

Understanding the Electricity, Water and Agriculture Linkages

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Background -1

- Farmers unrest, loan waivers have brought focus on economics of farming, mostly around MSP
- Need to also look at inputs side
- One important input is electricity
- Most discussion around electricity supply to agriculture relates to:
 - Subsidy burden on State and paying consumers
 - Financial distress of DISCOMs
 - Over-exploitation of groundwater



Background -2

- Total accumulated losses of DISCOMs in March 2015 were Rs 3.8 lakh crores —3.3% of the country's Gross Domestic Product (GDP) for that year (MOSPI, 2017).
- Agricultural supply singled out as the main cause
- A major push of power sector reforms
 - Elimination of subsidies
 - Increasing tariffs for agricultural consumers
 - Universal metering

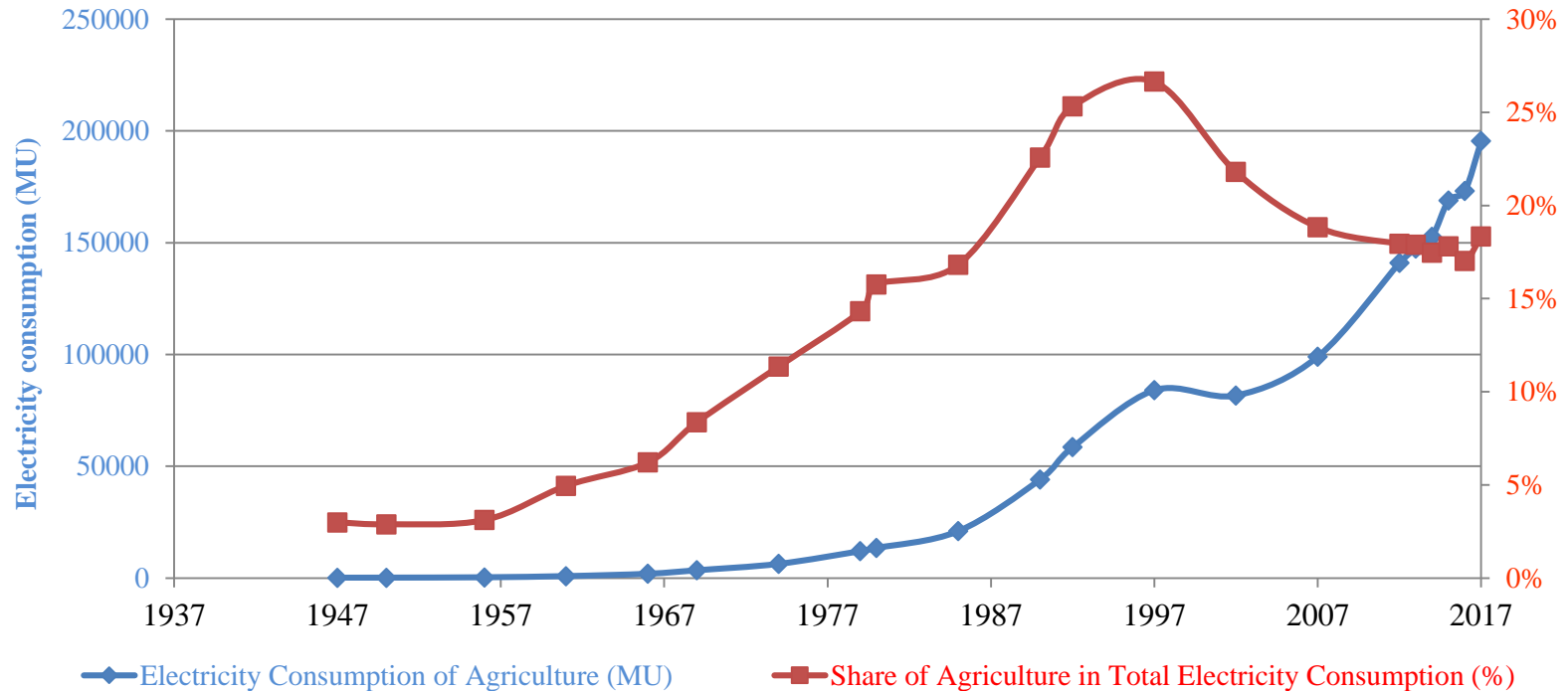


Background - 3

- Three financial bail-out packages for DISCOMs between 2001 and 2015
- Some efforts to address agriculture supply issues
- Yet, farmer, DISCOM and government unhappy with the situation
- Why? Discussion and solutions have ignored:
 - Crucial role of agriculture in the country
 - Strong linkages between electricity, water and agriculture sectors



