PRO-POOR AGRICULTURAL POWER POLICY FOR WEST BENGAL

Manisha Shah[1], Sujata Daschowdhury[2], and Tushaar Shah[3]

ABSTRACT

Sitting on one of the world's best aquifers, large swathes of West Bengal has groundwater in abundance. Even so, the state's farmers incur one of the highest irrigation costs in India. In spite of a series of groundwater and electricity policy changes, West Bengal's farmers fare no better. This paper brings findings from a yearlong research pilot based in Monoharpur village of Birbhum district. The pilot shows how the current electricity tariff structure has made irrigation unaffordable for small and marginal farmers, and has made irrigation services market tightly oligopolistic. If not revised, the agricultural economy, especially that of summer paddy which ensures household security of poor farmers, is likely to taper off in future.

Keywords: Farm power, pro-poor irrigation, electricity tariff, summer paddy, water markets

1. INTRODUCTION

West Bengal is India's largest rice producing state. In 2016, the state produced 15.75 million tonnes of rice over its 5.46 million ha of cultivable area (India Today, 2018). 7.24 million operational holdings exist in the state, of which more than half (53.4 per cent) are owned and operated by marginal farmers , almost one-third (28.3 per cent) by small farmers and mere 4 percent is owned by large farmers; the average landholding size in the state being 0.76 ha (GoI, 2018). Around half of this cultivated area (54 per cent) is irrigated and the cropping intensity in the state is 176 per cent (ICAR, 2018). The dependence on rainfall for agriculture is quite significant as almost half the area remains rain-fed. Nandargi and Barman (2018) analysed rainfall trends in the state for last 116 years to calculate standardized rainfall anomaly index and concluded that the numbers of dry years are increasing which is an alarming situation from water resources planning and agricultural point of view. Given the crucial role of agriculture in the state's economy, it is important to focus on increasing irrigated area by improving irrigation infrastructure and lift more farmers out of rain-fed agriculture.

The 5th Minor Irrigation Census reported 0.42 million groundwater schemes in the state irrigating gross area of 1.7 million ha. Gross area irrigated by minor surface lift and flow schemes is 0.57 million ha (MoWR, 2017). The most prevalent groundwater lifting mechanism is through shallow tube wells (STWs) powered by electric pumps. The same census also reveals that out of the 381,324 STWs in the state, 84 per cent are powered by pumps of size 4-6 HP, which, based on the average landholding and degree of fragmentation in the state would be ideal for selling water in informal, village-level irrigation services markets. These markets have been existent in West Bengal since 1980s, especially in areas not serviced by government canals. These markets have been responsible for increased (and often exclusive) dependence of farmers on groundwater for irrigation.

1 International Water Management Insitute (IWMI), Jal Tarang Building, IRMA-Mangalpura Road, Anand 388001, India [E-mail: shah.manisha90@gmail.com]

2 Independent Researcher, 'SOPAN', Gurupally South, Santiniketan, Birbhum 731235, India

3 IWMI, Jal Tarang Building, IRMA-Mangalpura Road, Anand 388001, India

2. ECONOMIC SCARCITY DESPITE NATURAL ABUNDANCE

Post independence, West Bengal was still struggling with food security issues when Green Revolution spread across Western India. Later in the 1980's, the State saw a widespread increase in agricultural production owing to the diesel shallow tube wells (STWs), which spread swiftly across the region. It witnessed a 6 per cent annual growth rate in agriculture during the decade on the back of rapid expansion in STW-driven irrigation of pre-summer *Boro*[4] rice crop. Like Bangladesh earlier, West Bengal too broke out of its agrarian impasse and morphed from a perennial rice-deficit state to a rice-surplus state, thanks wholly to the proliferation of diesel STWs (Rogaly, Harris-Whyte and Bose, 1999). But as diesel prices began their ascent in the 1990s squeezing the profitability of Boro cultivation, the slowdown of West Bengal's agrarian ascent began with growth rate decelerating to 1.2-2.0 per cent per year (Sarkar, 2006). Mukherji *et al.* (2012) estimated that during 2000-2008, the index of cost of labour and fertiliser went up from 100 to 136 and 115, respectively, while that for irrigation costs increased from 100 to 223 at 1999-2000 constant prices, a direct result of farmers' dependence on expensive diesel for pumping groundwater and low rates of rural electrification. But in spite of the high cost of diesel irrigation, irrigation service markets boomed in the state and pump owners with spare capacity to sell, sold irrigation services to their neighbours who were willing to cover the fuel cost and contribute some amount towards overheads. Mukherji (2009) found that smallholders benefitted in the informal water markets not only as water buyers but also, in several cases, as entrepreneurial pump owners. She found that, on an average, 77 per cent of all the water pumped and 69 per cent of area irrigated by any pump was for the benefit of the buyers. The shallow aquifers in the region ensured a round-the-year water availability and helped boom the service markets and the agrarian economy through an additional summer (*Boro*) rice crop.

