Beneficiaries of the IPS subsidy and the impact of tariff -hike

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Abstract :
The electricity tariff for irrigation pumpsets (IPS) is one of the most controversial issues in the power sector reforms. It is believed that poor agriculturist need this subsidy and without the subsidy, the food prices will substantially increase. The paper analyses the distribution of IPS subsidy among IPS users in Maharashtra, the likely impacts of consumption based tariff and tariff hike. The analysis shows that flat (Hp based) tariff results in highly skewed subsidy distribution and is regressive in nature. Most farmers can pay tariff much higher than usually believed. With efficiency improvements, majority of IPS users will be able to pay the cost price of electricity. It is seen that metering IPS consumption is essential to improve the subsidy distribution. Opposition to the metered tariff by the energy intensive IPS users needs to be seen as opposition to the move towards more equitable distribution of the subsidy. Where as, the opposition by SEBs needs to be seen as opposition to making SEBs accountable for the electricity losses and theft.

Introduction :
The Indian power sector is in grip of many crises, of which the capital crisis is the most talked about. The government has radically changed power policies in an attempt to solve capital crisis. But the survival of SEBs and the power sector in general is still linked to the policies regarding electricity use of agriculture pumpsets (irrigation pump sets, IPS in short).

The subsidised tariff for IPS is one of the most important cause for capital crisis. It is largely believed that; (i) the agriculturist, and especially the poorer section among the agriculturist cannot afford to pay electricity tariff as per the cost of electricity generation and supply, (ii)the cost of production of food grains will rise substantially if the electricity tariffs are raised, and (iii) metering agricultural consumption will be very expensive for the SEBs. Hence, the electricity tariffs have been kept way below the cost price and the billing of most IPS has been linked to the pump Hp rather than the electricity use.

The power sector has estimated that in 1994-95, the IPS users in the country consumed 69,000 million kWh (MU), which was about 29% of total electricity sales. The average tariff for IPS users was Rs. 0.218/Kwh. This tariff covered only 14% of the average cost of generation and supply. (PC 1995) Thus, the IPS users received a subsidy of over Rs. 10,000 crores in 1995 alone. This subsidy was equivalent to the cost of a 2,500 MW power plant; which is nearly half of the required capacity addition in the country. The policies regarding the IPS also have serious implications for the ground water situation and the rural economy. Despite such enormous importance, there has been little debate or analysis about the usefulness of this huge subsidy or who benefits from it.

Two different authorities have made opposite assessment of the impact of raising electricity tariff to the level of cost of production and supply. The object of this paper is to examine these questions in the context of IPS in Maharashtra.

1. Confusion about how much to charge and its impact :

In the ongoing process of SEB restructuring, the consultants and the World Bank (WB) have suggested that SEBs should charge cost-based tariff to agriculture. In case of U.P., the World Bank (WB) consultant has recommended a tariff of Rs. 3.5 /kWh (in 1995 prices) for the year 2000. (Putham Hayes & Bartlett, 1995) Raising IPS tariff is considered politically difficult. The National Development Council (NDC) had decided that Rs 0.5/kWh should be recovered from IPS users. But only six states have implemented such tariffs. (ADB 1995) Despite the fact that the prevailing tariffs are extremely low, farmers are not willing to pay their electricity bills. The recovery of dues from agriculture sector is very poor. The accumulated arrears of IPS users to the Maharashtra SEB (MSEB), for example, are nearly two and half times the amount billed in 1996 (MSEB, 1996).

2. Studies estimating the impact of IPS tariff hike :

The impact of tariff hike on different groups of farmers or crops is rarely analysed. Two studies analysing the impact of the tariff hike could be located. A study by the WB concluded that if the agricultural electricity tariffs are raised to the level of average cost of electricity, then it will lead to significant rise in the cost of the agricultural commodities and will have regressive impact on poor. On the contrary, the Council of Power Utilities (CPU, a consortium of public sector power utilities) has assessed the impact to be marginal if the tariff is raised to two third of average cost of electricity.

The study by the Council of Power Utilities (CPU) estimated the increase in food grain prices due to tariff hike. Based on the amount of IPS consumption claimed by the power sector, the CPU estimated the incremental income to the power sector if tariff is raised to two thirds of the average cost of supply. It estimated this additional burden on the farm sector to be Rs. 2,574 crore per year. It further claimed that if this burden is passed on to the marketable food grains (88 million Ton in 1989-90), then the cost of food grains would increase by Rs. 0.3 /kg. This increase would have been Rs. 0.5 /kg in 1993-94. The resultant impact on the citizen is estimated at only Rs. 7.5 per month per person (in 1993-94 prices), which is only a marginal one. (ET, 1995) A major lacuna in the study is that it attributes the increase in the cost only to the marketable food grains. In fact, a large share of irrigation water is used for non-food cash crops.

