

The Water-Energy Nexus: a Case Study of Reform

Community-Government Collaboration in Gujarat



Performance with Purpose
The Promise of PepsiCo



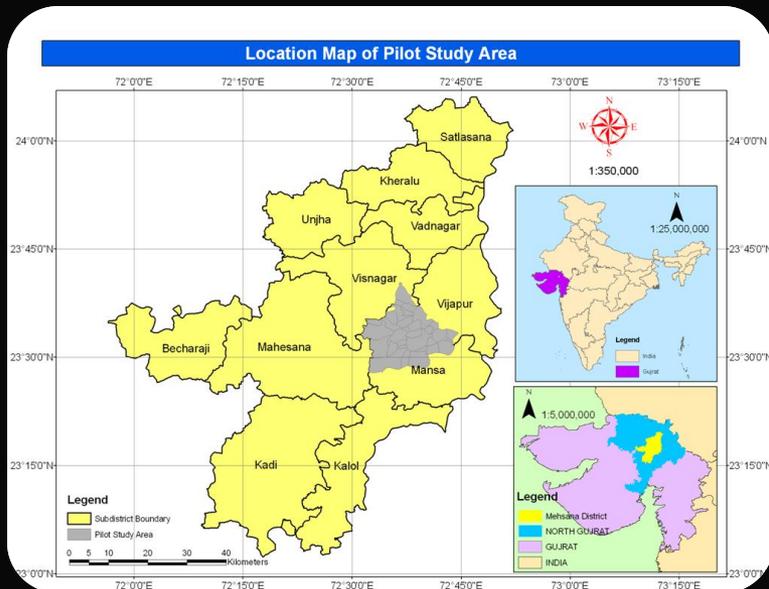
Columbia Water Center
EARTH INSTITUTE | COLUMBIA UNIVERSITY

Dan Bena
Senior Director
Sustainable Development
PepsiCo, Inc.
dan.bena@pepsico.com

Video

Context:

Rising insecurity in the water-energy-agriculture-livelihood nexus



Social

Agriculture is the mainstay of economy; land fragmented, small & marginal farmers

Climate

Semi arid, low rainfall & high variability

Resource

Groundwater depleting; salinity increasing

→deepening wells

→higher energy usage

Economic

Cost of drilling & maintaining wells increasing for farmers

→State's energy subsidy bill rising

Institutional

Groundwater markets, shareholding system prevalent

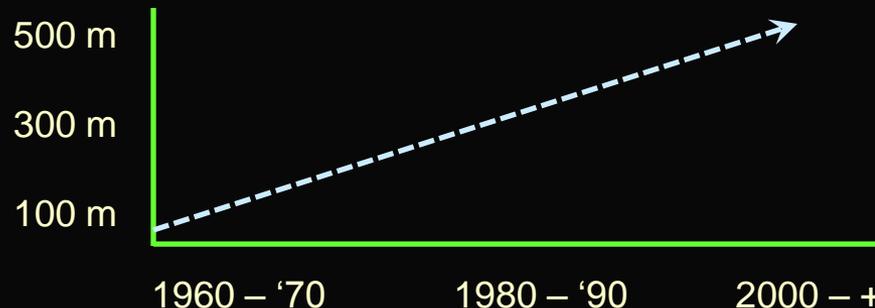
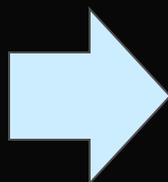
A “typical” farmer

	Rs / Ha / Year	Euro / Ha / Year	\$ US / Ha / Year
Gross Income	42,000-50,000	600-725	845-1,000
Net Income	15,000-20,000	220-290	300-400
Energy Subsidy	~30,000	435	600
Investment in Wells	5,000-15,000	70-220	100-300