As rural electrification began to lift hope of farmers to receive cheap electricity to irrigate their lands just like their counterparts did in Western and Peninsular India, the Government of West Bengal passed Groundwater Act in 2005. The Act made it a tedious and expensive process to get a "permit" for a new farm connection even while these connections were charged at fixed flat tariff. Further in 2008, West Bengal State Electricity Distribution Company Ltd. (WBSEDCL) changed the tariff structure from flat to Time-of-Day (ToD) metering-based. In 2011, after the "permit" system was abolished, farmers started applying for farm connections and the number of electric pumps increased rapidly in the state, from 175,032 in 2011 to 313,784 in 2014[5]. It was anticipated that the increased pump density would intensify competition in water markets, make irrigation affordable to buyers and further boost the *Boro* paddy cultivation in the state but the metering nullified the effect of increased pump density as farmers continue to pay near-commercial tariff[6] for utilizing their pumps for irrigation.

Shah and Daschowdhury (2018) reported declining trend in *Boro* cultivation in the state in spite of increase in number of electric pumps and in their exploration of 27 villages, found frequent instances of people having given up irrigated agriculture as their connections were cut-off due to inability to pay electric bills.

Irrigation markets are oligopolistic with water buyers (mostly small and marginal farmers) having little bargaining power. Shah and Daschowdhury (2017) studied

4 Traditionally, the rice cultivation is done in three seasons – Aus (autumn), Aman (winter) and Boro (summer).

5 Data collected from WBSEDCL Office

these irrigation service markets in the state and found that metered pricing of electricity at commercial rates resulted in hardening of monopoly power of WEM owners who formed a cartel to fix water rates every year. They reported that pump owners increasingly preferred leasing in land only for *Boro* rice cultivation at a fixed rental of 1.2 quintals of paddy or a cash rental of ₹2000 per *bigha*[7]. According to their calculations, a pump owner could earn only ₹1500 by selling irrigation to a *bigha* of *Boro* paddy but can make a net surplus of ₹4225 to ₹10,425 by leasing in a *bigha* after paying all costs as well as the lease rental of ₹2000/*bigha*. They found many pump owners committing Amon irrigation only on the condition that the buyer leases out all or a portion of his land to him for *Boro* cultivation. Refusing *Boro* irrigation was another strategy to compel small farmers to lease out their land. In another case study of groundwater-abundant Kumarpur village in 24 Paraganas district, Banerjee (2016) found that post-2012, electric submersible WEMs increased from 20 to 28, and as a result, the earlier declining trend in *Boro* rice area was reversed leading to a boom in rice and year-round vegetable cultivation through water markets. But he found that the economics of *Boro* rice cultivation with purchased irrigation was turning awry because the water price has doubled from ₹1000/*bigha* to ₹2000/*bigha* of *Boro* rice irrigation. These studies portray a grim state of affairs for subsistence farming in the state, a condition resulting purely from the policy of metered pricing on energy at commercial rates rather than actual scarcity of water.

3. ANALYTICAL BACKGROUND FOR BIRBHUM PILOT

Shah (1993) explored the role of energy policies and suggested that increasing the density of WEMs in a village is a slow route to increasing competition among water sellers, reining in their monopoly power and whittling down the W/AC[8] multiple. However, even quicker and stronger route to turning these oligopolies into competitive water markets would be to charge electric tubewells at affordably high flat tariff instead of pro-rata tariff (Shah 1993), as many electricity utilities were already doing. Shah (1993) alerted that flat power tariff would benefit resource poor water buyers but would threaten the sustainability of groundwater and strain the finances of electricity utilities. He argued that both these could be controlled by rationing farm power supply and periodically revising the flat tariff to cover the cost-to-serve power to farmers (Shah 1993). However, the state's policymakers seem to have given it only one-sided thought. High metered tariff would likely have increased the efficiency of water use and controlled groundwater depletion but for the farmers, it has come at a very high cost. The farmers, especially those in shallow aquifer regions, should be able to maximize their profits through unrestricted agricultural boom and pump owners should behave like competing market players rather than 'pumping for profit' entities.

In this context, we posited that West Bengal can maximize the benefits to its farmers equitably by adopting a revenue-neutral flat-cum-metered tariff structure, where a tube well owner is required to pay a fixed tariff per month per HP (higher during *Boro* season) in addition to a lower consumption linked rate (metered tariff). This structure will ensure that the tube well owners are not burdened by a high flat tariff rate and thus, do not perform excessive extraction of ground water and at the same time are motivated to sell more water to buyers, making the water market more competitive.

