Should governments discontinue power subsidies?

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1 Introduction

A variety of poverty alleviation programs such as income transfers (in terms of conditional or unconditional cash grants), price support for crops, subsidies for agricultural inputs, health policies such as nutritional supplements or vaccination drives (de-worming treatment in Kenya, polio drive in India), educational subsidies have been pursued by governments in developed and developing countries to alleviate poverty. Another important poverty alleviation program is electricity subsidies for agriculture. (Badiani & Jessoe, 2011).

The largest subsidies in the world in terms of expenditure are found in India; state-level under-priced electricity is the most costly individual subsidy in India estimated at USD 9.5 bn (Mapping India's Energy Subsidies 2020, IISD).

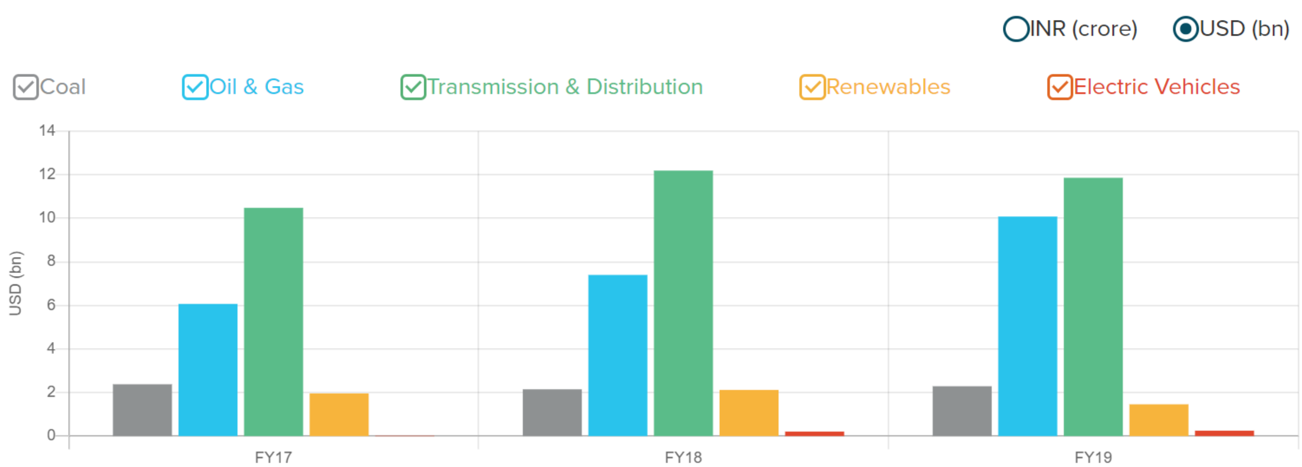

Figure 1: How Big are India's subsidies for Fossil and Clean Energy?

Nearly half of the electricity subsidies are allocated to household and agricultural consumers. These subsidies were introduced in an effort to accelerate economic growth, increase food security, expand access to electricity and lower the cost of irrigation (Badiani, Jessoe and Plant, 2012). Previous work finds that these subsidies (through their impact on irrigation) increased agricultural production (Badiani & Jessoe, 2011), food security (Singh, 2000), and rural incomes (Briscoe Malik, 2006).

2 Electricity Subsidies - Not without their benefits

These electricity subsidies enable agricultural users to access electricity prices below the marginal cost of supply, thereby lowering the cost of groundwater extraction, an essential input in agricultural production. These subsidies may also generate inefficiencies as they may distort decisions over electricity consumption, have environmental cost such as excessive groundwater extraction and also induce individuals to grow more water intensive crops. An additional environmental consequence is the impact of these subsidies on greenhouse gas emissions, since they increase electricity use, and the majority of electricity is produced using coal.

Prior to the introduction of agricultural electricity subsidy, agriculture's share in total electricity use amounted to just 3%. Following the introduction of agricultural electricity subsidies, the net irrigated land more than doubled from 21 million hectares in 1950-1951 to 56 million hectares in 2001-2002 (Gandhi Namboodiri, 2009).