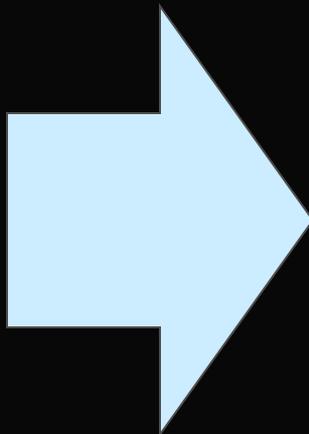
Water Use / Recharge:
Energy Use (KWH/Ha):

600 mm / 300 mm
10,000 (India Average: 1600)

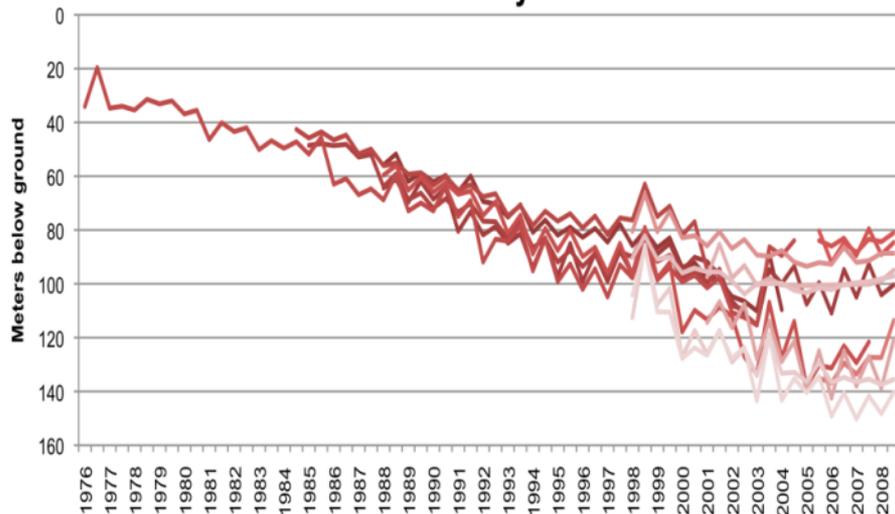
Depth of Wells:



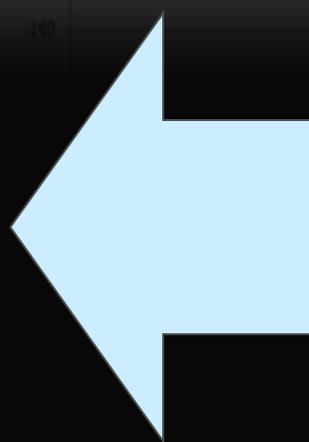
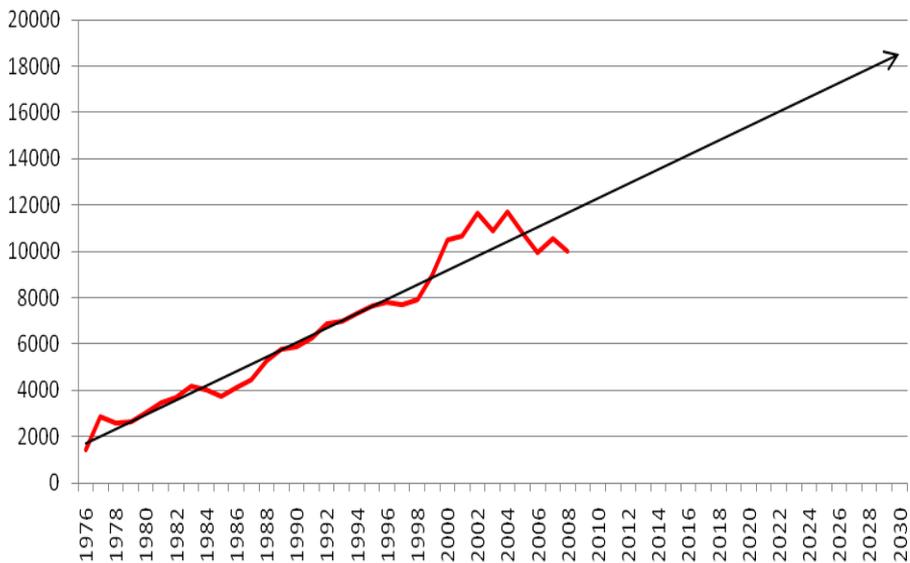
As water tables decline



