to the government to at least increase the metered tariff up to ₹ 2.5 unit^{-1} without giving any additional burden to farmers. Moreover, if metered tariff system is implemented, the over exploitation of the ground water can be minimized as the farmers will be conscious of not wasting the electricity but ultimately ground water would also be saved.

1. INTRODUCTION

Ground water (GW) has clearly emerged as the most vital source of water for sustainable livelihoods and economic development which is reflected in the increase of net irrigated area during 1970-95 from 38 to 54% (Sharma *et al.,* 2004). The state of Uttarakhand in the northern part of India was formed in 2001; earlier it was a part of Uttar Pradesh state. Uttarakhand is a pre-dominantly hilly state with the bulk of its agricultural lands limited to the southern Terai parts of the state. The mean rainfall in the state is around 1500 mm. The state has an annual net available groundwater resource of 2.10 billion cu m (BCM), of which 66% is being utilized presently (Umar *et al.,* 2010). GW development boom in India is fuelled by a power sector in crisis, financially and institutionally, because the ground water irrigation accounts for between a quarter and a one-third of the total national electricity consumption (Roy and Shah, 2003, Mukharji *et. al.,* 2009). The quality of irrigation water deteriorated in semi arid region because of over exploitation of G.W. (Jha *et al.,* 2012).The subsidizing of electricity rates is believed to be the prime reason for the fact that so many state electricity boards are on the verge of bankruptcy (e.g. in Uttarakhand production cost of per unit electricity is ₹ 2.96 against the metered tariff of ₹ 0.70 and flat tariff ₹ 126 HP^{-1} for agriculture). Flat rate regime is held responsible for this state of affair and a shift to universal metering is being pushed by the donor financial agencies as the remedy (Kishore *et al.,* 2000; Shah *et al.,* 2003).

Uttaraklhand has constituted the State Electricity Regulatory Commission (SERC) which is implementing Accelerated Power Development Reform Program (APDRP) in the state. Under this programme, energy accounting has been made mandatory and in pursuance of this, meters were being installed and billing was being done based on the meter reading. Though metering process was under way but to rationalize electricity pricing on the basis of huge transaction cost, collection charges based on metered use, farmers apprehension towards metering and mobilization of huge manpower to operationalize this system were some of the key challenges being faced by the SERC. The move shall also have an impact on the assessment and utilization of GW by farmers and prevailing

GW market mechanisms. Hence there was a need to analyze the flat and metered tariff electrical system to understand the feasibility of both the systems from farmer's as well as electricity consumption point of view to operate the tube wells for irrigation in Uttarakhand.

2. MATERIALS AND METHODS

Haridwar district of Uttrakhand state was selected as study area because it is having maximum cultivated area in the state and transformation of metering system also started from this district as a pilot project. Its latitude and longitude are 29°58' degree N and 78°13' degree E, respectively. The height from mean sea level (msl) is 249.7 m. Administratively, it is subdivided into three tehsils *i.e.* Haridwar, Roorkee and Laksar and six development blocks *i.e.* Bhagwanpur, Roorkee, Narsan, Bahadrabad, Laksar and Khanpur. As per the 2001 census of the state, the population of the district is 14,44,213. The irrigation intensity of the study area was 139%. The area grows four major crops *viz.,* sugarcane, paddy, wheat and maize. Cropping pattern in sample villages are concerned paddy and groundnut covers 34% area, wheat 24% and sugarcane covers 55% of total cultivated area (Anonymous. 2006).

This study was based on the primary as well as secondary data. Data collection techniques applied, include both *quantitative* and *qualitative* methods. The first step of designing appropriate methodology was to formulate the study design followed by identification of testable hypotheses. In this particular study, Haridwar district of Uttarakhand state was selected. A total of 5 data collection instruments were administered in the study. These included two quantitative survey instruments and three check lists for qualitative as well as quantitative data collection from different departments. The key formats for data collection were Village information questionnaire, Individual level questionnaire, Union questionnaire, Check list for Electricity department and Check list for Tubewell department.