The transformation from rain-fed farming to irrigation has been credited with helping India to increase its agricultural output (Murgai, 2001; Repetto, 1994) and to achieve food self-sufficiency (Singh, 2000).7 Earlier work attributes the increase in agricultural yields in the 1960s and 1970s to an increase in fertilizer inputs and groundwater irrigation and highlights that since the Green Revolution, the prices of these inputs, largely driven by subsidies also declined (Murgai, 2001).

Badiani & Jessoe (2011) find that a 10% decrease in the electricity subsidy (which amounts to more than a two-third increase in electricity prices) would reduce groundwater extraction by 4.3% and lead to a 13% decrease in agricultural output. This decline reflects a decrease in crop yields as well as a decrease in the share of land devoted to water-intensive crops. Others suggest that the benefits of groundwater irrigation extend beyond food security and agricultural productivity and find that groundwater irrigation, and the Green Revolution more generally, led to an increase in industrial employment (Rud, 2011) and agricultural wages (Foster Rosenzweig, 2003a, 2003b).

Badiani & Jessoe also find that a 10% reduction in the average subsidy generates a 6.7% decrease in groundwater extraction, and may have long-run environmental implications in the form of groundwater extraction. While these subsidies may in fact come at the cost of the environment and future agricultural production, we find that they are relatively efficient at transferring government expenditure to agricultural consumers of electricity. On average 88% of government expenditure on these subsidies is transferred to farmers.

3 Is there a Way Forward?

Global experience with groundwater regulation has been dominated by four direct policy instruments that seek to regulate the behavior of groundwater users (Shah 2008).

1. Direct administrative regulation involves laws or executive orders requiring the issue of licenses/permits, prescribing the volume of groundwater the permit holder is entitled to extract, or specifying norms for the distance to be maintained between existing and new wells.

2. Economic instruments include charges and taxes levied on irrigation wells or the volume of water withdrawn. For example, Jordon created a 'quasi water police' to measure withdrawals from irrigation wells, enforce pumping quotas and levy volumetric groundwater fee.

3. Tradeable water rights for groundwater existed in United States and Chile. By making these rights, some countries have tried to create markets for water rights.

4. Participatory aquifer management by groundwater communities is based on the western United States experience with groundwater districts. This model has been tried in Spain and Mexico, where aquifer users are registered and organized into associations with a mandate to manage the aquifer on a sustainable basis (Sandoval, 2004; Villarroya and Aldwell, 1998)

Electricity sector reforms have attempted to restrict overconsumption of electricity for extracting groundwater by adjusting the tariff system. Most states in India have subsidized agricultural power consumption by opting for a flat-rate tariff system (Swain Charnoz, 2012). Haryana started this flat-rate tariff in the early 1970s. Another set of electricity reforms have focused on separating the feeders based on users agricultural, domestic and commercial. Connections are then metered to improve energy audits. At times, feeder segregation has been combined with high-capital investments such as the installation of high-voltage distribution systems (HVDSs).

3.1 Electricity Reforms: Alternative Business Models

a. The economic and environmental benefits of replacing diesel-based agricultural pumps and old inefficient electric pumps with solar pumps is well documented. The shift is expected to result in an increase in crop productivity, improved energy access, groundwater conservation and better standards of living in rural areas. However, the drawback is that the initial capital investment of a solar pump is much higher than that of a traditional pump, and there is a need of a subsidy to bear this upfront cost. Further, since agricultural tariffs are usually the lowest, there is no need incentive for an farmer to shift to a solar pump.

b. electricity used by agriculture is largely used in agricultural pump sets, which generally have very poor efficiency. In India, the Agriculture Demand Side Management Program (Ag-DSM) initiated by the Bureau of Energy Efficiency carried out pump-set enhancement pilots through private-public partnerships (PPP). Despite their huge savings potential, none of them could be scaled up to a large extent, possibly due to the following reasons:

   - Because water and electricity are free to farmers, there is little to no incentive for farmers to shift to efficient pumps. [*] Irrigation and electricity subsidy are a politically sensitive subject in India, and any efforts made by the utilities for metering agricultural connections, tariff hikes, etc face stiff resistance not only from the agricultural sector, but also from the politicians.

