

ACIAR SDIP Foresight Program: Status Report

THE CHANGING ENERGY: IRRIGATION NEXUS IN EASTERN INDIA

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Highlights

- Groundwater is physically abundant, but economically scarce in Eastern Gangetic Plains (EGP) mainly because diesel pumps, the mainstay of groundwater irrigation in the region, have high fuel costs.
- In 2013, 95% of all irrigation pumps in Bihar and 76% in West Bengal were diesel pumps.
- The total number of electric pumps in West Bengal increased from 0.1 million in 2013-14 to 0.29 million in March 2017-18. The government of Bihar is also implementing a program to increase the number of electric pumps from less than 20,000 in 2017-18 to more than 0.4 million in 2022.
- Electrification can reduce the energy cost of groundwater irrigation by 70-75 percent even if farmers were to pay the full cost of electricity. Affordable irrigation can transform the region's agriculture.
- Unlike all other states of India, farmers in West Bengal pay a reasonably high unit rate for electricity used for irrigation—ranging from Rs. 3.78/unit to Rs. 7.48/unit depending on the time of use.
- High-quality power supply for irrigation at reasonable unit rates will be better for farmers, taxpayers, utilities and the environment of Bihar.

States in the Eastern Gangetic Plains (EGP) of India have rich and stable groundwater endowments. According to the Central Groundwater Board, **Bihar and West Bengal use only 40% of their total net annual groundwater availability (10.77 BCM of 27.42 BCM in Bihar and 11.65 BCM of 27.46 BCM in West Bengal). Annual withdrawal of groundwater for all uses is less than 40 percent of the total replenishable recharge in all blocks in Bihar and 90% of the blocks in West Bengal**¹. Rather than reducing water use, state policies should be targeted towards sustainable development of water resources. Energy policies have an important role to play in this groundwater dependent region.

Though physically abundant, groundwater is economically scarce in EGP. A farmer in Bihar pays up to 30 times more for water compared to his counterpart in Punjab who irrigates from deep and depleting aquifers. The high cost of irrigation in the EGP makes farmers under-irrigate their crops resulting in low yields, low cropping intensities, high vulnerability to droughts and terminal heat and lower profit margins.

Groundwater irrigation is expensive in the region because it is dependent almost entirely on diesel pumps. **The most recent Minor Irrigation Census (2013-14)**² showed that **more than 95% of the 0.64 million pumpsets in Bihar and 76% of the 0.43 million pumpsets in West Bengal were diesel pumps. In comparison, the share of diesel pumps was below 30% in the rest of India.** Diesel is a more expensive energy source than grid electricity, and diesel pumpsets are significantly less energy efficient than the electric pumpsets. **A 5 HP diesel pump uses 1 liter of diesel in an hour costing Rs. 65-70. In comparison, a 3.5 HP electric pump, which is just as effective as a 5 HP diesel pump, uses only 3 kWh of electricity costing only Rs. 15-18 per hour.** The fuel cost of irrigation with diesel pumps is, therefore, 3-4 times higher.

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This is a pre-publication discussion paper. It is not peer-reviewed and the views expressed here are of the author(s) alone and not of ACIAR, DFAT or IFPRI.

¹ http://cgwb.gov.in/gw_profiles/st_Bihar.htm and http://cgwb.gov.in/gw_profiles/st_westbengal.htm

² <http://mowr.gov.in/sites/default/files/6.IntegratedTables%281%29.pdf>

Only 4% of all landholders in Bihar and 6% in West Bengal had a pump-set in 2013-14. The other 94-96% of farmers rely on rental markets for irrigating their crops³. Not only that, an average land holding in Bihar is divided into 2 parcels and in West Bengal into 3 parcels of land that may not be close to each other. So, even pump owning farmers often need to rely on other pump owners to irrigate some of their land parcels. Irrigation with rented pumps is significantly more expensive because rental markets are not competitive.

The high cost of access to irrigation through uncompetitive rental markets disproportionately affects marginal and Scheduled Caste (SC) farmers, especially, in Bihar where pump ownership is highly unequal (Table 1).