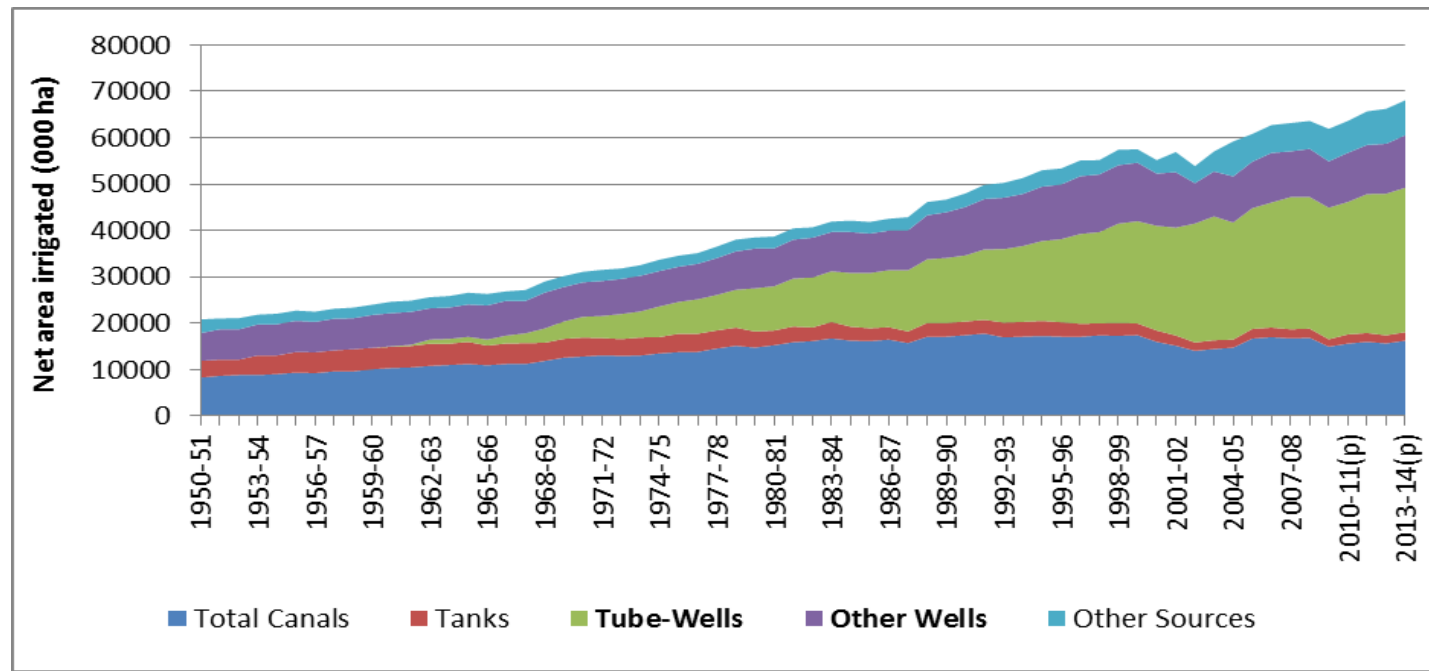
Linkages: Rising Electricity Use in Agriculture



- 50 times growth in the electricity use in agriculture from 3,465 MU in 1969 (8% of total) to 173,185 MU in 2016 (17%)
- Virtually all electricity in agriculture used for pumping, mainly groundwater
- 85% of pumping energy from electricity



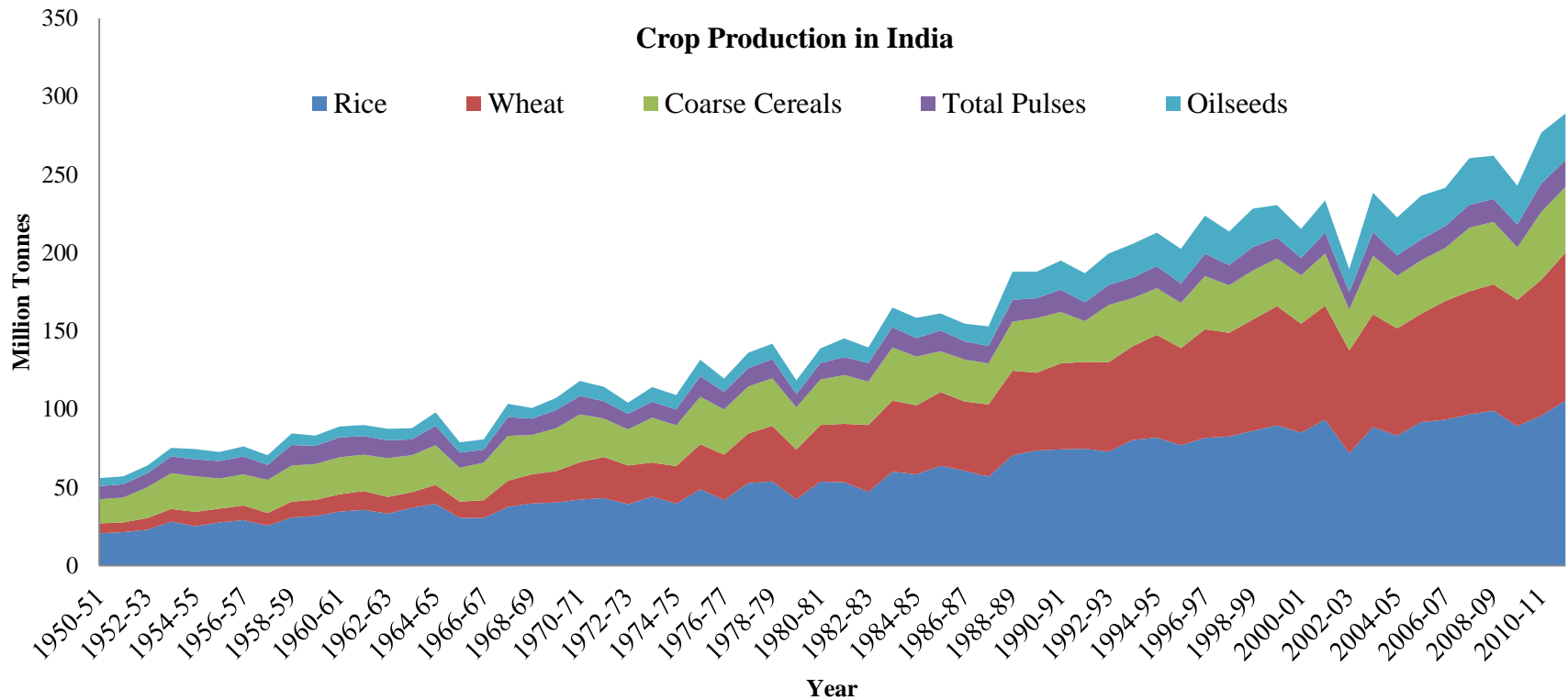
Linkages: Growth in Groundwater Irrigation