- There is a lack of data pertaining to pump set mixes, energy consumption of irrigation pump (IP) sets, metering status, water table position.
- Agriculture pump sets, despite being energy efficient, are bound to fail in one and a half to two years due to lack of poor quality of electricity supply. Lack of skilled servicemen and poor after-sales services further dissuade farmers from installing these pumps.

c. Feeder Segregation focuses on separating the feeders based on the users - agricultural, domestic and cultural. Connections are then metered to improve energy audits. Gujarat launched the Jyotigram scheme (JGS) in 8 districts on a pilot basis. By 2006 more than 95% of Gujarat's 18,000 villages were covered under JGS. This undertaking involved laying a parallel rural transmission network across the state at an investment of US$290 million. JGS involved complete wiring of rural Gujarat, aimed primarily at bifurcating, at the substation level, feeders supplying electricity to agricultural connections from those supplying rural commercial and residential connections. Meters on distribution transformer centers were also installed on both the sides of feeders to improve the accuracy for energy accounting. (Shah, 2008)

   World Bank undertook a study of India's experience in rural load segregation in the states of Andhra Pradesh, Gujarat, Rajasthan, and Haryana. For all the states, the study found that monitoring and evaluation of project execution and outcomes has been negligible. The study found that relatively a large proportion of consumers without working meters; significant variation in actual connected load vis-a-vis utility records; higher hours of 3 phase supply made available ranging between 8 to 14 hours; and finally, peak load was higher than connected load indicating the presence of unauthorized load (World Bank, 2013).

   Thus, feeder segregation requires monitoring to ensure assumptions like 'the feeder is still carrying minimum non-agricultural load'. The results of feeder segregation suggest that these technical reforms ca equip policy-makers and utilities with better data but cannot solve the complex problem of electricity-irrigation.

4 Mitigation Option

The state of Haryana is selected for a roll out of an intervention for reform through electricity, irrigation and fertilizer. Haryana is one of the key agricultural states in the country, with a high percentage of rural households engaged in agriculture, as well as a large number of wells. It however, also has the lowest power tariffs for agricultural consumers.

There is a need for implementing reforms in collaboration. Spatial targeting of crops by investing in technology requirements coupled with energy-efficient pumps and solar pumps is essential. This is because the economics work in favour of energy-efficient and solar pumps over the other reforms since changing electricity tariffs involves a massive political hurdle. The targeting of zones that grow a particular crop pattern will ease implementation challenges by allowing one set of reforms to be implemented through the zone and hence draw out the highest positive impact.

As a first step towards bringing in more accountability for water and electricity consumption by farmers, the electricity supply must be measured and monitored. The cost of installing, managing and monitoring electricity meters at each farm may be prohibitively expensive for the DISCOM; therefore, innovative solutions must be developed for managing the electricity usage at the farm level.

One such mechanism could be to monitor the supply at the feeder level for a group of farms that are connected to a specific feeder. DISCOMs can provide a quota of subsidized electricity in number of units (kWh) to this group of farmers each month. This quota can be decided based on the acres of field being irrigated by the water pumps connected to this specific feeder or through other proxies. If the farms collectively use more electricity than that provided as per the quota, then this group of farmers may be charged a higher tariff. Or simply their higher and lower usage of electricity in a month would be adjusted against the quota for subsequent months. It simply means that if the usage of electricity in a month exceeds the quota, then the availability of electricity may be reduced in the next month.