Depth to Water observed by 15 Monitoring Wells in the Study Area



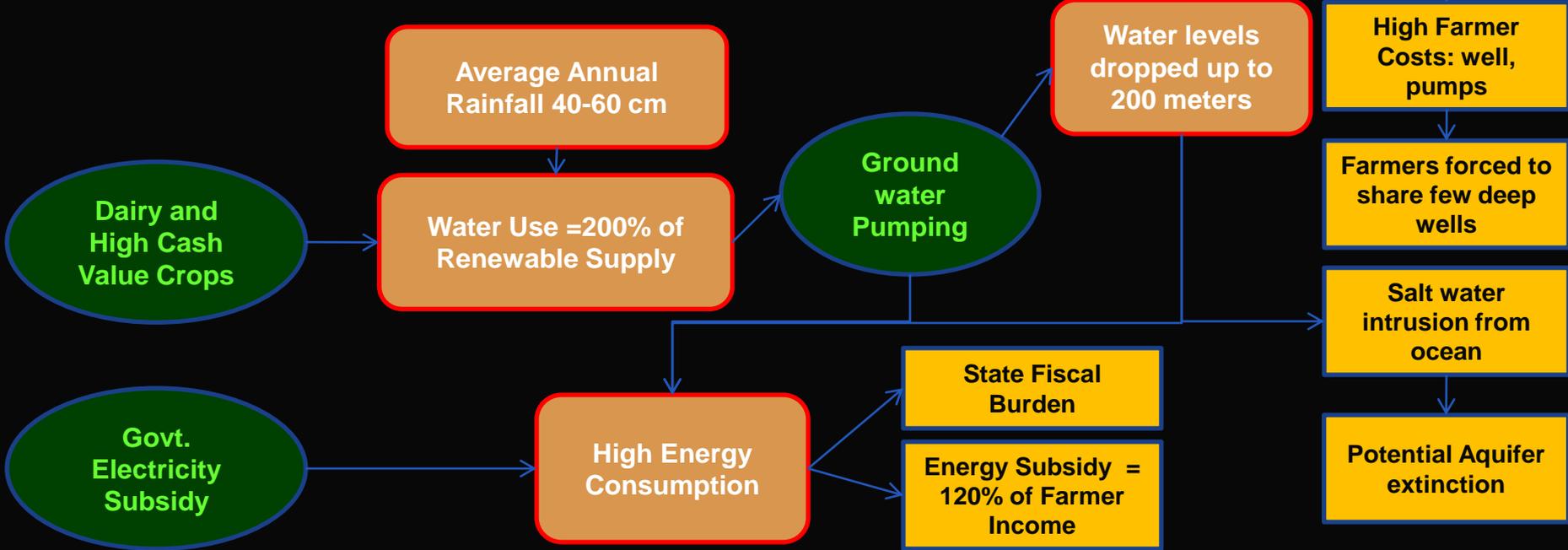
energy required to lift 600mm/Ha (kwh/Ha)



