

Comanagement of Power and Groundwater Resources: Issues in Sustainability and Equity in Groundwater Scarce Areas

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Executive Summary

1. **Groundwater** resources are showing increasing signs of overdevelopment in many arid and semi-arid regions in India. Groundwater is a very valuable resource in India since it accounts for 75-80 percent of the value of irrigated crop produced in India. Roughly 35 million hectares can be irrigated by groundwater - a figure which exceeds the 33 million hectares of irrigation potential created through all major and medium irrigations projects in India. If current trends continue, overdevelopment could pose a major threat to the sustainability of irrigated agriculture in these areas.

2. In the North-Western state of Gujarat, groundwater accounts for over 76 percent of the total area irrigated in the state. In the southern state of Karnataka, groundwater accounts for 26 percent of the gross area irrigated. Many districts in these states are facing acute groundwater overdevelopment problems. In Mehsana district in Northern Gujarat, groundwater accounts for 85 percent of the districts irrigation needs. In Kolar district of Karnataka, it accounts for 59 percent of the areas irrigation needs.

3. Water tables have been rapidly falling in Mehsana. The decline has been nearly three meters per year since 1981. Majority of wells in Mehsana are drawing water from depths of nearly 400 feet. In the hard rock region of Kolar in Karnataka, there is a high borewell failure rate (nearly 50 percent) and decreasing probability of striking water.

4. Dramatic increases in the number of electrified pumpsets is one of the major reasons for overdevelopment of groundwater. The provision of electricity based on the horse power of irrigation pumpsets and not on actual electricity consumption at highly subsidised rates is also seen as a factor responsible for overdevelopment.

5. The provision of subsidised electricity to the agricultural sector is mainly responsible for the poor financial performance of the monopolistic electricity utilities called State Electricity Boards (SEB's). Gujarat sells over 40 percent of its electricity production to agriculture, while the corresponding figure for Karnataka is 36 percent. While the average cost of electricity production in Gujarat and Karnataka is 150.89 paisa/kwh and 110.64 paisa/kwh, farmers in these states are charged only 23 paisa/kwh and 11 paisa/kwh as electricity tariff respectively. The SEB's in these states have incurred huge commercial losses due to the unremunerative tariff structure in these two states. In Karnataka, 95 percent of the irrigation pumpsets owners do not pay any tariffs since tariff is levied only on farmers operating pumps over 10 HP.

6. The poor state of the financial health of SEB's is reflected in the demand supply gaps, frequent power cuts, poor quality of power supply to the agriculture sector. Gujarat and Karnataka have a flat rate HP (horse power) based tariff system for the agricultural sector. In a HP based system, farmers are charged on the basis of their pump HP and not according the actual electricity consumed. Both Gujarat and Karnataka are unable to meet the minimum rate of return of 3 percent as enacted by the 1948 ESA (Electricity Supply Act).

7. Charging higher electricity tariffs based on a metered (consumption) system to the agricultural sector is frequently recommended by many policy makers to improve the financial health of SEB's and also arrest the overdevelopment of scarce groundwater resources. The implicit assumption being that in a HP based system, farmers have no incentive to save on both power and groundwater.

8. Three separate case studies were undertaken in the state of Gujarat and Karnataka to study the role of energy (electricity) pricing in mitigating groundwater overdevelopment. These studies were conducted in Mehsana a alluvial region of the state and Junagadh a hard rock region. In Karnataka the study was conducted at Kolar a hard rock region. All these areas face acute groundwater scarcity. The equity implications of using a consumption based energy pricing policy was also studied. These case studies are very site and assumption specific and relevant to the specific groundwater scarce region only. Moreover, the study only looked at prices that are within a politically feasible range i.e., the average cost of electricity production in the state concerned.

9. In the case of Mehsana, Gujarat a region where the institution of groundwater markets is pervasive it was seen that switching over to a consumption based tariff will not have any effect on the rate of groundwater extraction. In Mehsana, the price of groundwater currently reflects its scarcity value and not the cost of extraction.