7 1 acre = 2.5 bigha

8 W/AC multiple shows the competitiveness of an informal water market where W is the price of water and AC is the average cost of the service delivery.

4. STUDY DESIGN AND SAMPLING

Monoharpur village of Birbhum district, with 20 STW owners participating in water selling, was selected for the pilot. Kendradangal village of the same block was selected as a comparison village. All the pump owners (water sellers) in the study village and all water buyers (including landless labourers and oral lessees) were a part of this action research pilot. A randomly picked sample of 20 pump owners and their 100 water buyers (sampled through snowballing) were selected for the study. A baseline survey was done in the selected villages to understand the pre-existing groundwater market dynamics and related transactions in June 2017. The entire village's farm economy was mapped and the contribution of water trade was estimated. Amongst the measurement variables selected were irrigation charges, number of renters, area irrigated per pump, payment mechanism (cash, produce, leasing contracts), quality of irrigation service provided by private water sellers, cropping intensity, and time-based pump use pattern.

July onwards, a flat-cum-metered tariff structure was proposed to the pump owners wherein they were paid 70 per cent of their monthly electricity bill in excess of the benchmark set for every month. The benchmarks were set based on average monthly consumption of all pump owners in the village in 2016-17. The benchmark would mimic a flat tariff whereas all excess consumption subsidized by 70 per cent was designed to mimic a low consumption-linked tariff. Our hypothesis was that since all the pump owners were aware of the actual cost of pump operation under this experiment, their rational behaviour was likely to make them more aggressive water sellers in order to make the most out of this subsidy offered and the irrigation market would end up being more competitive.A census of Monoharpur farmers and survey of 120 sampled in Kendradangal was completed in July 2018. Data obtained was used for a before-after and with-without comparison.

5. BASELINE CONDITIONS

The baseline census of all farming households in Monoharpur and sampled households from Kendradangal revealed a stark difference in landholding size as well as average family size between water buyers and Irrigation Service Providers (ISPs). Average landholding of an ISP household in Monoharpur and Kendradangal is 10.9 and 14.7 *bigha*, while that for the water buyers was 2.47 and 3.95 *bigha*, respectively. The average family size of pump owners was 6 while that of water buyers was 4. This means that the two constraining factors for agriculture in the villages, irrigation and labour, are present with the ISPs. And given that they seem to have more family labour available, it makes sense for them to lease in land from water buyers and maximize their profits rather than selling to them.

Average cost of electric pump installation was calculated to be ₹88,173, a large chunk of which is the cost of pump, pipes, electric connection and shed construction. As was clear from interviews and discussion with the farmers in both villages, many of the pump owners resorted to illegal practices such as line hooking, meter tampering, passing off larger motors as small and bribing meter readers due to the high metered tariff which they found difficult to pay on most months. 18 of the 20 ISPs in Monoharpur have one 5 HP pump while the other two have two 5 HP pumps each (which are all in fact 6.5 HP pumps). The underreporting is mainly due to the Groundwater Act[9], which allows up to 5 HP pumps to be installed in blocks which are

9 It exempted farmers located in 301 or so "safe" groundwater blocks and owning pumps of less than 5 horsepower (HP) and tube wells with discharge less than 30m3/hour only from having to get permits for groundwater use from the State Water Investigation Directorate (SWID).

groundwater safe. And as pointed by many farmers, Shah and Daschowdhury (2018) reported that using administrative boundaries for groundwater development has been an irrational decision because farmers in adjacent block with equally good water levels have not been able to install pumps. Average water level reported by ISPs in the study village is 49 feet (~15 m) and declining water table has never been an issue in the village.

Even since installation, farmers have been well aware of the ToD metering system and try to maximize their pump usage time in off-peak hours. Figure 1 shows the monthly time-based consumption pattern of all ISPs combined at baseline. The weighted average tariff based on the consumption pattern in Monoharpur is ₹5.18/kWh. It is clear than farmers try to use their pumps only in off-peak hours except in *Boro* season (January to April) when the water demand is too high to be met by running pump only for half the day.