Another report by the WB, titled 'India - Long Term Issues in the Power Sector - Technical Report', also estimated the effect of IPS tariff hike and a shift to the consumption based tariff on the prices of different crops (World Bank, 1991). The study concluded that, the prices of cereals and sugar will be most affected. It predicted a respective increase of 7.3% and 3.9% in prices, if tariff was increased to half the 'long -range marginal cost' (i.e Rs. 0.88 /kWh for Maharashtra in 1990). The average cost of generation and supply in Maharashtra was Rs 0.993 in 1990, only slightly higher than suggested tariff. The report also points out that, (i) rural poor spend over a quarter of household budget on cereals and such tariff increase would have regressive impact and (ii) IPS consumption would significantly decrease.

The conclusions of this study were contradictory to the logic that water intensive crops such as sugarcane rather than cereals will have larger impact. The WB analysis was based on the input-output tables of the Planning Commission. For calculating the impact of the increased tariff, the study used the coefficients from the input-output tables referring to the direct electricity use (as a percentage of value added). These coefficients in the input-output tables are in turn based on the data collected by the CSO (Central Statistical Organisation). About the method of arriving at these coefficients, the CSO says:

> *"Information on electricity consumption (in agriculture) is not explicitly available from CSS. Data on electricity utilised for agricultural purpose is obtained from CEA and is distributed to various crops in proportion to crop wise area irrigated by tube wells and pumpsets."* (CSO, 1990) (emphasis added)

It implies that CSO too neglects the effect of different water requirement for various crops. Sugarcane, for example, requires 9 times as much water (and hence electricity) as Jowar. Hence, use of these coefficients would give erroneous results. There are a few additional factors which have a large influence on the crop-wise electricity consumption, but their impact is difficult to account for. These factors are also neglected by CSO. One such factor is the typical crops grown on different IPS configurations. For example, sugarcane is largely grown on lift irrigation schemes (LIS) in Maharashtra. The LIS have large delivery heads and long pipe lengths. Whereas cereals are mostly grown on well-irrigation, which have limited delivery heads and small pipe lengths. Our analysis shows that, one Ha. of cane grown on a typical large LIS, would require about 18 times more electricity than rabi jowar grown on well- irrigation. Therefore, distributing electricity-consumption uniformly over the area irrigated is highly erroneous and would project substantially higher electricity consumption for cereals than the actual consumption.

Due to use of CSO coefficients, the WB study neglects such issues. Its results are therefore questionable. Contrary to the conclusions of the WB study, our analysis, as described later, shows that farmers growing rabi Jowar on well irrigation already pay 40 to 60% of the average cost of supply. Where as, the LIS consumers (mainly growing cash crops such as sugar cane) pay less than 6% of the average cost. Hence, the effect of consumption based tariff will be far more on farmers growing water intensive crops than that on other IPS consumers.

Apart from these issues, both studies had one major flaw. These studies analysed the impact of the IPS tariff hike on the cost of production of agricultural produce by averaging out the increased burden on all agricultural production. The production from IPS irrigated area was not distinguished from the production from other irrigated or un-irrigated areas. The crops grown on IPS form only a part of the total production. Hence, the direct impact on the IPS users will be substantially higher than the impact estimated by these studies. And the behaviour of IPS users cannot be predicted by looking at the increase in average costs. We need to estimate the direct impact on IPS users.

For the above task, first it is essential to get a clear picture of the existing electricity consumption patterns and the distribution of subsidy among different IPS users and crops. Only then can we comment on the likely impact of tariff increase on IPS users and consequently on crop prices. With a case study of Maharashtra state, this paper examines following issues :

- Present subsidy distribution and effective tariff paid :
    - distribution of subsidy among different IPS users,
    - effective tariff (Rs./kWh) paid by different IPS users,
- Impact of tariff increase on IPS users :
    - present electricity bills as a share of gross value of produce,
    - expected electricity bills with introduction of metered tariffs[1],
- Possible reduction of impact by improving the end use efficiency.

3. Deficiencies in the IPS data :

Though an inquiry into the IPS tariff and inbuilt subsidy is of considerable importance, there are serious data gaps, which make any work on this issue extremely difficult. For example, even the Hp wise number of IPS was not readily available with MSEB. The state government departments do not have data on (i) area irrigated by IPS, (ii) cropping pattern on wells or IPS irrigated area, (iii) distribution of IPS based on the sources of water etc. Similarly, the directorate of sugar or the irrigation department is not aware of the amount of sugarcane grown on canal water as against that grown on ground water or surface water lifts (LIS). Our analysis, based on MSEB's IPS number and the data from the department of agriculture about area irrigated and number of IPS on wells showed a large discrepancy in the total net area irrigated in the state. (Sant, Dixit, 1996) Hence, any inquiry in this regard has to be based either on extensive survey or on typical case studies. Present study is based on typical combinations of pump Hp, area irrigated, cropping pattern etc..

