

**Private investments in groundwater have emerged as the main pathway through which smallholder farmers in India access irrigation. Revisions to policies governing groundwater and provision and pricing of electricity could propel smallholder farmers in West Bengal on a path to higher agricultural growth and improved livelihoods.**

### The Opportunity

West Bengal is well endowed with groundwater. The natural annual recharge is high (30.36 billion cubic meters) as is rainfall (1500-200 mm per year), yet its potential for development in many regions has not been reached. Only around 42% of the State's groundwater resources are being used because of policy restrictions and concerns over groundwater scarcity and quality.

Groundwater has played an important role historically in West Bengal's agricultural productivity. In the late 1980s and early 1990s, agricultural growth rates were 6% per annum, which was attributed to expansion in the area under *boro* rice cultivation and an increase in yield of all paddy crops due to assured groundwater irrigation from tubewells. Carefully crafted groundwater policy revisions could help the State return to these agricultural growth rates and support poverty alleviation.

### The Research

Findings are based on questionnaires with 896 respondents in 59 villages in 10 districts; interviews with district officials of the State Water Investigation Directorate (SWID) and West Bengal State Electricity Distribution Company Ltd. and district-level staff in charge of providing electricity connections and tubewell meters to farmers. Groundwater level data from 508 wells across all districts of West Bengal was also used. The data covers the period from 1990 to 2009 and rainfall data from 1990 to 2005.

### Main Findings

#### Groundwater Policies and Water Quantity

The 2005 Groundwater Act was designed to control the number of new wells and create an inventory of groundwater structures. Permits and registration applications were routinely rejected even in districts where groundwater development was only 20-25% or where groundwater was less than 30 feet.

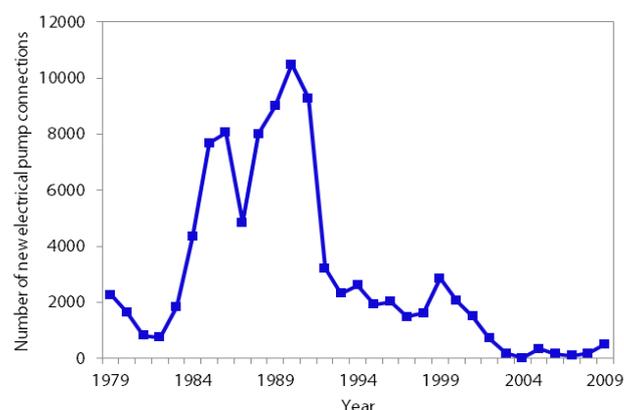
Data from the SWID, the organization responsible for implementing the Act, challenges the assumption of physical groundwater scarcity.

Groundwater development in the State is just 42%, and none of the districts use more groundwater than annual renewable recharge capacity.

## GROUNDWATER IRRIGATION IN WEST BENGAL

*Based on a report by Aditi Mukherji*

Mathematical modeling of the State's alluvial aquifers shows that for one meter of pre-monsoon drawdown, recovery goes up by 0.85 meters on average after the monsoon. This suggests that the drawdown of groundwater in the dry season creates storage space so that the subsequent monsoon rains can be captured for use in the next dry season rather than flowing out of the system unused. To compensate for any net depletion, this natural recovery process could be enhanced through complementary policies and in-situ rainwater harvesting.



**Figure 1. The decline of electric pump connections.**

#### Electricity Policies

Findings suggest that the difficulty in obtaining electricity connections for tubewells and the high cost of diesel to operate pumps are the factors constraining groundwater use; not physical scarcity of groundwater.

Since 2003, the West Bengal State Electricity Distribution Company Ltd. has virtually stopped sanctioning new electricity connections for agricultural tubewells as illustrated in Figure 1.

The electricity utility is also demanding the full-cost of connection. This can cost US\$ 1,000-4,000 and is outside the means of smallholder farmers.

These costs can be avoided by renting pumps — around 500,000 farmers own pumps but others can purchase water from pump owners. About 3.1 million households (50% of all farming households) report hiring irrigation services. However, these water markets are influenced by electricity tariffs and diesel prices.

Since 2007, the State Government has removed the flat electricity tariff and started metering electric tubewells. This has reduced the profit water sellers can earn so buyers get less access to groundwater. It has increased the demand for new electric connections because farmers want a secure water supply.

In response to inadequate water supplies resulting from difficulties in obtaining electricity connections and high diesel prices, West Bengal farmers have reduced cultivation of the lucrative dry-season *boro* paddy from 1.5-1.6 million ha to 1.2 million ha. Coupled with increased input costs and stagnant output prices, farmers' overall profit margins have decreased and agricultural productivity and living standards have fallen.



*Affordable electricity could dramatically improve the livelihoods of farmers in West Bengal and does not have to deplete the water table.*

### Water Quality

The threat of arsenic contamination of groundwater is often cited as a reason for restrictive groundwater policies in West Bengal. Evidence shows that groundwater containing arsenic is unlikely to affect the quality of irrigated grain, but does pose a threat to human health through drinking water supplies.

In the short-term, affordable technologies exist, such as low-cost filters, to eliminate arsenic from drinking water. In the longer term, research suggests that improved nutrition reduces the risk of arsenic absorption by humans.

### Where can groundwater be used?

Not all areas are suitable for groundwater use — coastal areas have saline water, some areas have high levels of metals and others have insufficient groundwater. The SWID has the data to identify appropriate places for groundwater development and should base decisions on this.

### Solutions

- **Ease the entry barriers to rural electrification**

Based on the research findings, the SWID has changed a provision of the 2005 Groundwater Act to release some smallholders from the requirement to obtain permits. The State Electricity Distribution Company has passed a policy resolution in which, instead of paying the full cost of wires, poles and transformers, farmers pay a fixed connection fee ranging from around US\$20 to US\$ 590.

- **Policies that encourage farmers to make efficient use of groundwater**

This includes strict and 'intelligent' rationing of power supply to farmers, charging a judicious mix of pro-rata and metered tariff and ensuring that public money is used for excavating tanks and ponds to provide additional recharge in the post-monsoon season.

- **Mitigate the problems of arsenic contaminated drinking water**

Efforts are needed to supply arsenic free drinking water along with targeted schemes to provide nutritional supplements. Monitoring will be required to ensure problems do not arise.

### Potential impact

Providing affordable electricity connections to half a million more electric pumps would allow for irrigation of an additional 3.7 million ha of farm land. If only 50% of this potential is reached the irrigated area would increase from 2.98 million ha to 4.83 million ha; 88% of the cultivated area. Assuming average *boro* paddy productivity of 2.5 tons/ha sold at US\$ 195 per ton, farmers would earn additional income of US\$ 900 million per year.

West Bengal has a high natural endowment of groundwater and rainfall but AWM strategies must be matched with the hydrogeological setting to safeguard the underlying resource base.

These findings and recommendations are preliminary and are reproduced here for the purposes of discussion. The AgWater Solutions Project welcomes all comments and suggestions. These should be directed to [AWMSolutions@cgiar.org](mailto:AWMSolutions@cgiar.org), please write "West Bengal" in the subject line.