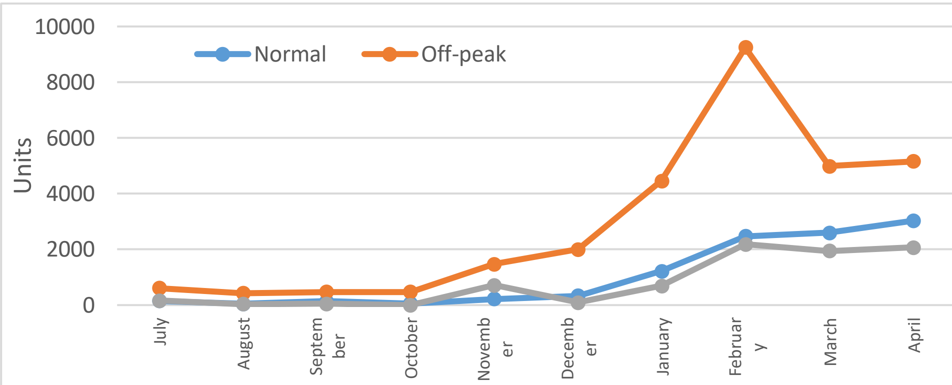

Figure 1. Time-based monthly power consumption (kWh) of all ISPs of Monoharpur

The average area irrigated by an ISP annually is 54.6 *bigha* (21.8 acres). The gross income from selling water to the buyers is ₹38,150 in *Boro*, ₹9,963 in *Kharif* and ₹3,600 in *Rabi* – an aggregate of ₹51,713 annually. The ISPs reported an average annual maintenance cost of ₹9,781. Data on power consumption in 2016-17 shows that the ISPs utilized an average of 3,503 units (kWh) of electricity in peak months of January to April, which roughly translates to ₹16,000 of bill paid. Including their own landholding of 11 *bigha* (average for 20 ISPs), an ISP on average irrigates 36 *bigha* in *Boro*, with each *bigha* requiring about 30 hours of irrigation.

Given that ISPs were only billed for an average of 3,503 units, there appears to be a huge amount of power being drawn using illegal means to run the pumps and the electricity utility / DISCOM is losing almost 50 per cent of its potential revenue owing to "unaccounted" losses. The earnings of ISPs, on the other hand, are ₹38,150 in *Boro* season, solely from sale of irrigation service – significantly higher than the average electricity bill – indicating W/AC multiple greater than 1.

6. NOISES IN THE EXPERIMENT

As mentioned earlier, farmers resort to illegal means of drawing power which was a cause of serious distortions in billing and pump use data. Furthermore, the irregularity in meter reading by the utility meant that even if ISPs do try to increase pump usage during the experiment, without proper meter reading, his actual usage will not be recorded and hence, subsidized by the pilot project. But much larger distortions were created in the experiment by two unforeseen external changes, first, the "Mini-Barga" rumour and second, the conversion of transmission cables to tamper-proof cables.

The land-leasing market in the study year shrunk significantly in our study village owing to rumours spread by a local political party that Barga Act would be implemented for all lessees who cultivate on leased land in *Boro* of 2018. Few persistent ISPs, however, managed to lease-in land from relatives and neighbours increasing average area leased in by pump owners from 5 *bigha* in base year to 7 *bigha* in study year in Monoharpur, even though the total land leasing market saw a decline.Second disruption was created by conversion of overhead cables to make them more tamper-proof by the utility under its ₹1,000 crore project to prevent physical pilferage (ToI, 2017). In this process, most of the ISPs who ran their pumps on stolen power in base year might not have been able to do so in study year and hence, their recorded power consumption might not reflect increase in pump usage.

7. IRRIGATION SERVICES MARKET UNDER THE PILOT

A total subsidy amount of ₹1,35,927 was paid under the pilot to the 20 ISPs over the course of one year and their monthly energy consumption recorded. Data was collected from the same sample studied at baseline from both the villages. Figure 2 shows the average bill of ISPs in 2016-17 (base year) and 2017-18 (study year). An increase in average pump usage is observed but as mentioned earlier, the increase could be result of reduced power pilfering opportunities.

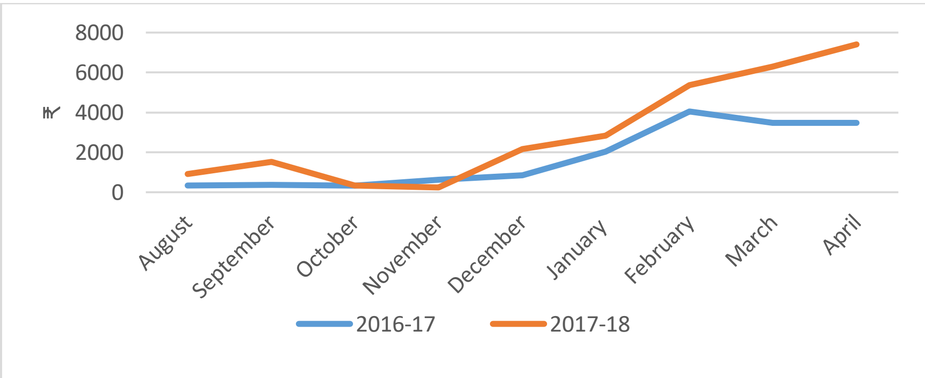

Figure 2. Average monthly power bill of ISPs (₹)

At the baseline, the W/AC multiple was found to be higher than 1 as ISPs were charging a lot more from their buyers than what they had to pay to the utility for power consumption. In Table 1, we have calculated W/AC multiple at baseline and the end of the experiment.