Eight sample villages from Haridwar district *viz.,* Sisona, Madhopur, Manakpur, Jhabreri, Kuakhera, Mandawar, Sahdevpur and Aneki were selected for study having a total population of 35420 with total geographical area of 5067 ha. The selection was made on the basis of geographical spread of these villages across the district by covering Bhabar, Terai and old alluvial plain. Due care was taken to select only those villages where electricity based GW irrigation system was in use. *Stratified Random Sampling* procedure was adopted to conduct the household (HH) survey. Care was taken that HH should be either pump owner/water seller or water buyer representing different sections of the village community. The above methodology helped to portray an overall socio-economic condition, GW development scenario and electricity utilization scenario for irrigation, cropping pattern and productivity as well as preference of farming community for electricity bill payment. The sample size was 117 farmers from eight villages which included both the Water Extraction Mechanism (WEM) owners (74) and water buyers (43).

3. RESULTS AND DISCUSSION

Irrigation System in the Study Villages

Total irrigated area covered by private electric submersible pumps was 2090 ha (51%), followed by 745 ha (24%) by private diesel pumps, mainly in the *Terai* region. Private electrical centrifugal pumps are operational in the areas where watertable is shallow and irrigate 19% area. The government tube wells (Government TW) cover only 6% of area as they are operational only in the regions with deep water table. The number of submersible pump for irrigation is maximum (341) in the area followed by diesel pumps (282) (Fig. 1).

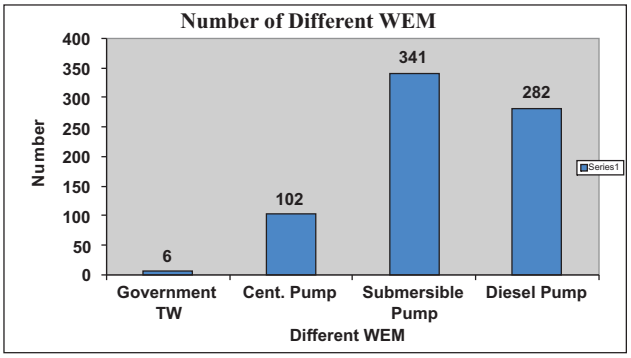

Fig. 1. Number of different Water Extraction Mechanism (WEM)

Presence of GW Market

The GW market in the region is intensive in certain regions like Bhagwanpur block and parts of Roorkee and Bahadrabad block (Bhabar and upland plain) and in rest of the Districts, it is localized and informal. However, it is observed that 84% farmers with small, medium as well as scattered land holdings are able to maximize their agricultural economy because of the presence of both formal (government tube wells) and informal water market in the study area (Table 1). The maximum numbers of farmers (50%) were found to be (WEM) owners whose land holdings ranged between 3.33-6.67 ha. However, in case of water buyer's category, farmers having land holding between 1.33-3.33 ha were the biggest beneficiaries.

The Necessity of Metering System

The electricity subsidies take the form of a flat rate paid by farmers per unit of horsepower per pump; farmers' actual power use is not metered or recorded. These flat-rate subsidies help to camouflage theft and pilferage by agriculture and other sectors of power usage. Under India power reform programme it is believed that energy accounting will prevent to camouflage theft and improve

Table: 1
Size classification of WEM owners and water buyers in the sample villages

Sl. No.	Size class category (ha)	No. of WEM owners	No. of water buyers
1.	Marginal (< or = 0.67)	-	4 (9.3)
2.	Small (> 0.67 and < 1.33)	2 (2.7)	11 (25.6)
3.	Medium (=1.33 and <3.33)	17 (22.9)	21 (48.8)
4.	Large (=3.33 and <6.67)	37 (50)	7 (16.3)
5.	Very large (= 6.67 and > 6.67)	18 (24.3)	-
	Total	74 (100)	43 (100)