- Groundwater irrigation dominates, accounts for ~66% Net Irrigated Area
- Net area irrigated by groundwater increased seven times from 1950-51 to 2013-14, from 5.98 m ha to 42.44 m ha
- In the same period, canal irrigated increased only two times, from 8.29 m ha to 16.28 m ha
- Trend likely to continue due to advantages of groundwater irrigation



Linkages: Growth in Food Production



- High growth in food grain production since 1950, mainly in cereals
- Paddy and wheat account for 75% of total food grain production
- About 70% paddy and wheat production is from irrigated areas

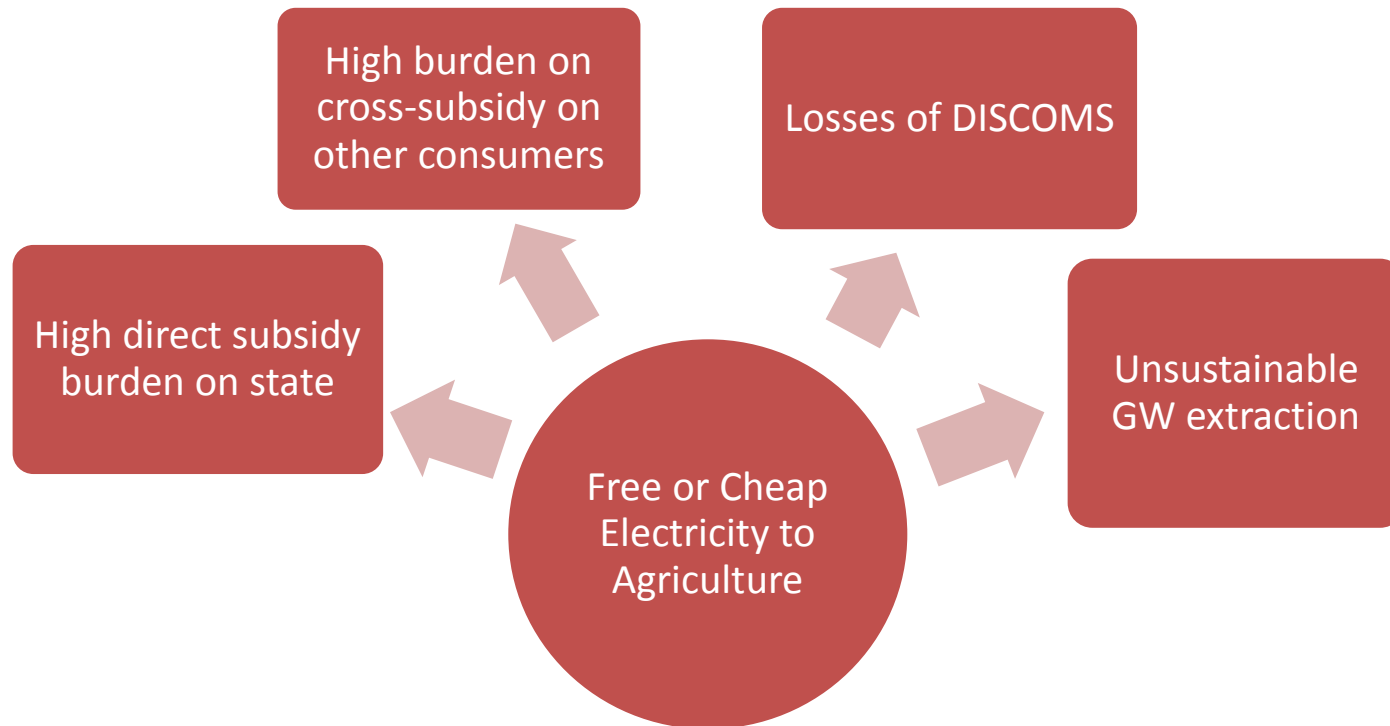


Features of Electricity Supply to Agriculture

- Flat tariffs, mostly (~ 75%) unmetered
- Highly subsidized tariffs or free power
- 7-10 hours of supply
- Poor quality of supply