To understand the likely impact of tariff increase and distribution of IPS subsidy on different groups of farmers, classification of farmers is crucial. It is customary to classify farmers on the basis of (i) crops grown, (ii) size of land holding, (iii) income and other economic aspects. On one hand, such classification was found to be impossible for IPS users due to the lack of data; on the other, farmer's electricity consumption as well as his choice of crop (hence his income) are closely linked to the availability of water and in turn to the source of water. Therefore, primary classification followed here is on the basis of the source of water (well v/s lifts from surface water sources). The applicable tariff (metered v/s flat tariff) and the size of pump (in the case of lift irrigation schemes) are also used for classification.

The next section describes the situation in Maharashtra, the data available with MSEB and presents the limited analysis possible based on the same.

4. IPS situation in Maharashtra :

In 1994, Maharashtra state had 18 lakh IPS against 95 lakh agricultural land holdings. IPS owning farmers consumed 8,923 MU, which approximately equals to one quarter of the total electricity sales in the state.

[1] Shift to consumption based tariffs has been assumed due to its multiple benefits.

The average realisation from the IPS users was only Rs. 0.23/kWh, which covered less than 17% of the average cost of electricity. As a result, the IPS users received a subsidy of over Rs. 1,150 crores in 1994 alone. As per the statement of the Deputy Chief Minister, Government of Maharashtra this subsidy has increased to Rs 2,000 crores in 1996 (Sakal, 1996).

IPS users in Maharashtra had an option between (i) metered and (ii) flat tariff. The metered tariff was Rs. 0.5/kWh with a constraint of a minimum charge of Rs 90/Hp/year. This minimum charge was equivalent to the consumption in 240 hours of pump usage.[2] The other option of flat tariff was Rs. 300 /Hp/year. [3] For a pump operation of more than 800 hours a year, the flat tariff was more economical than the metered tariff.

In 1994, about a quarter of IPS users had opted for the metered tariff linked to the consumption and the rest, 75% users paid Hp based tariff. The consumption of these 75% IPS users is not metered and is estimated by MSEB. The method of estimation is not transparent. And doubts have been expressed about the real level of consumption. (Roy S N, 1996, Reddy et.al. 1991)

The consumption of metered IPS was only 211 MU, i.e., 2.4% of the total IPS consumption. The connected load of these users was about 1,400 MW. Based on the consumption and the connected load, their consumption per Hp works out to be only 113 kWh/Hp/yr. At this level of consumption, they would be charged the minimum tariff of Rs. 100/Hp/yr.[4] Therefore, these users effectively paid a tariff of Rs 0.88 /kWh.

The average cost of generation and distribution for MSEB was Rs 1.56 /kWh. Hence, these users received a subsidy of Rs 0.67 /kWh. For all metered consumers this subsidy works out to be Rs 14 crores of the total IPS subsidy of over Rs 1,150 crores. [5] Implying that, the 75% of the IPS users received over 98% of the IPS subsidy !

The conclusions possible from these data are : (i) about four fifth of the farmers do not have pumps and do not benefit from the IPS subsidy, (ii) even among the beneficiaries one quarter of beneficiaries get negligible subsidy. The limitation of this analysis arises from the fact that, the group of farmers that we can isolate as the largest beneficiary is quite large, over 13.5 lakh; and the crop wise analysis of subsidy distribution is not possible. The following sections try to focus the conclusions with the use of additional information. This includes, information about (i) large IPS connection of the co-operative Lift irrigation societies (LIS), (ii) typical pumpset efficiencies and possible energy savings, (iii) the recommended crop water use, crop yields on irrigated area, and the crop prices.

4.1 Distribution of Subsidy among farmers :

Among the IPS consumers paying the Hp based tariff, it is possible to distinguished the large LIS users from other users which are usually small consumers.

About 3,200 co-operative lift irrigation societies (LIS) are in operation in the state. These LIS irrigated 2.4 lakh Ha. using the surface water sources. (Sant, Dixit, 1996:25) The connected load of these users has been estimated at 341 MW, and the actual beneficiaries at 1.91 lakh farmers.[6] The LIS are designed for 3,000

[2] Rs 90/Hp/yr = 241 Hr/Yr x 0.746 kW/Hp x 0.5 Rs./kWh.

[3] Since 1st July 1996, MSEB has revised IPS tariff for Hp based billing. As per the new tariff, high tension users (large pumps, mostly large LIS) pay Rs. 600 /Hp/yr. The marginal farmers can avail of the concessional tariff of Rs. 500 Hp/Yr. The metered tariff was not changed.

[4] For metered users with connected load more than 10 Hp the minimum tariff was Rs 120/Hp/yr, while, for smaller pumps it was Rs 90/Hp/yr. Hence, an average of Rs 100/Hp/yr is considered for analysis.

[5] This analysis ignores the shortfall in recovery from IPS users. The shortfall was significant averaging over 30% of billed amount for last few years. The analysis also assumes that MSEB's claim about the electricity use by IPS consumers is correct.

[6] The connected load of the large LIS is not documented by MSEB or any other government agency. This has been estimated based on their irrigated area and the norm of 'kW/Ha' which was derived from the data

hours of operation per year, but they operate for much longer periods, generally between 4,000 to 5,000 hours a year. Assuming an average operation for 4,500 hours per year and total connected load of 341 MW in 1993-94, these large LIS would have consumed 1,530 MU. As most LIS pay flat rate tariff, these LIS would be expected to pay Rs 14 crores (@ Rs 300/Hp/Yr).