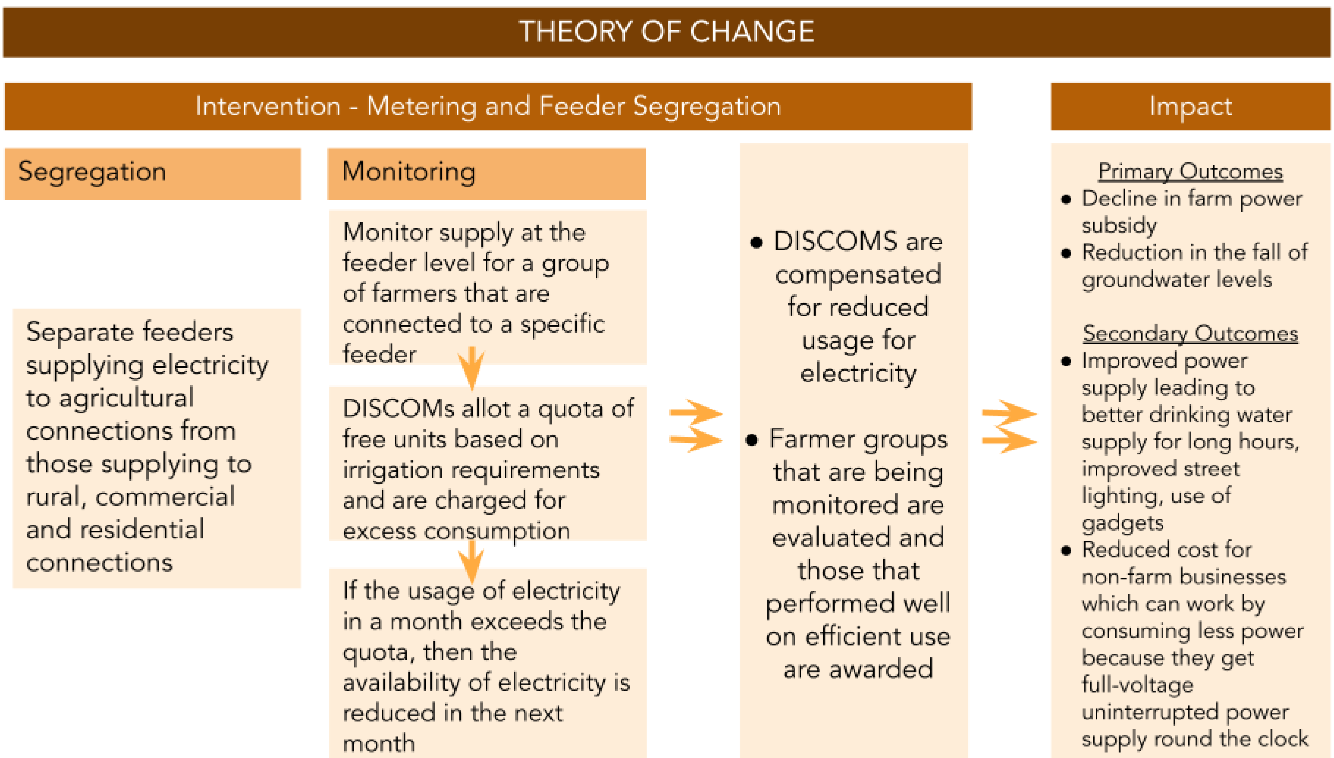

Figure 2: Theory of Change

This can be tested by doing a pilot run. Feeder segregation takes time and all districts will not have segregated feeders instantly. We can take advantage of this roll out, but using the villages in one district that have segregated feeders as a treatment group, and those that are yet to receive as a control group. Villages selected to have segregated feeders would be selected randomly.
Out of the villages that are in the treatment group, half of the villages would be monitored (as described under the 'Monitoring' section) and half would not be monitored. The unmonitored villages will however still have segregated feeders for agricultural and non-agricultural use.
A baseline survey is essential to determine success of the randomization and an endline survey is necessary to collect data on various outcomes highlighted under the 'Impact' section of the Theory of Change.

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