Agriculture supply: Mainstream Understanding



Solutions proposed:

- Rationalise subsidy – increase tariff (attempted)
- Limit hours of supply to agriculture (done)
- Limit number of connections (done)

Focus only on DISCOM finances - misses key aspects, ignores linkages



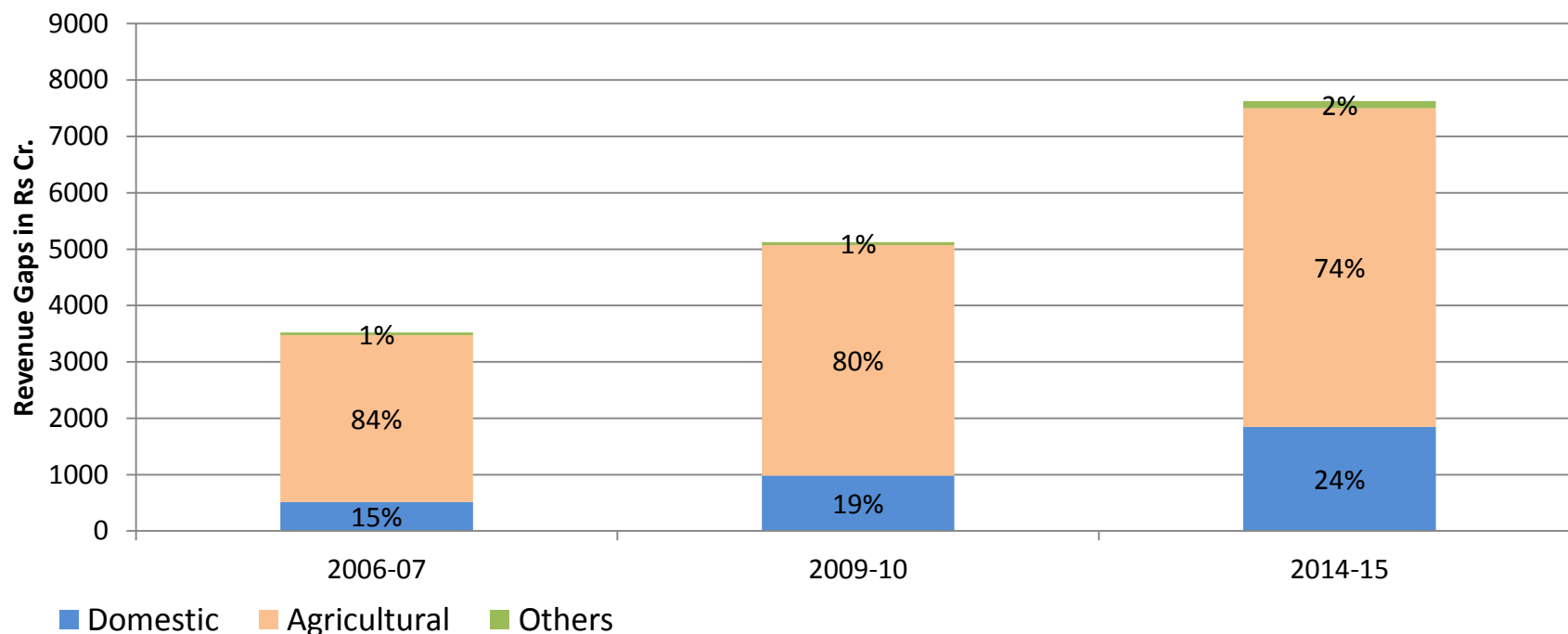
Subsidy: Agricultural Subsidy is Overestimated

- Doubts on the Number, Connected load and Hours of operation of pumps
- Several re-statements of agricultural sales and distribution losses – e.g. thrice in Maharashtra so far, and twice in Punjab
- Agricultural sales re-stated in Maharashtra (10%), TN (16%), Punjab (5%) and Haryana (39%) in recent times
- Credibility of distribution/AT&C loss in question



Subsidy: To Other Categories Increasing

Revenue Gaps of Subsidised Consumer Categories in PSPCL (Punjab)