As per MSEB data, the unmetered IPS consumed 8,712 MU and had a connected load of 4,908 MW. Considering the MSEB claim to be correct, remaining 13.2 lakh small un-metered IPS consumed the balance 7,182 MU. These small un-metered IPS would account for a connected load of 4,567 MW and hence were supposed to pay tariff of Rs 184 crores.

The consumption and the connected load of un-metered consumers has been estimated above. The consumption and the applicable tariff for the metered IPS is calculated in the previous section. Based on this analysis, table 1 shows the number of beneficiaries, electricity use, and the subsidy availed for these three categories of IPS users. The subsidy is calculated by subtracting the applicable tariff from the cost of electricity consumed (based on the average cost of supply for MSEB).[7]

Table 1 : Consumption and tariff paid by different groups of IPS users (1993-94).

	Metered IPS	**Un-metered IPS**		**TOTAL**
		large (LIS)	**small IPS**	
No. of Beneficiaries ('000)	428	192#	1,324	**1,944**
Connected load (MW)	1,399	341	4,567	**6,307**
Electricity consumption (MU)	211	1,530	7,182	**8,923**
Applicable Tariff (Cr.Rs)	19	14	184	**217**
Subsidy (Cr.Rs)	14	226	936	**1,176**
Share of IPS subsidy	1%	19%	80%	**100%**
Subsidy (Rs./Beneficiary)	331	11,777	7,049	**Avg. 6,049**
% of Land holdings	4.5%	2.0%	14.0%	**20.5%**

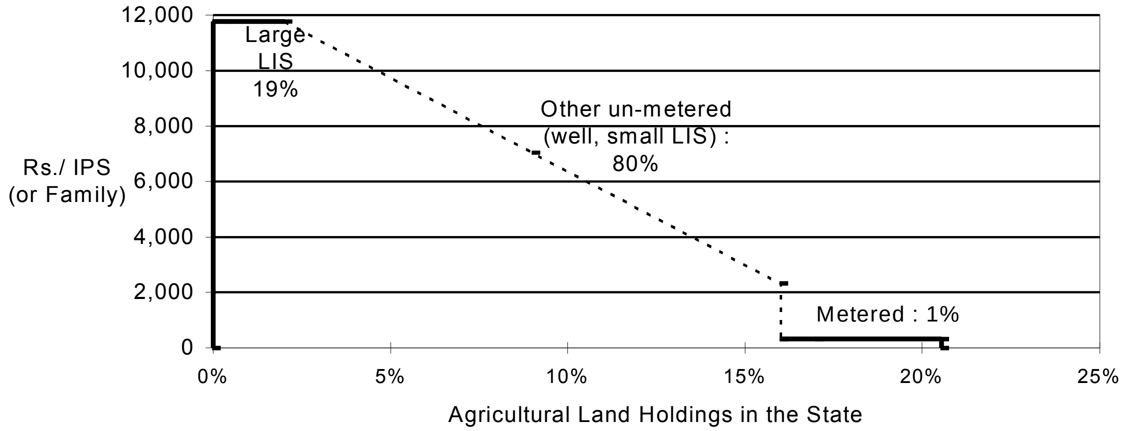
Notes : - Average cost of generation and supply for MSEB (1993-94) was Rs. 1.56 /kWh. The minimum tariff for metered and unmetered IPS was Rs. 134 and Rs. 402 per kW per year respectively.
- The number indicated the beneficiaries of 3,200 large LIS connections.

Figure 1 plots the number of beneficiaries as a percentage of the agricultural land holdings in the state (on X-axis) against the subsidy received per beneficiary per year (on Y-axis).

Figure 1 : Distribution of IPS subsidy within farmers.

of 11 large LIS cases. The design irrigation area (irrigation potential) and membership of LIS co-operatives is much larger then actual area irrigated or persons benefiting. The beneficiary families were estimated using the norm of average land holding in the 11 sample LIS, which was 1.32 Ha per beneficiary (the average land holding in the state in 1991 was 2.2 Ha, as per the Economic survey of Maharashtra, 1993-94).

[7] There is a discrepancy in the billed amount estimated in table 1 and the actual billed amount by MSEB (as per the information available from MSEB). The estimates here are based on the connected load of unmetered IPS, the consumption of metered users, and the applicable tariffs (all data from MSEB annual report). This discrepancy of about 9% may be due to fact that MSEB reports the number and load of electrified IPS, without accounting for disconnected IPS.



About 79% farmers do not benefit from IPS subsidy. About 4.5% farmers paying metered tariff, receive negligible (1%) subsidy. On the other hand, subsidy per beneficiary for large LIS is more than what would be needed to support a person for a full year on minimum wages. The third group, comprising the rest of unmetered consumers, received a subsidy of Rs. 7,050 per IPS per year.