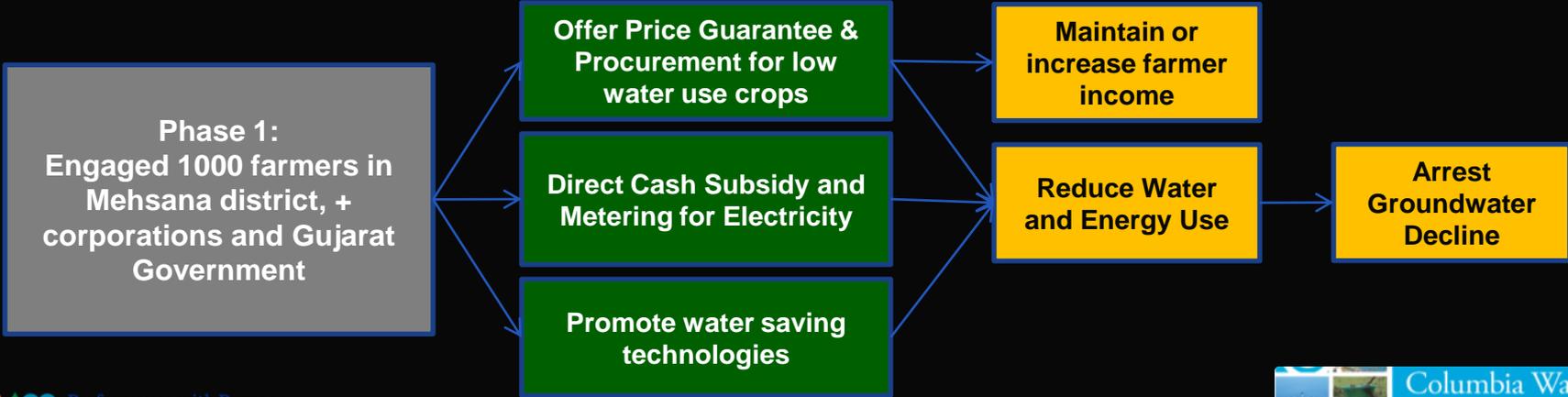
More energy is required

How could one design a model to address the challenges?

Gujarat: Economic Development but Vanishing Groundwater



Solutions: PepsiCo Foundation-Columbia Water Center-Gujarat Government



Design criteria

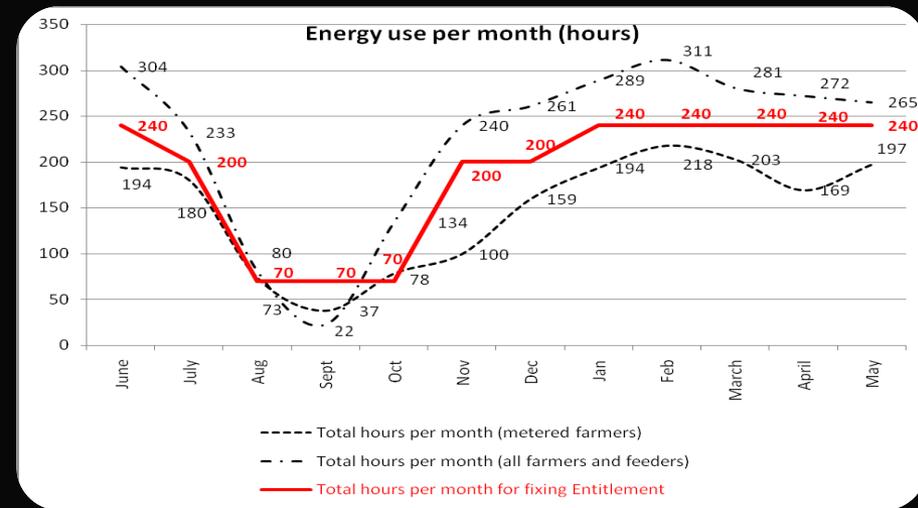
Groundwater-energy-saving mechanism

- Integrated hydrologic and groundwater modeling
- Extensive farmer surveys
- Strategies for water-energy conservation
- Benefit-cost analysis to arrive at monetized value of groundwater-energy saving strategies
- Stakeholder discussions at various levels
- Water-energy savings reform strategy based on revenue neutral model

How does it work?