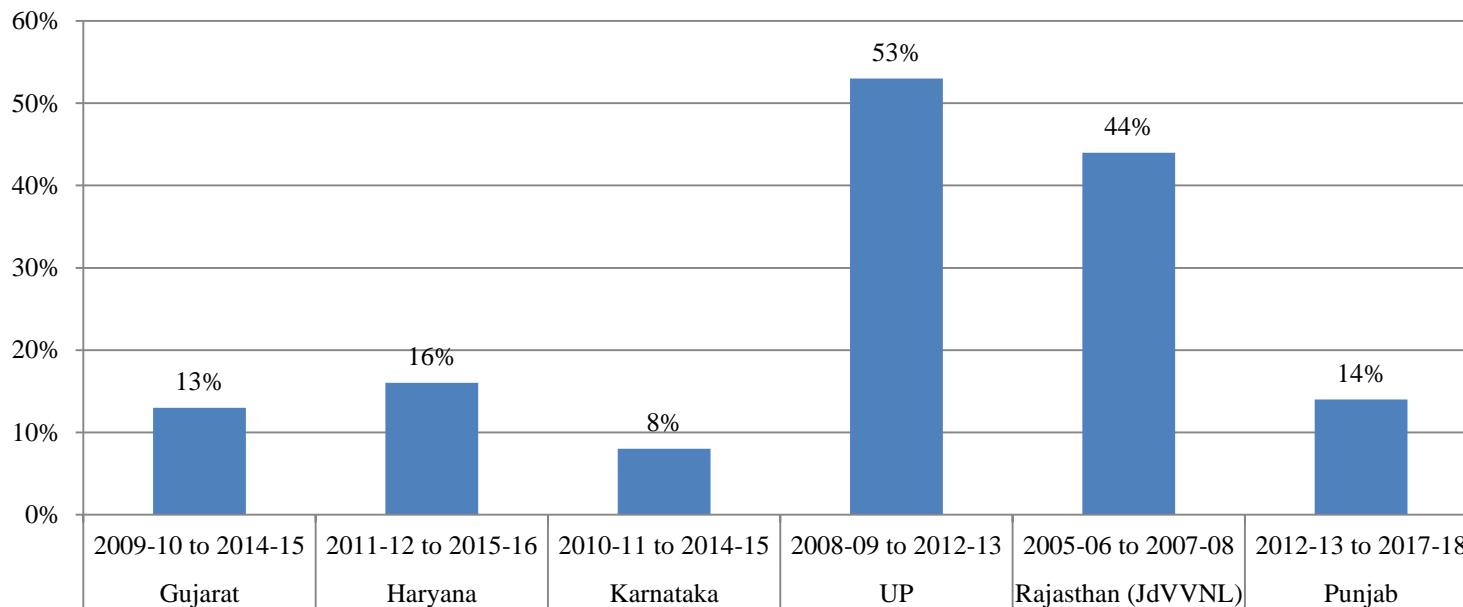


- Agriculture is the dominant subsidized category, but share of other categories increasing
- Small domestic dominate, but industry also being subsidized in some states



State government subsidy shortfalls

Cumulative subsidy shortfall as % of total government subsidy required by DISCOMs



- State subsidy is about 75% of the total subsidy
- Outstanding subsidy or inadequate subsidy allocation by state government
- Not all financial losses can be attributed to agriculture
- Other reasons for financial problems of the DISCOMs include poor power procurement planning, inefficiencies in operations and loss of cross-subsiding consumers



Rationing of Electricity supply and Connections has Limited Impacts

- Decline in daily hours of supply to agriculture in many states due to rationing
 - by 1-5 hours on average between the period of (2005-10) and (2011-17)
- But significant increase in consumption and connected load in Maharashtra, Rajasthan, Punjab, U.P and Karnataka.
 - Decline in groundwater levels a factor, but not the only factor.
 - Example of Maharashtra in Table
 - hours of supply reduced from 16 hrs to 8 hrs from 2005 to 2013
- Irrigation need of crop is crucial driver for electricity consumption

Percentage Increase in select parameters over 2003-04 to 2012-13

State	Electricity			Ground water
	Connected Load (MW)	Consumption (MU)	Average Pumpset Size (kW)	Draft for Irrigation (BCM)
Maharashtra	102%	90%	28%	12%



Challenges in supply and service quality

- Evidence of poor quality from literature and interaction with farmers
 - Limited hours of supply, based on DISCOM convenience
 - Night-time supply, Frequent interruptions, Voltage fluctuations, Shock accidents, Long time to repair
- Higher tariff suggested as a solution, but it may not result in growth in revenue
- Trust deficit between DISCOM and farmers
- Irregular and faulty meter readings