It is clear from the calculations that the hypothesis with which the experiment started appears to be refuted. While the subsidy did reduce the average cost of serving a plot of land for ISPs, the prices increased, possibly on account of having to pay for all the power used. What become very clear from the table is that ISPs are trying to cross subsidize their own irrigation by charging much higher prices from the buyers. While the utility might find that its attempt to prevent pilferage has worked well as number of billed units have increased, calculations show that there is some level of power theft continuing in the villages (see Table 2).

Whether the reason for increased bill amounts is increased usage or reduced pilferage cannot be ascertained using quantitative data but we asked the ISPs about their pump usage in the study year. Almost all the ISPs reported having attempted to increase their lease-in area, half the ISPs dug farm ponds and started aquaculture and some of them increased *Rabi* cultivation.

Table 1. W/AC multiple comparison at baseline and end line

Parameter	2016-17	2017-18
Average units of power consumed (kWh)	3,503	4,588
Cost of power at ₹5.18/unit	₹18,146	₹23,765
Average pump maintenance cost in *Boro* season	₹5,156	₹3,495
Operating cost (₹3000/month)	₹15,000	₹15,000
Total cost of service delivery over 5 months	₹38,300	₹42,260
Buyers' area irrigated by one pump (*bigha*)	25	24.5
Break-even price for ISPs (for buyers' area irrigated)	₹1,532	₹1,724
Actual price charged by ISPs (ISP-reported)	₹1,526	₹1,740
Actual price charged by ISPs (water buyer-reported)	₹1,614	₹1,798
Profit percentage for ISPs (at buyer-reported prices)	5.35 %	4.29 %
Average subsidy received by an ISP under the pilot	NA	₹7,970
Profit after addition of subsidy provided by ITP	NA	5.71 %
Savings on irrigating own land	₹7,737	₹10,059
Profit after accounting for savings	25.5 %	28.05 %
W/AC Multiple	1.31	1.81

Table 2. Calculation of units actually consumed compared to billed units

	2016-17	2017-18
Area of water buyers irrigated by one pump (bigha)	25	24.5
ISPs own area irrigated by the pump (bigha)	11	14.3
Average pump running hours (area irrigated*30)	1080	1164
Power consumed by 6.5 HP pump for given hours	4,888	5,269
Units consumed at 75 % efficiency	6501	7,008
Percentage of actual consumption billed	53.9 %	65.5 %

Unlike other market transactions where price is known in advance of the transaction, water buyers in Monoharpur do not know what they will be charged for irrigation until later. And based on the increased prices in study year, it is apparent that the experiment failed to create competition amongst ISPs. To understand the reason for that, we conducted individual interviews and FGDs with all ISPs. Based on these interactions, Daschowdhury (2018) reported thatthe ISPs of the area have an informal institution for price setting and pump owners who own 5-6 pumps in the area, across villages, generally dictate prices as it suits them. The group knows that they will benefit by sticking together and keeping their profits on the higher side.The ISPs understood that the subsidy under the pilot would only last a year or maybe two but it was not forever, neither did they see any such tariff change implementation by the utility in near future.Lowering prices this year opens them up for negotiation and pressure from buyers next year, which they cannot allow to happen as they might incur losses due to the high power bills.One of the major issues that ISPs face is timely collection of payment from buyers who being small farmers, often cannot pay during a bad crop season (Shah *et. al* 2017) and the transaction cost involved in the collection process is high. ISPs who did lower water price for a few water buyers did it only as buyers paid an advance upfront so their future transaction cost was reduced.

Purchasing a pump and getting an electricity connection requires a substantial investment, which was even higher a decade ago. No ISP would invest in one without guaranteed command area for selling water. The ISPs have an informal agreement to not encroach into each others' designated area set during pump installation. Many

ISPs also own other agriculture equipment like tractor, thresher, etc. which gives them more power over their water buyers, who require these machines in addition to irrigation services- mostly all at credit till they sell off the produce or in exchange for crop.

Daschowdhury (2018) also reported that there are cases when a water buyer requests an ISP for their services when they have dispute on any matter with their former ISP. The new ISP, however, starts selling water only after a gap of one season to ensure not to damage relationship with fellow ISPs.

On the surface it appears that the market remained tightly oligopolistic in spite of our attempts and that compelled us to further delve into market characteristics. We calculated Herfindahl–Hirschman Index (HHI)[10] using the market share of each pump owner at baseline and then at the end of the experiment. Monoharpur's irrigation services market shows a slight shift in market characteristics based on the index. Not only has the total irrigated area of the water buyers (in either or both seasons) increased by 8.7 per cent, the HHI of the market has decreased by 66 points i.e. the market has moved towards being more competitive.