Note: Primary data collected during questionnaire survey.
Figures in parentheses are in % to total sample size.

the electricity availability in the agriculture sector. In this back drop many states have resorted to energy accounting under APDRP and are in the process of meter installation. Uttarakhand is one of the states where this process is underway. Yet there are few takers for metered connections; instead, demand for free power to agriculture has gathered momentum in many states. Farmers' opposition to metered tariff has only partly to do with the subsidy contained in flat tariff; they find flat tariff more transparent and simple to understand. It also spares them the tyranny of the meter readers. Moreover, there are fears that once under metered tariff; SEBs will start loading all manner of new charges under different names (Shah *et al.,* 2007; Singh *et al.,* 2012).

Sensitivity Analysis of Electricity Rates

Sensitivity analysis of electricity rates versus pumping hours and HP of pump was made and presented in Table 2. It can be seen from the table that as number of pumping hours increased from 500 hrs onward, the margin of gain by farmers in term of bill decreased as compared to flat rates in all category of pump user from 5 HP to 10 HP. In all cases of pump user, farmers will be gainer even if metered tariff increased from ₹ 0.70 to ₹ 2.5 unit^{-1} if pumping hours are less than 1000 hrs.

The average pumping in the study area has been determined and found 850 hours. It revealed that farmers having pump of 5 HP for full years will be the gainers even if the electricity rates goes up to ₹ 2.5 unit^{-1} from the current ₹ 0.70 unit^{-1}. This is also true for motive powers up to 12.5 HP. This indicates that at the current average pumping hours the farmers will be the gainers up to a rate of ₹ 2.5 unit^{-1} cost of electricity.

Loosers and Gainers with Variation in the Unit Cost of Electricity

Based on 94 respondents, an analysis was done for the loosers and gainers if tariff is increased from the current rate of ₹ 70 to ₹ 2.5 unit^{-1} (Table 3). This showed that all the respondents will be gainers at ₹ 0.70 tariff, if it increases to ₹ 1.5 then also for 5, 7.5 and 10 HP, the gainers will be 96.7%, 96.9% and 77.4%. In case if tariff further increases to Rs. 2.96 unit^{-1}, then for 5, 7.5 and 10 HP, the gainers will be 64%, 49% and 44%.

The study also reflects that the current flat ₹ 126 HP^{-1} + ₹.20) is very near to the generation cost of ₹ 2.96 unit^{-1}. That means the Uttarakhand State Regulatory Commission will have to increase the tariff from the present ₹ 0.70 in order to avoid the fiscal deficit in future.

Fig. 2 shows that metered electricity bill will break even with the flat rate of system between 2650 to 2750 hours for 5, 7.5, 10 and 12.5 HP meter. As already stated that the average yearly pumping hours in Haridwar is only 822 hours. This indicates that at the prevailing unit cost of ₹ 0.70 the burden on the farmers will be extremely low and they will be saving in the range of ₹ 3191 to ₹ 6876 but still 30% farmers believe that they are better off with the flat regime. In effect this is the price they are willing to pay to avoid the hassles associated with metering system.

Table: 2
Sensitivity analysis of different electricity rates vs pumping hours and HP

HP of WEM	Pumping hrs	Flat rate (₹)	Metered tariff				
			@ ₹ 0.70	@ ₹ 1.0	@ ₹ 1.5	@ ₹ 2.0	@ ₹ 2.5
5	500	7800	1306	1865	2798	3730	4663
	1000		2611	3730	5595	7460	9325
	1500		3917	5595	8393	11190	13988
	2000		5222	7460	11190	14920	18650
	2500		6527	9325	13987	18650	23312
7.5	500	11580	1958	2798	4196	5595	6994
	1000		3917	5595	8393	11190	13988
	1500		5875	8393	12589	16785	20981
	2000		7833	11190	16785	22380	27975
	2500		9791	13987	20981	27975	34968
10	500	15360	2611	3730	5595	7460	9325
	1000		5222	7460	11190	14920	18650
	1500		7833	11190	16785	22380	27975
	2000		10444	14920	22380	29840	37300
	2500		13055	18650	27975	37300	46625