TABLE 1 OWNERSHIP OF GROUNDWATER STRUCTURES BY MARGINAL AND SC FARMERS IN BIHAR, WEST BENGAL AND THE REST OF INDIA

States	Marginal Farmers		SC Farmers	
	Share of Cultivable Land (%)	Share of all Groundwater Structures (%)	Share of Cultivable Land (%)	Share of all Groundwater Structures (%)
Bihar	57.4	13.6	11.4	6.8
West Bengal	52.5	45.9	19.9	18.3
Rest of India	19.9	35.8	8.1	10.2

Source: Authors' calculation using data from and the Agriculture Census, 2010-11 and the MI Census, 2013-14

Electrification of Groundwater Irrigation in Bihar and West Bengal

After a policy change in 2011 that liberalized the tubewell permit system and reduced the capital cost and the hassles of getting the electricity connection for irrigation (Shah and Chowdhury, 2017)⁴, **the total number of electric pumps in West Bengal has increased rapidly--from 0.1 million at the time of the last MI Census in 2013-14 to 0.29 million in March 2017⁵**. It is our surmise that two-thirds of all irrigation pumps in the state now run on electricity. This estimate assumes that the total number of pumpsets has not increased between 2013-14 and 2017-18 — a reasonable assumption given the stagnation in the number of mechanized wells in West Bengal since 2006-07. Unlike other states of India, most electric pumps are metered in West Bengal and farmers pay a time-of-day (ToD) tariff of Rs. 3.78/unit from 6 am to 5 pm; Rs. 7.48/unit from 5 pm to 11 pm and Rs. 2.42/unit from 11pm to 6 am, in addition to a fixed monthly charge of Rs. 20/KVA of connected load.⁶

Studies in West Bengal (and Bihar) suggest that access to affordable irrigation from electric or solar pumps can unleash a second green revolution in the region with sharp increases in the irrigated area,

³ Authors' calculation based on number of pump owners data from the MI Census, 2013-14 and the number of holdings data from the Agriculture Census, 2010-11

⁴ Shah, Tushaar and Sujata Das Chowdhury. (2017). Farm Power Policies and Groundwater Markets: Contrasting Gujarat with West Bengal (1990-2015). *Economic & Political Weekly*, 52(25-26), 39-47.

⁵ in https://www.wbseedcl.in/irj/go/km/docs/internet/new_website/pdf/Final_Report_16-17.pdf

⁶ http://www.wberc.gov.in/sites/default/files/WBSEDCL_PDF_0.pdf

crop production and productivity and farmers' income in a short time (Mukherji, 2012)⁷. However, there is very little evidence on the actual impact of the rapid electrification of groundwater irrigation in West Bengal on state's agrarian and rural economy. An unpublished report by Sujata Das Chowdhury, cited in Shah and Chowdhury (ibid), found that it led to a sharp increase in the number of water sellers and the cropping intensity in the Birbhum district. Surprisingly, water markets became less competitive even as the tubewells density increased and pump-owners started leasing-in land from smallholders, instead of selling water to them, to capture a larger share of the benefits from irrigation. Shah and Chowdhury (ibid) contend that the switch from flat to metered tariff for electricity made water markets less competitive. They recommend a two-part tariff for electricity to encourage pump owners to sell more water. We disagree with their contention and their recommendation. Rather than fiddling with the tariff structure, state policy should try to reduce barriers to entry may be more effective in making water markets more competitive. Programs that make it cheaper and easier to own electrified wells even for smallholders will make water markets more competitive in West Bengal.

Recently, the Government of Bihar also started an ambitious program to electrify irrigation pumpsets in the state. If the program achieves its target, the number of electric pumps in the state will increase from less than 20,000 in 2017-18 to more than 0.4 million in 2022. In addition, following the Jyotigram Yojana (JGY) model in Gujarat, Bihar is also creating a dedicated feeder for agriculture with the budget outlay of nearly Rs. 5,000 crores.

Bihar, like West Bengal, is late in electrifying groundwater irrigation and is therefore in the enviable position of being able to implement a world-leading system. However, instead of learning from the mistakes of many other states of India, the Government of Bihar seems set to repeat them. Utilities in Bihar charge farmers only Rs. 0.96/kWh of electricity, plus a monthly fixed charge of Rs. 30/hp. At present, most pump connections are unmetered and the flat tariff for such connections is Rs. 130/hp/month.

Even if Bihari farmers pay the full cost of electricity, the hourly cost of irrigation will be one-fourth of what it is now with diesel pumps. They do not need subsidized electricity. Utilities treat farmers who get subsidized electricity as their beneficiaries and not as their consumers. Bihari farmers will be better off if they are clients of the power utilities, not their beneficiaries. As they extend the grid connection to farms, the two utility companies in the state should strike a business deal with the farmers: to provide a reliable and high-quality power supply for the full tariff.