8. QUALITY OF IRRIGATION SERVICES

Just as we had estimated the quality of irrigation services using a 5-point scale at baseline, we collected the data again during the final survey of water buyers. The buyers reported an increase in service quality they received under the subsidy regime (see Figure 3). To ensure that their buyer doesn't switch to another ISP, apart from ensuring meeting water needs of buyers as timely as possible, they provided additional services such as channelling water through furrows and pipes themselves without water buyers having to be present in the field, providing discounts for advance payments, or willing to wait for payment until paddy prices are higher so that the buyer doesn't have to sell-off their harvest at lower prices under pressure to pay. While water buyers might not have gained directly through reduced irrigation cost, they have benefitted through better services which also impacts their productivity and income.

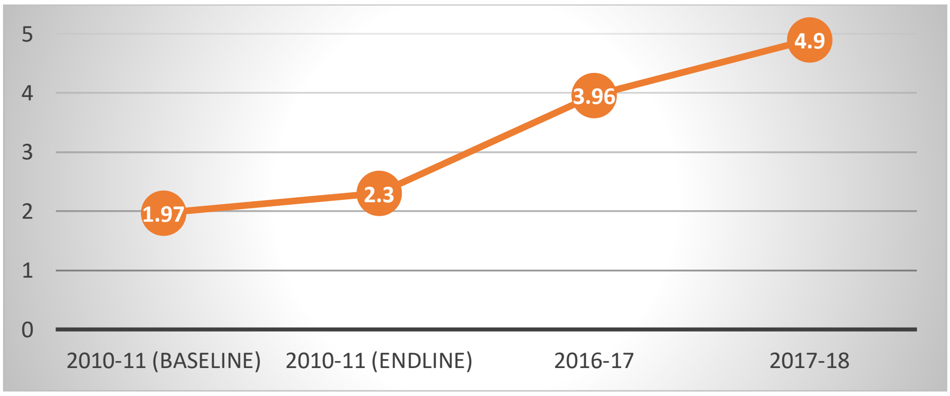

Figure 3. Quality of irrigation services on a scale of 1 to 5

10 HHI is commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. HHI < 100 indicates perfect competition, 100<HHI<1000 indicates monopolistic competition and HHI>1000 indicates oligopolistic competition.

9. CONCLUSIONS AND POLICY IMPLICATIONS

Even though our experiment could not provide sufficient evidence to support our hypothesis mainly due to external disturbances, the theory still remains compelling. Past studies in the state have shown that high flat tariff led to buyers' water markets, stimulated competition amongst sellers and helped buyers bargain competitive prices. Mukherji *et. al* (2009) reported that the flat tariff in West Bengal led to equitable benefits of subsidized power to pump owners and their water buyers alike as existence of prolific groundwater markets ensured the benefits trickled down. Even though the utility revised the tariff often and pump owners were paying nearly ten times higher flat tariff in 2007 compared to 1994, water buyers continued to benefit from cheaper irrigation services, and pump owners were under a constant pressure to sell water to recover annual tariff which ensured that water prices did not go up drastically. After introduction of metered tariff, however, in spite of only few pump owners having to pay higher than annual flat tariff, water prices increased by 30 to 50 per cent for different seasons, water markets shrunk, pump owners' monopoly strengthened and *Boro* paddy cultivation declined (Mukherji *et. al*, 2009). Other studies following up on the impacts of metering have also reported increasing monopoly of pump owners and high water prices squeezing profits from *Boro* cultivation, posing a threat to food security of small and marginal farmers who purchase irrigation services (Banerjee, 2016; Shah and Daschowdhury, 2017).

It has now become imperative for the utility to step up and take up the responsibility of expanding poor farmers' access to affordable irrigation, especially if it is possible to achieve it in a revenue-neutral manner. It is clear from the experiment and from past studies that the current tariff structure will reinforce monopolistic water markets that will transfer wealth from resource-poor water buyers to tubewell owning water sellers. Given that the primary goal of government policy on farm energization is improving poor people's access to reliable and affordable irrigation, WBSEDCL should experiment with alternative policy proposals that achieve this goal better. We believe there are at least three other ideas that need to be pilot-tested through randomized control trial to obtain robust evidence to modify their farm power policy:

Continue with current energy pricing regime for 8 months of the year but introduce a special *Boro* season tariff between December and April with a tariff of ₹1500/HP and a metered rate of ₹1.50/kWh billed at the end of the season; Issue hassle-free temporary *Boro* season connections on above tariff; Replicate Gujarat's Suryashakti Kisan Yojana (SKY) scheme in which solar ISPs can sell surplus solar power to the DISCOM at ₹3.50/kWh.