Table: 3
Looser and Gainers from the respondent

HP of Pumps	Number of respondents	% gainers under ₹ 0.7 unit^{-1} meter tariff	% gainers under ₹ 1.5 unit^{-1} meter tariff	% gainers under ₹ 2.5 unit^{-1} meter tariff	% gainers under ₹ 2.96 unit^{-1} meter tariff
5	30	100	96.7	80	64
7.5	32	100	96.9	59.4	49
10	31	100	77.4	45.2	44
All	94	100	89.4	60.6	48.9

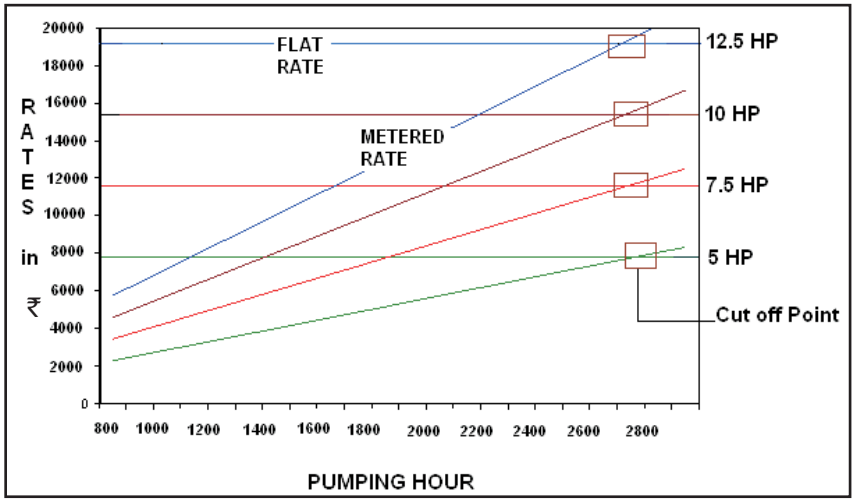

Fig. 2. The break even pumping hour for flat and metered tariff at the prevailing rate in Uttarakhand (Flat ₹ 126 HP^{-1} month^{-1})

Preference Analysis for Metered Tariff

The proportionate opinion in favor of meter system from different categories of pump owners and water buyers is given in Table 4. It can be seen from the Table that the WEM owners who do not sell water but buy water from others (PB) have strong preference towards metered tariff system which is reflected by their preference with regard to actual consumption (88.9%), not to pay for unused hours (77.8%), HP not a limiting factor (66.7%) and save charges in rainy season (88.9%). The shareholder of a group of owned WEM (WB) has least preference for metered system as reflected by their preference with regard to actual consumption (46.7%), not to pay for unused hours (44.4%), HP not a limiting factor (37.8%) and save charges in rainy season (0%). On an average, 81% pump owners have their preference for metered tariff reflects that pump owners have strong preference for this where as 49% water buyers have their preference for metered tariff.

Preference Analysis for Flat Tariff

On an average, 21% pump owners and 51% water buyers have given preferences for flat tariff. Fig. 3 given below reflects the preferences of different categories of pump owners and water buyers. The reasons cited by the respondents are less corruption (19%), knowing tariff in advance (17.9%), less harassment (18.8%) and irrigation in large area (17.1%).

Salient Features of Community Perception

Most respondents reflected groundwater depletion and deterioration as one of the major problems in the area but

Table: 4
Preference for metered tariff by different category of respondent (%)

Category of the Pump Owner	Actual consumption	Not to pay for unused hr	HP not a limiting factor	Save charges in rainy season
SB	66.7	66.7	66.7	83.3
PB	88.9	77.8	66.7	88.9
WS	72.0	64.0	24.0	72.0
PO	75.0	75.0	53.6	78.6
WB	46.7	44.4	37.8	0

Note: PO=WEM owner (who neither sells water nor buys water); WS=WEM owner (who sells water to others but does not buy water); PB=WEM owner who does not sell water but buy water from others; SB=WEM owner who sells as well as buy water from others; and WB=shareholder of a group owned WEM.