Understandably, it will be difficult for the government in Bihar to sell electricity to farmers at full cost when every other state in India, except West Bengal, is subsidizing it heavily. Late arrivals should learn from others' errors instead of repeating them and learning their lessons the hard way. The Government of Bihar should not subsidize the unit rates of electricity or offer flat tariff arrangements. Instead, the power utilities in the state should charge the full tariff to farmers and the state government can make a lump sum transfer directly to bank accounts of pump owners who pay their electricity bills on time.

Let's assume that the modal electric pump in Bihar will be 3.5 hp in size and operate for 1,000 hours per year. If the government of Bihar wants farmers to effectively pay only Rs. 1/unit of electricity, the utility can still charge them at Rs. 5.00/kWh and the state government can transfer Rs. 12,000 (Rs. 4/unit X 3 units X 1,000 hours) to every pump owner's bank account in two or three equal installments to reward regular bill payments. Government of Bihar is actively considering direct cash transfer of electricity subsidies to consumers' bank accounts⁸. The state government has already set up a DBT system for farmers to transfer all state agricultural subsidies directly to their bank accounts. Power subsidies can also be a part of the DBT system.

⁷ Mukherji, A, T Shah, and P S Banerjee (2012): "Kick-starting a Second Green Revolution in Bengal," Economic & Political Weekly, Vol 47, No 18, pp 27-30.

⁸ <https://www.dnaindia.com/india/report-bihar-for-direct-subsidy-transfer-to-power-consumers-2368614>

DBT of power subsidy, instead of subsidizing unit rates, will encourage efficient use of energy and water in agriculture. If farmers pay the full cost of electricity to the utilities, they will be able to demand quality service from them, and hopefully, the utilities will also treat them as legitimate customers.

At present, there are only a few electric pumps in Bihar. Most of them are not metered. This arrangement must change right away. All new and existing connections must be metered, to ensure accountability and transparency. Power utilities in India often use the flat-tariff for agriculture to overstate agricultural consumption of power and hide their own transmission and distribution losses. This way, a significant part of the subsidy allotted in the name of farmers, goes to cover losses elsewhere. The flat tariff system also incentivizes farmers to use scarce energy and groundwater wastefully as the amount of water they pump costs the same no matter how much they use.

There is one potential problem with the DBT of electricity subsidy to owners of electric pumps. **Only 4% of farmers in Bihar own pump-sets, while the other 96% rent them from the owners who are often larger and better-off farmers.** A lump sum transfer of power subsidy in cash to electric pump owners' accounts will be a regressive transfer because it will not benefit the water buyers. The lump sum subsidy will not have any effect on pump rental rates charged by water buyers. The DBT of power subsidy will at least be free from other problems like incentivizing wasteful use energy and water, delayed transfers of power subsidy to utilities and deliberate misreporting of power use in agriculture and transmission and distribution losses in the system.

As Bihar embarks on a massive expansion in grid connection of pump-sets—a targeted 20-fold increase in 4 years—the time for changing power tariff and supply regimes is now. Once farmers get used to the flat and subsidized tariff, the system will be entrenched and changing the status quo will be well-nigh impossible. Experience from other states shows that farmers resist any increase in power tariffs, and utilities also drag their feet in installing meters on pump connections.

The Government of Bihar should learn from the West Bengal model of charging a reasonable metered tariff from farmers, with the aim of promoting the development of groundwater resources for agriculture in a sustainable and equitable way, so that the current cost of irrigation is reduced while still working within sustainable extraction limits.

Foresight for Food Systems Status Reports

The Foresight for Food Systems in the Eastern Gangetic Plains (EGP) is a project led by IFPRI that seeks to lay down the groundwork for an open, scientifically informed and participatory foresight for food exercise in the EGP region led by regional scientists and engaging with other stakeholders like policy-makers, private investors, and farmers. A set of status reports on different components of the food system for better understanding of the current status, future challenges, research and knowledge gaps has been prepared for informed policy making for a sustainable future. The status reports will provide inputs into foresight and scenario building exercises in the region.

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SDIP initiatives aim to build technical capacity, share and generate knowledge, facilitate transboundary dialogue and mobilise the private sector and civil society in support of this objective. The focus area for SDIP initiatives is the three Himalayan river basins – the Indus, Ganges and Brahmaputra – which cover parts of India, Pakistan, Bhutan, Nepal and Bangladesh.

SDIP is a 12-year strategy (2012-2024), recognising that many of the critical interventions required for improving the integrated management of water, food and energy at the river basin level require sustained engagement to build regional cooperation and capacity over time. The Australian Centre for International Agricultural Research (ACIAR) is one of seven partners in SDIP. ACIAR SDIP funds research and development activities that improve agriculture's contribution to sustainable food systems. **For further information on the project please visit <https://aciarsdip.com/component-2>**