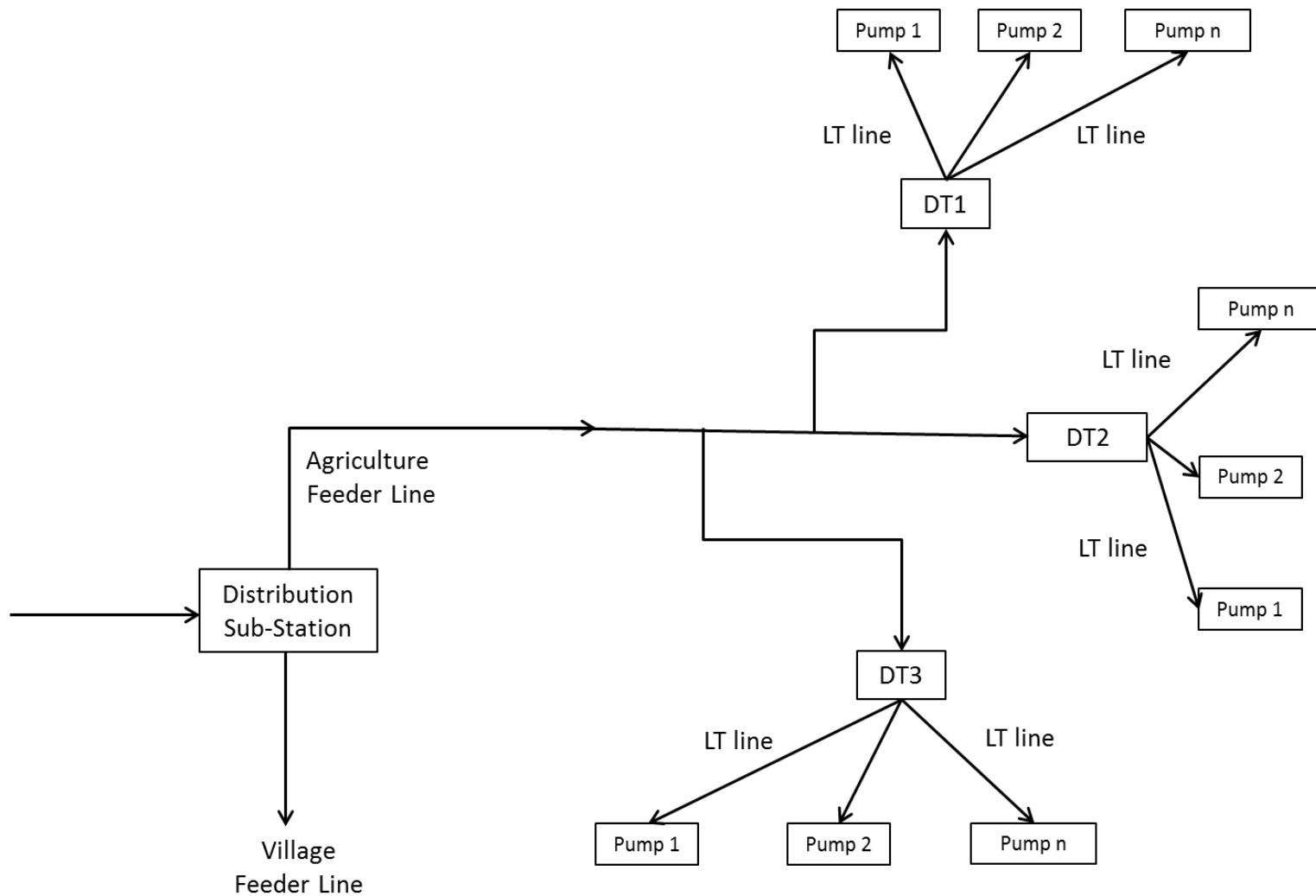


Is universal pump metering a solution?

- Challenges of pump metering
 - Coverage – overall 27%, in many states 0%
 - Many attempts for universal metering, but no progress
 - Farmer opposition is common narrative, but evidence of DISCOM reluctance as well
 - Doubts on the quality and use of meter data
- Evidence from West Bengal- metering led to shrinking of water markets, affected water buyers
- Feeder and DT metering important for energy accounting and consumption estimation
 - Low coverage and quality of DT metering
 - Limited use of feeder metering for consumption estimation
 - Feeder separation helps to limit hours of supply and improve quality of supply, but may adversely affect water markets
 - Metering can be tried in some areas