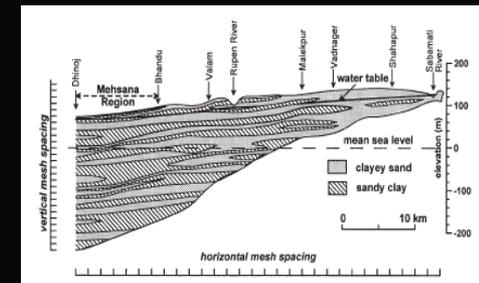
- Establish month-specific baseline using historical data
- Farmers agree to install meter on premises
- Compensation Rate:
 - Recommendation: 5 Rs/unit
 - Gov't actual: 2.55 Rs/unit
- Means of compensation:
 - Tradable voucher
 - Gov't did credit against existing utility flat tariff bills
 - Capped at 15% of baseline
- Frequency: monthly
- Commitment horizon:
 - Recommendation: 5 years
 - Gov't actual: 3 years

- Monthly use varies due to rain
- 800 Farmers participating
- 27% of farmers saved in 1st cycle
- 90% saved in the 2nd cycle



Government support

- A three-year MoU (starting April 2011) extending cooperation to the Center signed with Government of Gujarat
 - Senior endorsement
 - Principal Secretary of Energy
 - Chief Minister
- Financial support from the State Government for costs of the incentive mechanism (receipts accrue to the farmers)
 - USD 250,000
- A working advisory group formed
 - Chaired by the Principal Secretary of Energy



Represents a major step of attempting to restructure the sensitive socio-political energy subsidy regime towards incentives, introduced in the country

Field implementation



Tensiometer installation

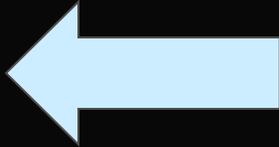


GIS mapping

- Farmer level implementation of crop-specific water-energy saving strategies
- Robust agricultural extension services
 - Raise awareness and build capacity
- Farm level GIS mapping
 - Land holding size, cropping pattern, area
- Crop diversification
 - Less water intensive-high remunerative crops
 - Partnership with FieldFresh (Bharti-Delmonte group)
- Electricity bill redesigned to capture water savings
- Energy meters installed for each borewell to measure savings
 - Load rectification completed (electricity company)

Overwhelming response from the farmers (over 85% consents received)
Increasing acceptability for low-cost technologies visible

Tensiometer: soil moisture



High-cost version with a pressure gauge

- Rs 6000 – 10000 each

Low-cost version

- Customized to specific crop
- No pressure gauge
- Rs 300 – 400 each



Successfully applied in rice and wheat

- Saves 22 percent irrigation water (rice)
- Saves 15-18 percent irrigation water (wheat)
- Currently testing for cotton

Scale-up

Rice



- Last season: in Punjab → 500
- This season: in Punjab → 5,000
- Next season target: in Punjab → 50,000

