

# Toward Enhanced Efficiency and Transparency of Power use in Irrigated Agriculture in India

## Expanding a Pilot Program in Gujarat



### In brief

- India faces a groundwater-electricity crisis, thought to be caused by misaligned incentives: groundwater pumping is unpriced and is powered by heavily subsidized flat rates.
- To create new incentives for efficient usage, a pilot project was launched in 2011. Farmers were invited to have their pumps metered, and to receive financial compensation per unit in voluntary reductions in power usage below existing baselines.
- Whilst the majority of farmers were willing to participate and did not tamper with the metering equipment, no evidence was found that the new incentive led to reductions in water and energy use or changes in agricultural practices.
- However, the pilot project compensation was much lower than the electricity cost for domestic and industrial consumers and not sufficiently higher than prevailing rates in local informal water markets. This mixed success prompted the local power authority to consider an expansion of the pilot to areas where conditions may be more amenable for farmers to respond to the incentive.
- Policy Implications:
  - The pilot site suffers from extreme circumstances, making farmers' response difficult.
  - In most locations surveyed, the marginal value of electricity for pumping seems to be lower than the rate non-agricultural consumers pay
  - Expanding the pilot to broader areas while setting the compensation rate accurately can give the reform a 'fair chance' to demonstrate its potential.
- The rate of compensation be increased, any caps on compensation should be removed and the government makes a strong and long-term commitment to the program.

## Policy Motivation

*“The pilot successfully proved the feasibility of voluntary metering and meter-based billing of existing consumers”*

A novel, market-based mechanism to stimulate the metering and efficient allocation of agricultural power consumption was piloted in Gujarat in 2011 (for details, see Further Readings below). The pilot successfully proved the feasibility of voluntary metering and meter-based billing of existing consumers. However, substantial shifts in farmers’ power usage were not observed, plausibly due to an overly conservative implementation and circumstances that are highly specific to the pilot site. In this study, we assessed the potential of broader regions in North Gujarat to exhibit a more substantial response if the pilot is expanded to them.

## Policy Impact

We found that the circumstances in broader areas are likely to be more favourable to demonstrate the program’s potential impact. The first year’s pilot proved the program’s feasibility, and if an expansion to additional areas is properly designed to reflect the real value of power, prevailing agricultural circumstances can give farmers more flexibility to respond to the scheme than in the original pilot site.

## Audience

The Government of Gujarat (GoG) and the Northern Gujarat Power Utility (UGVCL), the original implementers of the pilot, as well as other state governments and power utilities facing similar challenges around India.

## Background

*“Attempts to restore the actual cost of the electricity or even to introduce metering have all but failed on political grounds”*

India is facing an acute groundwater-electricity crisis that is often blamed on misaligned incentives: groundwater pumping is un-priced, and is powered by electricity that is provided at highly subsidized, flat rates by state governments. Attempts to restore the actual cost of the electricity or even to introduce metering have all but failed on political grounds, leaving policy makers with few tools with which to address the crisis.

Against this background, a novel reform was piloted by the Columbia Water Centre (CWC), of which the PI was then a member, the Government of Gujarat (GoG), and the Northern Gujarat Power Utility (UGVCL), starting in April 2011. To participate, Farmers were invited to have their pumps be metered, and to receive financial compensation per unit of voluntary reductions in their power usage below existing baselines, creating new incentives for efficient usage.

The pilot proved, contrary to prevailing priors, that a majority of farmers were willing to participate; meters were not tampered with; and the utility was able to effectively issue electricity bills based on meter readings. At the same time, no evidence was found that the new incentive led to reductions in energy or water use or substantial changes in agricultural practices. However, field research identified

several possible causes that were highly specific to the pilot site. In particular, the low level of compensation that was offered per unit of electricity, set at 2.5 Rs. per unit, was much lower than electricity cost for domestic and industrial consumers (4-5 Rs. per unit), and not sufficiently higher than prevailing rates in local informal water markets (1.5-2 Rs. Per unit on average).

*“Substantial shifts in farmers’ power usage were not observed, plausibly due to an overly conservative implementation and circumstances that are highly specific to the pilot site”*

The mixed “success” of the pilot has prompted UGVCL to consider an expansion of the pilot to additional areas where conditions may be more amenable for farmers to respond to the incentive. The surveys we conducted under this grant were originally intended to map candidate areas for this expansion as well as to assess the potential and suitability of the scheme in other areas in UGVCL’s command.

## **Policy Implications**

### **The original pilot site suffers from extreme circumstances that make farmers’ response difficult**

Extreme levels of water scarcity in the pilot site meant that incentives for efficiency were already strong, despite the lack of marginal power pricing. Also, the high cost of deep wells led farmers to co-operatively own wells and practice rigid irrigation scheduling that made it difficult for individual farmers to respond to the incentive. In surrounding areas where water tables were higher, the number of share-holders tended to be lower and irrigation coverage was higher (figure 1), suggesting that farmers may be more motivated and more free to respond to the incentive.