The reliability of power sector data regarding the IPS number as well as consumption is under doubt. The IPS consumption may be actually lower or the IPS in operation may be fewer than the MSEB claims. In either case the above conclusions regarding iniquitous subsidy distribution remain valid. If the IPS consumption is lower than claims, then the estimated consumption of the 'small un-metered IPS' (third category) would be accordingly lower. This would imply more skewed subsidy distribution then shown here.

The LIS co-operatives in Maharashtra have been promoted by the sugar factories for increasing cane production in their area. (NABARD 1991) Generally one third to one half of the area irrigated by large LIS is under cane. For the three sample LIS analysed; the average cropping pattern was 47% sugarcane, 24% summer ground nut, 32% rabi wheat and about 20% rabi jowar (among major non-Kharif crops with area as percentage of net irrigated area). Assuming that the recommended water use was adhered to, 75% of the water output of LIS was used for sugar cane. Extrapolating this to all the LIS co-operatives, 1.13 lakh Ha of cane grown by LIS co-operatives received a subsidy of Rs. 170 crores (Rs 15,044/Ha of cane). On the other hand, metered IPS users have very small pump usage, which is expected to be used for irrigating single non-water intensive rabi crops (mainly cereals). These users received a much smaller share of the subsidy. *This shows the regressive nature of IPS tariff in Maharashtra, in which the cereal growers are benefit the least, while the cash crop cultivators benefit the most.*

4.2 Estimation of effective tariff paid by typical consumers :

This section estimates the effective per unit tariff (Rs./kWh) paid by different types of IPS consumers. As mentioned earlier, the effective tariff for metered IPS works out at Rs. 0.88/kWh. Among the unmetered IPS, differentiation is done between the LIS users and the IPS on wells. In the case of Hp based billing, the effective (per unit) tariff depends on the hours of pump usage. Higher the pump usage, lower is the effective tariff.

The LIS are usually promoted for sugar cane, and have large static heads as well as long pipes. Hence, the hours of usage are high. The large co-operative LIS operating for 4,500 hours a year, consume 3,357 kWh/Hp/yr., hence effectively pay only Rs. 0.09 /kWh. The small (individual or group) LIS operate for lesser period. Considering an operating period between 1,500 to 3,000 hours a year, their effective tariff works out at Rs. 0.26 to 0.13 per kWh.

The hours of operation of IPS on wells widely vary with the crop, the irrigated area, and the pump Hp. The usage of un-metered IPS on wells is estimated for different crops, based on the recommended water application. The pump usage is calculated for pumping water quantity equal to the recommended water use (shown in annexure I), for the typical values of pumpset efficiency, water delivery head, and pump Hp.

Most wells have a 3 Hp or a 5 Hp pump. A total head of 10 meters and pump efficiency of 20% has been considered for all IPS on wells. The calculation assumes two hector irrigation per well. Most irrigated crops are taken in combinations and in rotation. To simplify the analysis, only four major crops with the highest irrigated area in the state have been considered. These crops include; sugar cane, summer ground-nut, rabi wheat and rabi jowar.

The average area irrigated per well in the state is about 1.25 Ha. (Epitome 93-94/94-95) Hence, the calculation over estimates the pump usage hence under-estimates the effective tariff. But the calculation neglects possible over-watering of some crops like sugar cane. In case of over irrigation, the pump usage would be more and effective tariff paid would be lower than what is estimated here.

Table 2 shows the estimated electricity consumption, the electricity bill, and the effective tariff (in Rs/kWh) paid for irrigating different crops.

Table 2 : Effective tariff paid by un-metered IPS on wells

	Crops	Estimated consu-mption kWh/Yr.	Pump Hp	MSEB bill (Rs/yr)#	Effective tariff Rs/kWh
1	Sugar Cane	7,855	5	1,500	0.19
2	Wheat, summer Groundnut	3,927	5	1,500	0.38
			3	900	0.23
3	Wheat	1,309	3	900	**0.69**
4	Jowar	873	3	900	**1.03**

Assumptions : Area irrigated per IPS = 2 Ha./IPS; Static head = 10 meters,
overall pumpset efficiency = 20% and water losses = 5%.
\# : The MSEB bill calculated for a tariff of Rs. 300/Hp/Yr. The effective tariff is arrived at by dividing the electricity bill by the electricity consumption.

Farmers growing only rabi crops on well (usually jowar or wheat) under the flat tariff, and the quarter of users covered under metered tariff pay the maximum tariff, which is well over Rs 0.5/kWh. Wherever a well has abundant water, the farmer opts for more profitable crops, such as, sugar cane or summer groundnut. These farmers pay much lesser tariff. And the LIS users, usually growing water intensive crops pay even lesser, i.e. half to one tenth of that paid by well irrigating farmers.

5. Impact of tariff hike on IPS users :

As seen above, the present tariff favours farmers having access to abundant water. Consumption based tariff is absolutely essential in order to make it more equitable as well as to create an incentive for efficient electricity use. Based on the above analysis of effective tariff paid, it can be concluded that LIS users will be the most affected if consumption based tariff is applied. It is also essential to evaluate whether farmers can afford to pay consumption based tariff and whether any subsidy is essential. Hence, the present electricity bill as a share of gross value of produce has been analysed first; followed by analysis of the likely increase in electricity bills due to the tariff hike.