Wheat



- This season: in Gujarat → 200

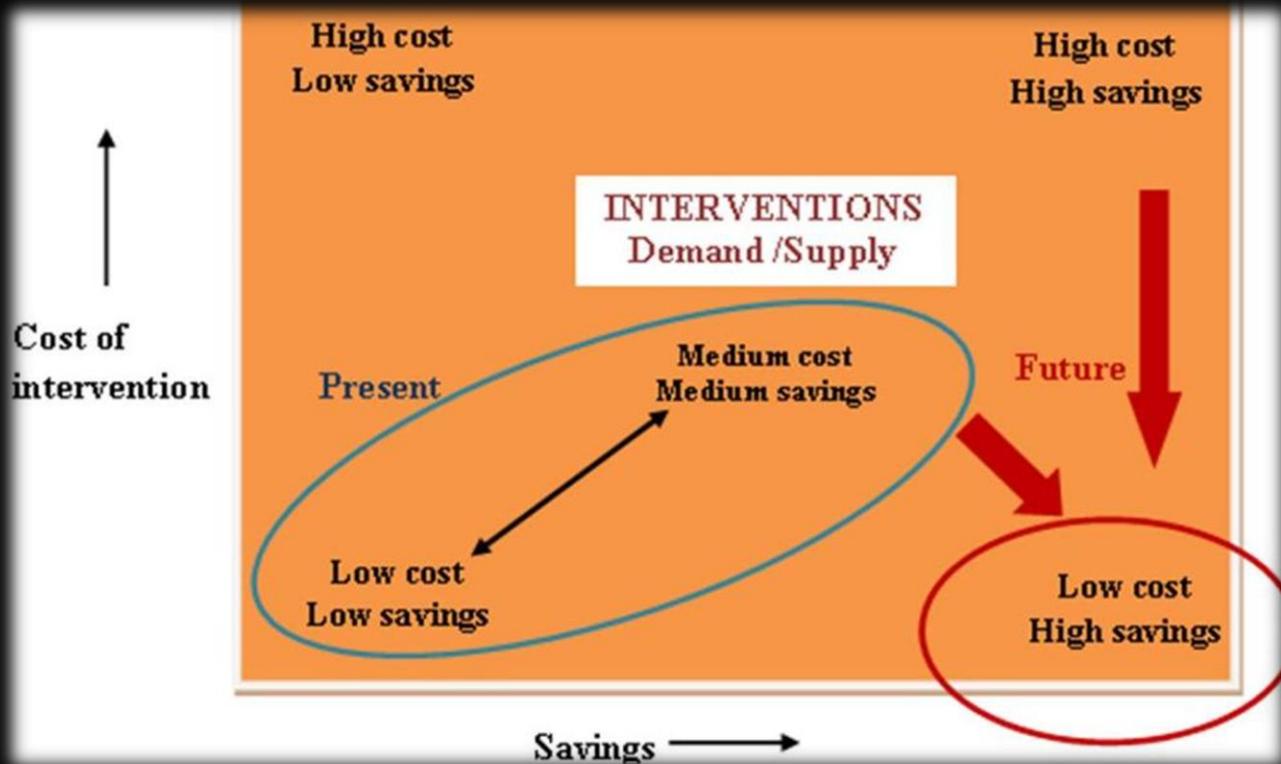
Cotton



- Experiments on cotton on-going

Energy Pricing Reform: Year 1

- Creating the *enabling environment* to facilitate appropriate choices
 - Farmers are willingly adopting low cost water saving interventions that includes reductions in the hours of groundwater pumping, tensiometers, and changes in furrow geometry



Results

ENERGY: 680,000 KWH saved

\$\$\$: 1,735,000 Rs

WATER: 20 million liters (est) saved

» rainfall months not included; only April-June included here)

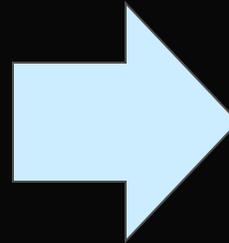
- Government and farmers are showing interest in expanding the scheme and scale-up

“...a small area in Gujarat (where the reform experiment is happening) has suddenly seemed to become a center-piece of energy and water reform discussions at the highest levels of bureaucracy”

--Managing Director, UGVCL, GoG

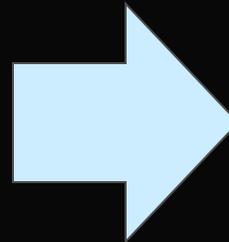
Three things needed for reform

1. Reform is based on three pillars- awareness, technology and incentives



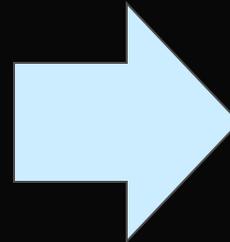
- Agricultural extension system of the Government needs to be current on state-of-the-art
- Incentive driven adoption of conservation strategies

2. Effective communication and leadership across traditional organizational boundaries



- Common vision
- Better integration of expertise and capabilities

3. Choosing the right area specific indicator that best addresses *Water-Energy-Agro-Farmer livelihood nexus*



- More income per drop per unit of energy per unit area irrigated