### **In most locations we surveyed, the marginal value of electricity for pumping seems to be lower than the rate non-agricultural consumers pay**

In almost all areas we surveyed, the effective price of a unit of electricity in informal water markets falls short of the 4-5 Rs. rate paid by domestic and industrial consumers (figure 1), even if it is sometime higher than in the original pilot site. This suggests a substantial scope for response by farmers if the rate of compensation is chosen to reflect the real opportunity cost of power.

### **Expanding the pilot to these broader areas while setting the rate of compensation accurately can give the reform a ‘fair chance’ to demonstrate its potential.**

We suggest expanding the pilot to additional areas surrounding the original site, while increasing the rate of compensation to the electricity price offered to non-agricultural consumers (4-5 Rs. range), at least during peak hours (‘time of day’ pricing). The pilot has shown that the scheme can be effectively implemented by UGVCL and is attractive to farmers, and an expansion of this kind will give it a “fair chance” of triggering farmers’ response and improving efficiency in the agricultural energy sector.

## Implementation

*“We also suggest... enabling farmers to trade their electricity entitlements amongst themselves and with non-agricultural consumers”*

The implementation of the program in new areas can be based on the successful implementation in the original pilot site, but we suggest that: The rate of compensation is increased; Caps on compensation be removed and the government makes a strong and long-term commitment to the program to boost farmers’ confidence.

We also suggest attempting the natural ‘next steps’ towards efficiency in the agricultural energy sector that include:

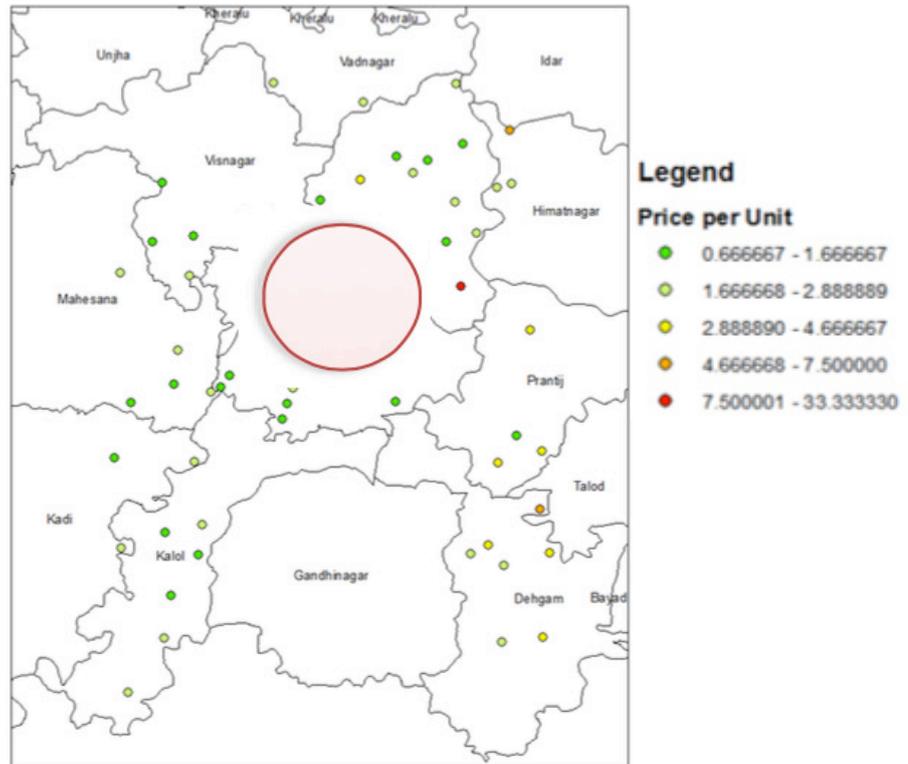
1. Enabling farmers to trade their electricity entitlements amongst themselves and with non-agricultural consumers.
2. Moving to full marginal pricing of agricultural consumers while providing them a direct transfer that reflects the current value of the power supplied to them.