If the utility charges farmers a flat-cum-subsidized metered tariff in *Boro* season as suggested in (1) above, it will be a win-win situation for all three stakeholders involved, viz. the utility, the pump owners and the water buyers. The utility suffered a revenue loss of ₹175.85 crore owing to delay in raising bills, theft of electricity and unauthorised use in the fiscal 2015-16 (PTI, 2018). A large number of ISPs fail to pay their bills on time accumulating large arrears and becoming non-performing assets impacting the overall financial performance of the utility. And as seen in Figure 1, major portion of their power consumption is in the months of December to March. The proposed structure will allow the utility to collect advance charges based on pump sizes at the onset of *Boro* cultivation ensuring an assured revenue. For the pump owners, not only would the subsidized tariff be a relief, they will also be able to save substantial amount on LPSC. This structure is also likely to disincentivize power theft especially when penalty on being caught is much higher[11] than gain from every unit of power consumed unreported.

Based on the available data of Monoharpur village, with this structure:

(a). The utility would receive an advance sum of ₹1,50,000 from the ISPs, and an additional ₹2,10,000 on billed power, which is not a bad trade-off compared to ₹4,61,078 billed in 2017-18, which includes large portions of LPSC, has high transaction costs and low certainty of being paid.

(b). The ISPs would have to pay ₹4,500 each (less than 20 per cent of their total bill in 2017-18) in advance and would save on LPSC (up to 30 per cent of their total bill). Once the water buyers pay back after harvesting, the ISPs can pay their *Boro* bill well in time at the end of the season.

(c). As the ISPs would have already paid upfront for *Boro* connection, water buyers will get an upper hand in negotiating prices. If the water buyers come together and collectively refuse to buy water from an ISP, the latter would not be able to recover the advance paid to the utility, let alone make profits. Even at the current W/AC multiple of 1.81, the water buyers can bargain 36 per cent lower water prices in the proposed regime.

Shah and Daschowdhury (2017) reported that farmers were not keen on temporary connections for *Boro* anymore because of delay in distribution (often after preparation of seedlings are complete), high per unit tariff and compulsion to pay a huge amount as advance. The pilot suggested in (2) above will encourage more farmers to take temporary connections on flat-cum-metered tariff structure, further boosting the competition amongst water sellers in villages. It will also add to the utility's revenue.

Knowing that WBSEDCL is already loss-making and has been investing more on infrastructure to curb their losses, a change in tariff structure that could reduce their revenue might not appear lucrative in the present. In that case, West Bengal Renewable Energy Development Agency (WBREDA) could play a significant role in making irrigation affordable for *Boro* farmers in the state through solarization. So far, the state has experimented with group-owned solar irrigation models which have shown promising results (Sabarwal *et. al*, 2018). But for a paddy-dominated agrarian scenario with lumpy irrigation demand, a much rewarding model for farmers would be replication of Suryashakti Kisan Yojana (SKY) model that is being tried out in Gujarat. It will offer the ISPs an option to evacuate power to grid in months when irrigation demand is low and earn income from it while sell water at near zero operating costs in *Boro* season. By increasing opportunity cost of power wastage, water use efficiency in irrigation is likely to increase addressing the state's concern of groundwater depletion as seen in the Dhundi experiment in Gujarat (Shah *et. al*, 2017b). Increasing solarization of irrigation pumps will subsequently crowd out the electric pumps and reduce burden on the electricity utility to provide services to non-profitable agricultural users. And for the pump owners who anyway have to shell out ₹50,000 annually for bill payments once power theft becomes more difficult and riskier, paying the same amount towards instalment of solar irrigation pumps would not be a big challenge with suitable financing options in place.

Central Ground Water Board (CGWB) assessed 268 blocks in the state and reported 71 per cent of blocks as "groundwater safe" while 28 per cent have semi-critical levels and the average groundwater development is 45 per cent (lower than India average

11 WBSEDCL penalizes power pilfering users through legal action as well as fines often exceeding ₹0.1 million (Source: multiple newspaper articles)

of 62 per cent) (CGWB, 2017). But in spite of sitting on one of world's best aquifers, the farmers of West Bengal have to pay through their nose for water to irrigate their crops. This is a lost opportunity for accelerating small-holder agrarian livelihoods. Data on *Boro* area over the last decade shows a declining trend[12] in the summer paddy area. More and more farmers are leaving agriculture and the trend is evident in a large number of districts (Shah and Daschowdhury, 2017). When most states of Western and Peninsular India with over-exploited hard-rock aquifers continue to offer farmers subsidized energy to reduce agrarian distress, it appears unfair that West Bengal's poorest farmers and seasonal tenants have to incur such high costs to access an abundant natural resource.