10. Given the wide disparity between current extraction and recharge rates in Mehsana and low groundwater demand elasticities, it is doubtful if electricity prices can play more than a supplementary role in the sustainable use of groundwater. The more productive means could be through technological intervention on the demand side and improving storage structures to conserve groundwater.

11. Simulations showed that tariffs above 60 paisa/kwh (less than the current average cost of supply which is 150 P/kwh) could have adverse equity implications on non-bhagidars by transferring their incomes to the bhagidars since there elasticity of groundwater demand is less than one.

12. If current rates of recharge and extraction continues in Mehsana, the prohibitive costs of investing in new wells could have major negative equity implications on small and marginal farmers. Energy consumption could also rise if higher HP pumps are installed to pump out groundwater from lower depths. This could again worsen the financial position of the SEB in Gujarat.

13. In Maliya taluka of Junagadh district, Gujarat, a hard rock region, water tables have been falling over the past ten years. The cropping pattern has not changed in this area with most farmers growing groundnut and wheat, the major kharif and rabi season crops. Most farmers operate 5 HP electric pumpsets in Maliya taluka while a substantial number of farmers also irrigate there farms with 5 HP diesel pumpsets. Electricity is available in the region for only 10-12 hours a day.

14. Farmers who operate 5 HP electric pumps pay approximately 20 paisa/kwh (in energy terms) while diesel pump operators pay approximately 200 paisa/kwh. Despite the wide disparity in energy costs between these two sets of farmers, a marginal productivity analysis showed that neither of them are using their groundwater input inefficiently in an economic sense. Efficiency here is defined as the point where the value of the marginal product is equal to the marginal cost of the input.

15. Despite paying higher energy costs, diesel pump owners did not resort to any water and/or energy conservation measures.

16. There was widespread technological dualism in maliya taluka with implications for equity. Diesel pump owners complained that during times of drought they were forced to irrigate less because water tables decline sharply and get beyond the reach of diesel pumps. They also said that continuous pumping by electricity pump owners in a bad rainfall year depleted there wells. Diesel pump owners are therefore very vulnerable as a group during times of water stress.

17. A related aspect of equity is the inherent inequity associated with the state (wittingly or unwittingly) continuing to subsidise electricity pump owners and not diesel pump owners, when both get the same price for there crops.

18. In Kolar, Karnataka, farmers use 6 HP submersible pumps to extract groundwater from a depth of 160 feet. The main crops grown in the region are ragi and paddy (mainly for self consumption) and tomato in the kharif season. Potato, carrots and cabbage are grown during the rabi season while mulberry and grapes are perennial crops.

19. The analysis for optimum water application at various electricity tariff rates showed that consumption based tariffs over a large range would not have any impact on water demand.

20. Over a large range of tariffs, water application intensity would be much larger than the present average application rate (which is sub-optimum). This implies that switching over to a consumption based electricity tariff structure would have no impact on water application intensity. Water application intensity is low because of the overall scarcity of water in Kolar.

21. Crop-switching to lower water intensive crops as a means to save water is also ruled out because of the overall scarcity of water. Even if crop switching did take place, water saved due to crop switching is likely to be used to either increase water application intensity and/or irrigate additional land.

22. The quality of power supplied to the region needs improvement. The poor quality of power supplied has led farmers to store water in tanks constructed near their fields. Groundwater is pumped into these tanks (at night when power is available for 8- 10 hours) used to irrigate the land the following day. This leads to a 25 percent loss in water stored in tanks due to seepage, percolation, and transpiration. The implied energy losses at some tariff rate may become prohibitive enough to compel farmers to invest in tank improvement measures. Our analysis showed that despite high (simulated) tariff rates, farmers may not invest in tank improvement measures. This is because of the lack of sufficient funds available with farmers and/or their risk averse behaviour.

23. Given the scarcity of groundwater resources in Kolar, there is a need to strengthen surface irrigation systems and also build efficient water harvesting structures to conserve groundwater. Given the cropping pattern in Kolar, modern irrigation like drip or sprinkler can also play a major role in conservation of groundwater.