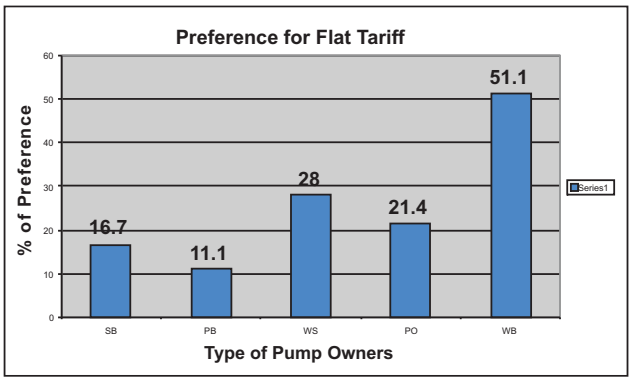

Fig. 3. Different categories of respondents for flat tariff

majority of them expressed more concern over the high cost under flat tariff and poor billing system of energy supply for groundwater irrigation, which has become a constant source of hurdle in the development of agricultural economy of the area. The proportion of the problem for different categories of owners are listed in Table 5.

Table: 5
Major difficulties of the Pump Owners

Category of the Pump Owner	Billing	Irregular supply	Voltage fluctuation	Delay in the R&M
SB	80	80	60	100
PB	88.9	55.5	55.5	66.7
WS	44	36	28	76
WB	0	64.4	75.6	0.0

In case of buyers, it is observed that non availability of water for irrigation at the time of requirement (80%), harassment by the seller (64%) and required number of irrigation for crop is not available (76%), are the major difficulties. It is observed that around 80% pump owners have got the meter fitted for their tube wells, out of which 40% have reported that they are getting their bills on the basis of meter but 100% respondents reported that metered billing is based on the provisional assessment rather than actual meter reading by electricity department. Around 15% farmers also reported that regular well failure and boring for new tube wells are causing major financial burden.

An overwhelming majority of almost 81% farmers felt that metering in its current set up will encourage corruption, 84% respondents felt that possibility of meter tampering will always be there while 59% felt that there will always be a possibility of exploitation by meter reader. Around 30-40% farmers felt that the current rate of meter tariff is a temporary phase, once farmer accept this system, government will increase the tariff rate substantially.

4. CONCLUSIONS

This study compares and contrasts the initiatives of the states in terms of the processes of metering and the impacts of this on groundwater use and users (including water buyers). In case of Haridwar where the process of meter installation was in the completion stage, but putting the system in place for meter reading and bill collection was far from compete this is causing serious concern among the users. Therefore, utilities in Uttarakhand have to re-engineer itself and take immediate steps to stream line the meter reading and tariff collection process. This paper analyzes the flat and metered tariff electrical system to understand the feasibility of both the systems from farmer's as well as electricity consumption and ground water exploitation point of view. It has been found that with average pumping hours of 850 if metered tariff increased from present ₹ 0.7 to ₹ 2.5 unit^{-1}, the farmers would be paying equivalent to flat charge (₹ 126 HP^{-1} + ₹ 20) among 5, 7.5, 10 and 12.5 HP capacity pump users. It means at flat charge, farmers are paying more than the metered charge of ₹ 0.70 unit^{-1}, still they are not willing to switch over to metered tariff systems because of complexity involved in the system. It also suggests to the government to at least increase the metered tariff up to ₹ 2.5 unit^{-1} without giving any additional burden to farmers. Moreover, if metered tariff system is implemented, the over-exploitation of the ground water can be minimized as the farmers will be conscious of not wasting the electricity but ultimately ground water would also be saved.

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