Schematic diagram of agricultural supply

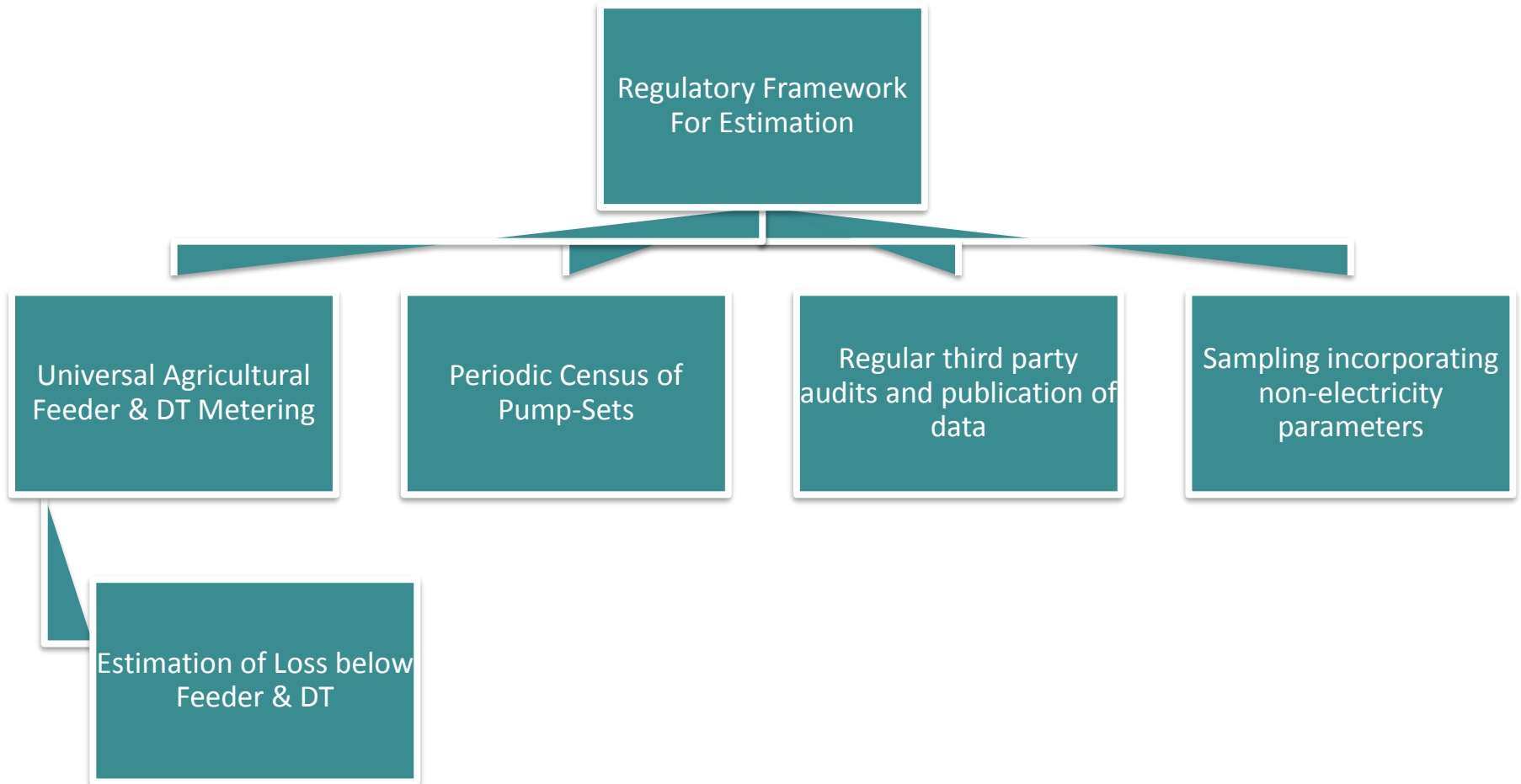


Electricity supply – suggestions

- Better estimation of agriculture consumption & hence subsidy
- DISCOM to take first step to improve quality
- Pilots to assess ideas



Better estimation of agriculture consumption



Pilots to assess ideas

- DT and Feeder metering with census of pumps
- Distribution transformers associations on lines of Water Users Association
- Solar Agriculture feeder
 - 11 kV feeder level grid connected solar plants
 - Day time good quality power supply for farmers
 - Not subsidy based
- Agriculture electricity supply not just a DISCOM challenge – also needs water, agriculture and social perspective



Agriculture, Water, Electricity

- Subsidised electricity, through groundwater irrigation has significantly facilitated agricultural growth
- Growth and dominance of groundwater irrigation due to its inherent advantage of offering control in hands of farmer, higher yields, problems of high cost and reach of canal irrigation
- Groundwater irrigation will remain crucial to agricultural growth, livelihoods and food security