## Further Readings

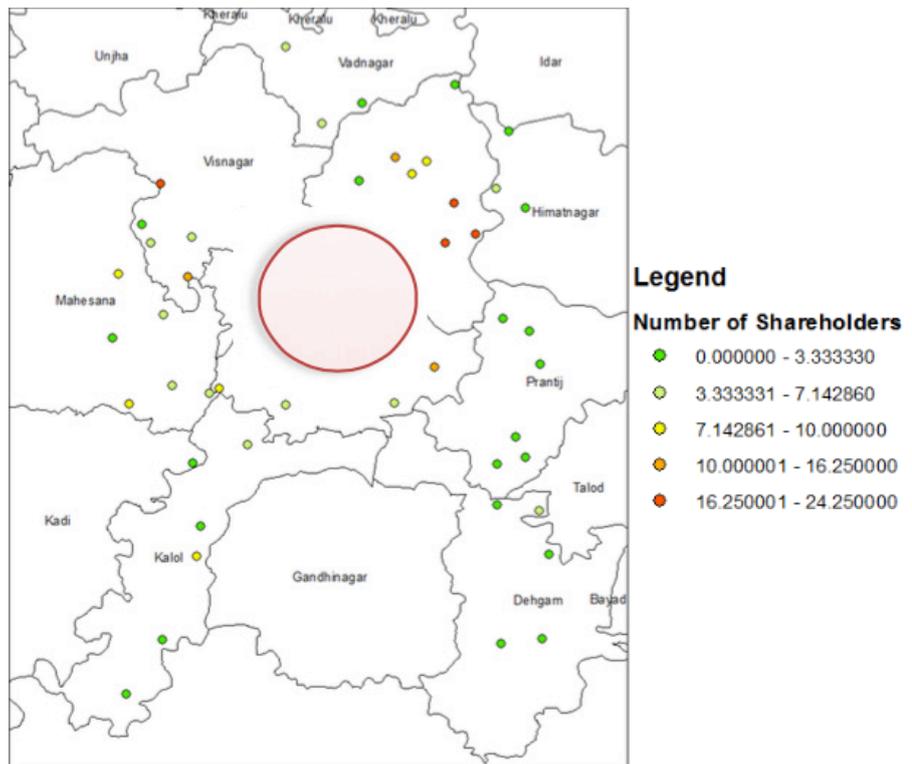
Towards Greater Accountability and Efficiency in Groundwater and Energy Use in Indian Agriculture Initial Report from a Field Pilot in Gujarat, India. Columbia Water Center Policy Brief.

Figure 1: Plots of the survey areas

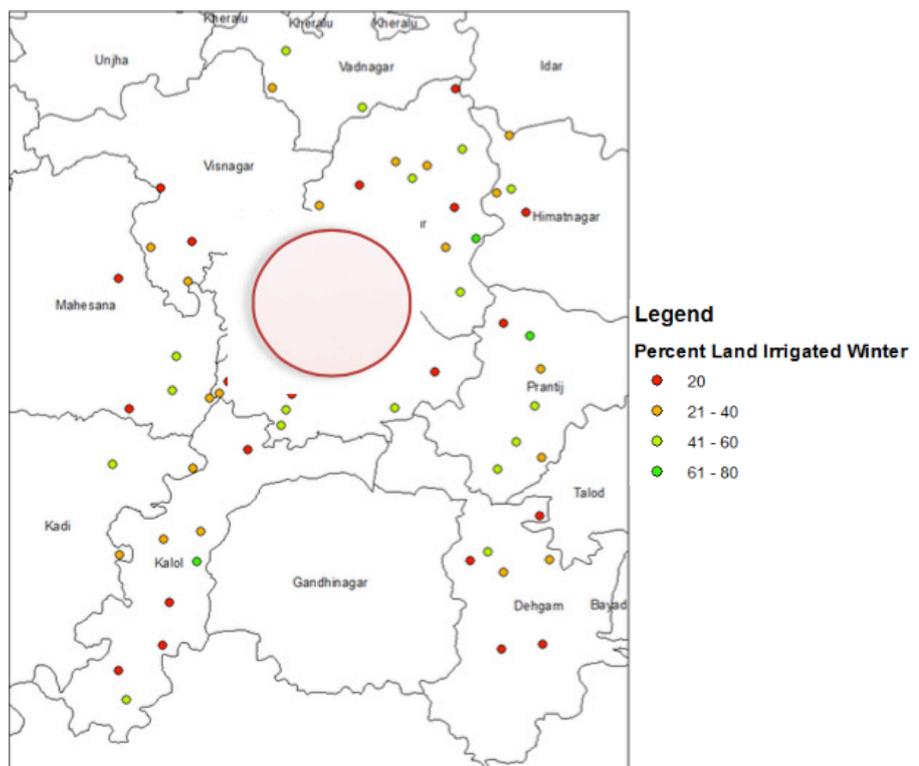
The approximate local on of the original pilot site is indicated by the oval. The plots show that outside the original pilot site, numbers of well co-owners tends to be lower, while the marginal value of electricity for agriculture is almost everywhere below 4.5Rs. Per unit, and in many locations larger fractions of land are irrigate



The above plot of the survey areas displays the price of a unit of electricity in informal local water markets.



The above plot of the survey areas displays the common number of farmers co-owning a well.



The above plot of the survey areas displays the fraction of irrigated area in the winter season

## **About the authors**

*Ram Fishman* is an Assistant Professor of Economics at George Washington University. His interests are in the social and agricultural dimensions of groundwater use and depletion in India, as well as in understanding the role of social discounting of the future in environmental policy. He is involved in the design and field piloting of a novel market based policy instrument for energy and groundwater conservation in India.

The International Growth Centre  
(IGC) aims to promote sustainable  
growth in developing countries  
by providing demand-led policy  
advice based on frontier research.

---

Find out more about  
our work on our website  
[www.theigc.org](http://www.theigc.org)

For media or communications  
enquiries, please contact  
[mail@theigc.org](mailto:mail@theigc.org)

Follow us on Twitter  
[@the\\_igc](https://twitter.com/the_igc)

International Growth Centre,  
London School of Economic  
and Political Science,  
Houghton Street,  
London WC2A 2AE



International  
Growth Centre

Designed by [soapbox.co.uk](http://soapbox.co.uk)