5.1 Present electricity bills as a share of gross value of produce,

Typical electricity bills and typical ‘gross value of produce’ has been worked out in this section. Four major crops and two typical situations (the LIS and IPS on wells) have been considered for analysis. For IPS on wells, various combinations of pump Hp and crops have been considered. A typical cropping pattern on LIS has been assumed as mentioned in section 4.1.

Under the flat rate tariff, the electricity bill is directly proportional to the pump Hp irrespective of the pump usage. For estimating pump usage, the norm of pump Hp per Ha irrigation found in case of 11 LIS has been assumed to be representative for LIS users. For IPS on wells, pump Hp per Ha has been worked out for different combinations. The tariff of Rs 300/Hp/yr has been considered to be applicable. The gross value of produce per Ha. is calculated using the irrigated yields and the wholesale prices in the state (refer annexure I for data used).

For convenience of further calculation, the electricity consumption per Ha of irrigation is also estimated. For IPS on wells, the electricity consumption as calculated in table 2 has been used. For large LIS, electricity use has been calculated on the basis of assumed pump operation for 4,500 hours a year and pumping power of 1.8 Hp/Ha irrigation.[8]

The gross value of produce (GVP), the pump Hp and consumption per Ha is shown in table 3. The electricity bill in Rs/Ha/yr and as a percentage of the gross value of produce per Ha. is also shown in the table.

The cropping pattern and irrigated area per Hp for small LIS is not clearly known and hence, has been omitted from this analysis. But the IPS on wells and the large LIS are extreme cases and the small LIS is expected to fall in between.

Table 3 : Present electricity bill as percentage of gross value of produce for major crops

Category of user	GVP (Rs/Ha)	Pump Hp per Ha (Hp/Ha)	Electricity bill (Rs/Ha)	Electricity bill (% GVP)	Electricity use (kWh/Ha/yr)
Large LIS	41,782	about 1.8	540	1.3%	6,075
IPS on Well (Crop, Hp)					
Sugar Cane, 5	66,400	2.5	750	**1.1%**	3,740
Wheat, summer groundnut,5	31,468	2.5	750	2.4%	1,964
3	- do -	1.5	450	1.4%	- do -
rabi Wheat, 3	10,738	1.5	450	4.2% #	654
rabi Jowar, 3	8,673	1.5	450	**5.2% #**	436

Calculated for flat tariff. If these consumers opt for metered tariff the corresponding values would be 3.0% and 2.5% for wheat and jowar respectively.

The above calculation shows that, the present electricity bills are not too large. And there is no reason to pardon defaulting farmers. With flat tariff, the large LIS users and the cane producers pay the least, even as a percentage of value of their produce. And the less water and energy intensive users such as the jowar and rabi wheat growers pay the most. Since, the LIS users mostly grow water intensive cash crops, the present tariff benefits the cash crop growers, while being relatively harsh on food grain growers.

5.2 Electricity bills with introduction of metered tariffs :

The impact on IPS users is analysis for two tariff levels; Rs. 0.5/kWh (as recommended by NDC), and Rs 1.73/kWh (MSEB's average cost of generation and distribution in 1994-95). The likely electricity bills have been calculated using the estimate of electricity consumption per Ha., as described in section 5.1. For both

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[8] The norm of 1.8 Hp/Ha was found in case of 3 LIS analysed. For large LIS, with a static head of 50 meters, the said cropping pattern, pump capacity of 1.8 Hp/Ha and pump operation of 4,500 hours/year; corresponds to overall pumping efficiency of 49%, with a water distribution loss of 25%. These efficiencies are close to representative values.

tariff levels, the estimated electricity bill and the increase in burden, as a percentage of gross value of produce (GVP) has been shown in table 4.

Table 4 : Impact of consumption based tariff on farmers
(values as % of gross value of produce)

Category of user	Rs 0.50/kWh (NDC)		Rs. 1.73 /kWh (Avg. cost)	
	New bill (% GVP)	Increased burden	New bill (% GVP)	Increased burden
Large LIS	7.3%	**6.0%**	25.2%	**23.9%**
IPS on Well (Crop, Hp)				
Sugar Cane, 5	2.8%	1.7%	9.7%	8.6%
Wheat, summer groundnut, 5	3.1%	0.7%	10.8%	8.4%
3	- do -	1.7%	- do -	9.4%
rabi Wheat, 3	3.0%	-0.8% (0%)	10.5%	6.3% (7.5%)
rabi Jawar, 3	2.5%	**-2.7% (0%)**	8.7%	**3.5% (6.2%)**

Notes : The values in parenthesis indicate the impact on the respective category of farmers in case they are already paying metered tariff. The negative values imply reduced electricity bills.
- Assumed area irrigated, efficiency and other details as per table 3. The highest and least values have been highlighted.