Subsidised
electricity to
agriculture

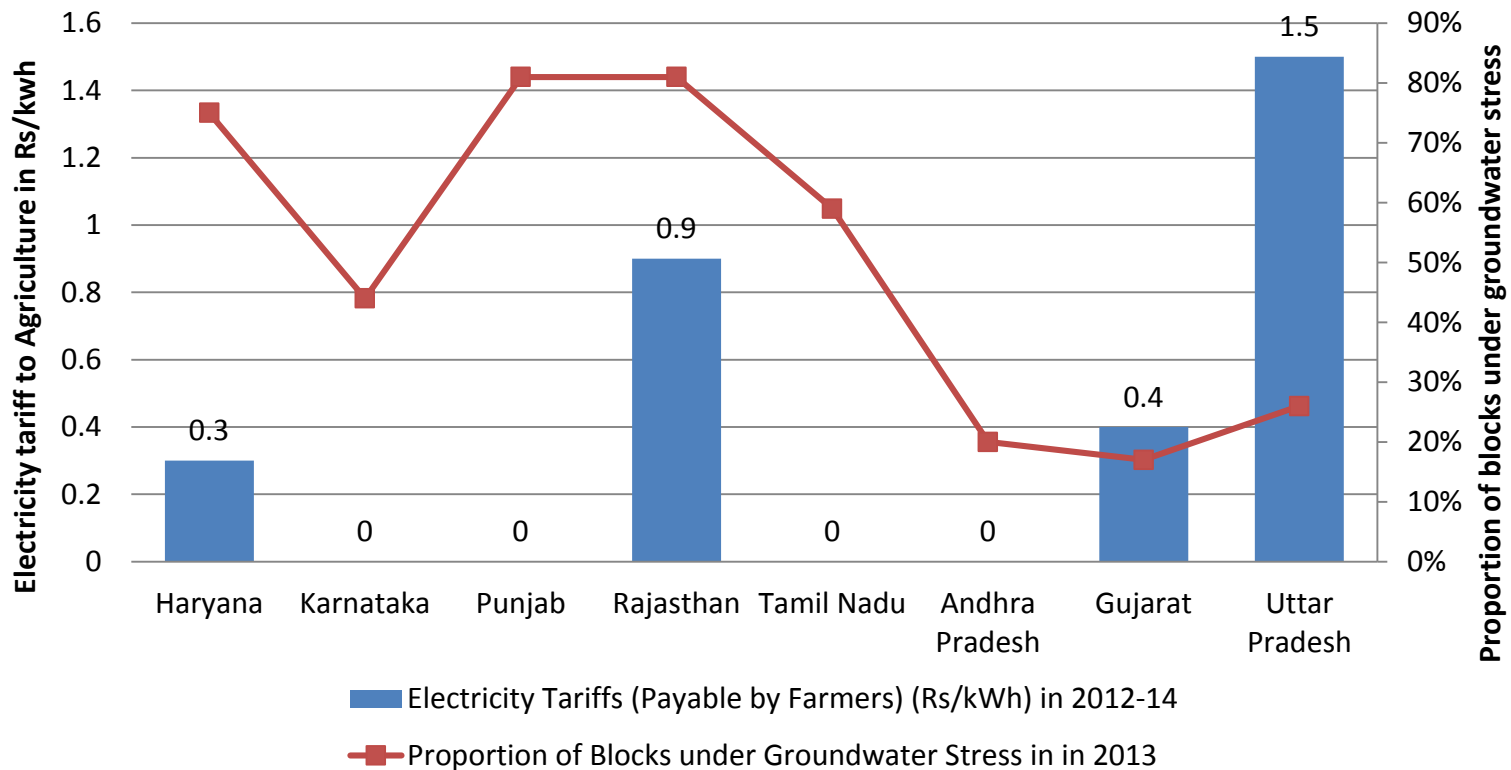
Massive
increase in
groundwater
irrigation

High growth in
food grain
production and
productivity



Groundwater Over-extraction: Subsidised Electricity Enabler, Not Driver

Direct correlation between low electricity tariffs and over extraction of groundwater not uniformly applicable across states



Groundwater Over-extraction: Subsidised Electricity Enabler, Not Driver

- For individual farmer, low priced or free electricity offers an incentive for unchecked lifting of groundwater
- But at broader level, extraction is dependent on many factors
 - Quality of power and hours of supply
 - Hydrogeology of the region
 - Groundwater conservation efforts
 - Farmers' awareness
 - Cropping patterns



Cropping Pattern - Major Driver

- Cropping pattern determines water requirement and hence irrigation withdrawals
- Cropping pattern is determined by price and market support, especially MSP and Procurement
- Support to water intensive crops not suitable to agro-climatic characteristics lead to excessive water withdrawals
- Extensive use of diesel powered wells in Punjab an example of pumping driven by cropping pattern and not cheap electricity



Impacts of Raising Tariffs

- Raising tariffs would have limited impacts on groundwater withdrawals
- Raising tariffs will significantly impact farmers' incomes
- Depending on crops and state, increase of Rs. 1 per unit of electricity can lead to increase of Rs. 1000-5000 Rs/Ha, being 5% to 89% of farmers net income
- Raising tariffs will not lead by itself to better quality of supply



Pilot Projects to Assess Ideas

- Pilot projects should be initiated to test and develop key interventions like
 - Hours of Supply/ Tariffs based on cropping pattern, groundwater situation
 - Price and procurement measures to shift cropping pattern
 - Community-driven Regulation of Groundwater Extraction and Recharge



Need for a Different Approach

- Larger social perspective, not just DISCOM focussed
- Integrated across electricity, water and agriculture sectors: Including farmers' interests, goals of food security, agricultural growth
- Subsidy requirement estimated based on a desired agricultural development plan, such a plan based on cropping pattern aligned to agro-climatic regions and groundwater situation
- Gives better justification / rationale for subsidy
- Measures in other related areas like decentralised rainwater harvesting, drip-sprinkler irrigation, organic farming
- Improving availability and quality of data in all sectors



Agriculture electricity supply - a comprehensive approach



Pilot projects

- Some ideas for pilot programmes, tailored to region/state specific realities
- Baseline studies for evaluation of impact

Solar Feeder

- 11 kV feeder level solar plants
- Grid connected
- Lower subsidy
- Day time good quality power supply for farmers

Block level tariff/hours of supply

- Cropping pattern and state of groundwater aquifers to be taken into consideration
- After consultation with farmers
- Crops suitable to agro climatic zone to be supported

Distribution Transformer Associations

- Similar to Water Users Associations
- Link between DISCOM and farmers
- Distribution of bills, collection of payments and grievance redressal
- Address safety issues

Shift Towards Appropriate Cropping Pattern

- Price and procurement support/market support for region suitable crops
- Need to explore issues regarding regional MSP vs national MSP