Had this experiment worked as anticipated, it might have provided strong evidence in favour of change in farm power tariff structure and energy pricing for farmers of the state. Nonetheless, with the experiment throwing light on true social cost of the current policy, the argument is stronger than ever, and it is very clear that the current policy needs an out-of-box overhauling. With the pilots suggested above, the utility should be able to gather sufficient evidence in favour of a policy change. And as farm power policy in India is largely a political issue, it would not be difficult to rope-in any ruling state government to sign it off, as the benefit to millions of poor farmers will work in their favour by strengthening their political vote bank.

10 REFERENCES

Banerjee, P.S. 2016. A Case Study on Liberalization of Electric pumps in Irrigation Kumarpur village, North 24 Parganas district, West Bengal. Unpublished report. Anand: IWMI-Tata Water Policy Program.

CGWB (Central Ground Water Board). 2017. Ground Water Yearbook - India 2016-17. New Delhi, India: CGWB.

Daschowdhury, S. 2018. Impact of flat-cum-metered tariff experiment in Monoharpur village. Unpublished report. Anand: IWMI-Tata Water Policy Program.

GoI (Government of India). 2018. Agriculture Census 2015-16 (Phase – 1). New Delhi India: Ministry of Agriculture and Farmers' Welfare.

ICAR (Indian Council of Agricultural Research). 2018. State Specific Chapter: West Bengal. https://icar.org.in/files/state-specific/chapter/125.htm (accessed 2 April 2019)

India Today. 2018. Top 10 rice producing states in India: Rice production and area under cultivation. 28 September 2018.

MoWR (Ministry of Water Resources). 2017. 5th Census of Minor Irrigation Schemes Report 2013-14. New Delhi, India: MoWR.

Mukherji, A., Das, B., Majumdar, N., Nayak, N.C., Sethi, R.R., Sharma, B.R. and Banerjee, P.S. 2009. Metering of agricultural power supply in West Bengal, India: who gains and who loses? Energy Policy, 37(12): 5530-5539.

Mukherji, A., Shah, T. and Banerjee, P.S. 2012. Kick-starting a Second Green Revolution in Bengal. Economic & Political Weekly, 47(18): 27-30.

Nandargi, S.S. and Barman, K. 2018. Evaluation of Climate Change Impact on Rainfall Variation in West Bengal". Acta Scientific Agriculture 2.7 (2018): 74-82.

PFC (Power Finance Corporation). 2016. The Performance of State Power Utilities for the years 2013-14 to 2015-16. New Delhi, India: PFC.

PTI (Press Trust of India). 2018. WBSEDCL suffered Rs 175.85-cr revenue loss in FY16: CAG report. 8 March 2018. Available online: https://www.business-standard.com/article/pti-stories/wbsedcl-suffered-rs-175-85-cr-revenue-loss-in-fy16-cag-report-118030800945_1.html

Rogaly, B., Harris-White, B. and S Bose. 1999. Sonar Bangla? Agricultural Growth and Agrarian Stagnation in West Bengal and Bangladesh, New Delhi: Sage Publications.

12 Data collected from multiple district agriculture reports

Sabarwal, H., Sharadindu, K., and Shah, M. 2018. Can solar pumps result in pro-poor irrigation in West Bengal? Unpublished paper. Anand: IWMI-Tata Water Policy Program.

Sarkar, A. 2006. Political Economy of West Bengal: A Puzzle and a Hypothesis. Economic & Political Weekly, Vol 41, No 4, pp 341–48.

Shah, M. and Daschowdhury, S. 2017. Causes and consequences of decline in Boro paddy area of West Bengal. Unpublished report. Anand: IWMI-Tata Water Policy Program.

Shah, M., Daschowdhury, S., and Shah, T. 2017a. Pro-poor farm power policy for West Bengal. IWMI-Tata Highlight #01. Colombo, Sri Lanka: International Water Management Institute.

Shah, T., Durga, N., Rai, G.P., Verma, S., and Rathod, R. 2017b. Promoting solar power as remunerative crop. Economic & Political Weekly, Vol 52, Issue 45.

Shah, T. 1993. Groundwater Markets and Irrigation Development: Political Economy and Practical Policy,Bombay: Oxford University Press.

Shah, T. and Daschowdhury, S. 2017. Farm power policies and groundwater markets contrasting Gujarat with West Bengal (1990–2015). Economic & Political Weekly, 52 (25&26): 39-47.

Shah, T. Verma, S. Rai, G.P. and Durga, N. 2018. Promoting solar irrigation service providers in Ganga Basin.Anand: IWMI-Tata Water Policy Program.

ToI (Times of India). 2017. WBSEDCL kicks off 1000 crore project to stem power theft. 20 June 2017.