As seen in table 4, for a tariff of Rs. 0.5 /kWh, farmers growing only rabi crops on wells will actually reduce their bills (if they have not opted for metered tariff already). A quarter of the IPS users that have already opted for metered tariff will see no change in their bills. Only farmers growing sugarcane on wells and LIS consumers will have to pay more. The increase in electricity bill will be only 1.7% and 6% of value of their produce respectively. This is definitely not an unbearable impact. This is the likely impact on the IPS users. The impact on average crop prices cannot be easily estimated. It is expected to be substantially less, as IPS irrigated crops form only a part of the total crop produce.

Some time ago, following NDC recommendation, a few SEBs attempted a move towards increasing the IPS tariff. A strong resistance from farmers for metered tariff of Rs. 0.5/kWh, was reported. From above table it can be seen that such a move would actually benefit or at least not harm the majority of farmers in the state. Only the LIS and cane growers would have to pay little more. Paying Rs 0.5 /kWh or even some what higher tariff should not be a problem for any category of farmers in normal situation. Actually, metered tariff would help in reducing the inequity in subsidy distribution. *And opposition to metered tariff needs to be seen as an opposition to a move towards equitable distribution of subsidy.*

At a tariff of Rs 1.73 (average cost of supply), the users with IPS on wells will need to pay 9 to 11% of the GVP for electricity use. The large LIS will need to pay nearly a quarter of the GVP. Hence, it will be difficult for large LIS to pay cost based tariff. This is especially true since these users also have to repay the bank loans. In other words the large LIS are un-viable with cost based tariff. But there are options to move closer to the cost based tariff even for the LIS users. One such option is to give LIS users capital subsidy for improving pump and water distribution efficiencies, and help them improve their yields; while correspondingly increase the tariff. These investments in efficiency improvement by the SEB are sure to be highly cost effective. Additionally, LIS users can be charged a tariff increasing (in real terms) with the years of operation. The LIS users can afford to pay such increasing tariff because as time passes, their loan repayment decreases in real terms.

6. Possible reduction in impact by improvement in efficiency :

The miserable efficiency of the IPS and the economically attractive possibilities of increasing this efficiency is well known. In many field studies and pilot projects, economically attractive saving of around 40 to 50% has been repeatedly demonstrated (Patel S. M., Pandey M. K., 1993; NABARD 1984, Rajshekahar P. Mandi et.al. 1994). Efficiency of the small and medium sized IPS is bad, because of improper choice of pump, piping and accessories, bad quality of pump and bad maintenance. In case of large pumps of LIS also, there exists scope for improvement, albeit smaller. For one LIS evaluated for efficiency improvement a saving of 12% was found to be feasible by pump efficiency improvement. The water distribution losses in these LIS can also be minimised, usually by 10% or so.

If we arbitrarily consider that electricity bill should be below 7% of gross value of produce for all IPS users; then with efficiency improvement, users with IPS on well can easily pay the cost price of electricity. The large LIS users can pay over Rs 0.6/kWh. This assumes an average energy saving of 40% in case of IPS on wells and 22% in case of LIS.

But charging consumption based higher tariff will not be sufficient to bring about the efficiency improvement. For example, farmers using diesel pumps do pay equivalent to as much as Rs 3/kWh, but their efficiency is far below achievable or technically desired level. (TERI 1994) The reasons for this are multifold and are not discussed here. The SEBs or the government will need to take substantial initiative to bring about the improvements. Even private capital and initiative can be utilised while minimising SEB's involvement.

If the SEBs and the state governments are serious and ready to take innovative approach, the financial burden of the IPS sales can be substantially reduced, while distributing the subsidy more equitably.

7. Objections to Metering

In 1993-94 MSEB claimed the IPS consumption to be 8,922 million kWh and the average recovery to be only Rs 0.23/kWh (PC 1995). If NDC recommended tariff (Rs 0.5/kWh) was introduced, MSEB's income would have increased by 240 crores.

The energy intensive IPS consumers have a clear incentive to oppose metered tariff. But many IPS users would actually benefit from metering . Most of such users are simply not aware of the option of metered tariff or the likely benefits. Hence, opposition from most IPS users for metered tariff can be easily overcome. The objections by LIS users needs to be overruled for the reasons already mentioned.

But the SEBs are as reluctant to meter IPS consumption as much as the IPS consumers. The SEBs are said to be afraid that (i) the cost of metering / meter reading would be high and (ii) meters are unreliable and may not work properly. The argument of metering cost is evaluated first. In Maharashtra, the one time cost of installing meters on 14 lakh unmetered IPS will be about Rs 100 crores[9]. The cost of meter reading is much smaller. Considering a cost of Rs 25 per reading and two meter readings per year; meter reading cost for all IPS will be only Rs 9 crores per year. Hence, the cost of metering is a baseless argument considering the expected increase in revenue of Rs 240 crores.

Second argument relates to the quality of the meters. The meter quality needs to be improved in any case and cannot be an argument against use of meters. But fortunately, for IPS users we have a simpler option. Once, a pump is installed, its power consumption is nearly fixed, which can be measured at the time of installation. The complicated energy meter, can then be replaced by a simple timer which will monitor the hours of pump operation. Simple multiplication of pump power consumption (the measured power consumption or to begin with the pump name plate rating) with the hours of use will give the electricity consumption. Such electronic timers are simple, reliable and cheap. This method can improve the reliability and reduce the cost of installing new meters.

Such electronic timers can also include electronic circuits for (i) low voltage protection of motors, (ii) remote cut off for big IPS users and (iii) a current sensor to prevent use of higher sized pump than the declared size.[10] The feature of motor protection will be a major incentive for farmers to install these meters. The remote shut-off will offer SEBs a tool to manage peak loads. The 3,200 large LIS in Maharashtra have

[9] Considering cost of meter, installation charges etc. at Rs 750 per meter.
[10] Some pump manufactures do offer pumps with power consumption higher than the name plate rating.

a connected load of about 350 MW. These users can be cut off during emergency, to offer substantial relief to the grid without causing inconvenience to the domestic and other rural consumers. Economics of such remote cut off is highly favourable to addition of new capacity or transmission lines.

But most SEBs have another strong reason for their reluctance. This reason is never stated. The SEBs know that IPS consumption is lower than what they claim. It has been alleged by researchers as well as ex-officials in power sector, that SEBs dump T&D losses in IPS consumption, to show low T&D losses. (Roy, 1995) Metering all IPS will expose high T&D losses, which are a sum of technical losses and commercial losses, such as theft. But for proper running of power utilities, this is all the more reason for metering all IPS.

Even if we ignore the benefits of more equitable subsidy distribution, reduction in water and electricity wastage, increased revenue to SEBs etc.; IPS metering is essential to monitor and ensure efficient running of SEBs. And it would be worth spending a few crores for that purpose alone.

8. Conclusion and discussion :

Though present study is based on sample cases, the qualitative conclusions are expected to be valid for Maharashtra. The conclusions may not be valid for other states. But considering that irrigated yields in Maharashtra are among the lowest in the country, the impact of IPS tariff hike will be more pronounced in Maharashtra. The major conclusions of the study are:

- The IPS tariff (which was in effect till June 1996) is not a large burden on any farmer in normal conditions and the defaulting farmers need not be protected. At the same time, a large number of farmers in drought prone area are not aware of option of metered tariff and end up paying high tariff, at times more than Rs 1.0/kWh.
- The flat tariff results in a highly iniquitous distribution of IPS subsidy. The relatively better off farmers, having access to abundant water and growing water intensive crops capture most of the subsidy. These users pay much lesser tariff (in Rs/kWh) and also pay much lesser in terms of share of their produce value, as compared to other IPS users. A shift to consumption based tariff is essential to remedy the situation.
- The metered tariff of Rs 0.5/kWh would not have large impact on any IPS users. And can be applied immediately. A somewhat higher tariff can also be considered.
- If the full cost of generation and distribution is planned to be recovered from users, then most farmers with IPS on wells can manage to pay the same with some difficulty. For them the increased burden will be 4 to 9% of the value of produce. But for LIS users the added burden will be about 24% of the value of produce. Which may not be affordable. And if such tariff is enforced, the LIS would be in serious trouble. However, with increased efficiency, a gradual tariff rise linked to years of operation is feasible.
- The impact of consumption based tariff will be mostly seen on cane and other water intensive crops with very small impact on cereals and other food crops.
- Efficiency improvement of IPS can substantially improve farmers paying capacity (in terms of Rs/kWh). Most farmers can pay the cost based tariff without major change in their costs. If SEBs take proper initiative, efficiency improvement can be achieved through private sector investment while benefiting the SEBs.
- Metering of IPS is not just feasible, but is also highly desirable for social equity, reduction of water and electricity wastage and more importantly for monitoring and improving the efficiency of SEBs.

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Annexure I

The major irrigated crops in the state are sugar cane, rabi jawar, rabi wheat, and summer groundnut (Epitome 93-94/94-95). These crops are also important from IPS power consumption point of view. The recommended water application, and the typical yield on irrigated fields in the state are given in table below. Table also shows gross value of produce per Ha. for the said yield.

Recommended water application, average yields and gross value for major crops.

Crops	Recommended water Application (Ha.-cm)	Yield (Kg/Ha.)	Gross value of produce (Rs./Ha)
Sugar Cane	274	83,000	66,400
Summer groundnut	91	1,382	20,730
Rabi Wheat	46	1,820	10,738
Rabi Jawar	30	1,446	8,673

Note :
1. Irrigation water needs at field head, in lift irrigation schemes as quoted in (Rath, Mitra, 1989, pp 21) .
2. Yields of crop cutting experiments as per 'Performance Budget Irrigation Department' (GOI, 1994)
3. Gross value of produce based on 1995 whole sale prices in Mahrashtra (Agricultural situation in India (1995) Ministry of Agriculture, GoI.)

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