Energy Distribution

The Problem

Power distribution system has been characterized with high losses in most parts of the country. Aggregate transmission and commercial (AT&C) losses in India were 24 percent in FY16 (PFC report, 2017) which is higher than the established international norms of 15 per cent (Kapure and Mahajan, 2016). Higher losses have resulted in poor financial health of the sector and utilities i.e. State Electricity Board's (SEB's) and Distribution Companies (DISCOMs). The consequence of continued losses in the utilities means that the owners i.e. the state Governments have to provide subsidies on an ongoing basis. A highly inefficient tariff structure which discriminates across consumers through a complex cross subsidization has created perverse incentives for all stakeholders. The State Government has been providing significant amount of subsidy, particularly for agricultural consumers. A review of RERC tariff orders for FY 17 and FY 18 indicates that approximately ₹ 7,000 crores were provided for the agriculture sector. As a result, farmers paying less than one-fourth of the tariff determined by regulator and Government subsidy covering the balance.

Distribution losses (Aggregate Technical and Commercial AT&C) in Rajasthan at 28 percent were higher than the national average of 24 percent in FY16. The accumulated losses of the DISCOMs have been increasing and were INR 92,652 crore by end of FY 16 even though the Government provide subsidy of INR 7,000 crore for agricultural connection losses (RERC, 2017).Among other sectors, agriculture is identified as one of the major inefficient users of electricity in India. Agriculture load in Rajasthan comprises 48 percent of the total connected load and 42 percent in sales. However, the contribution of the sector in revenue was just 9 percent in FY17.While some states have initiated demand side management interventions, limited action is evident in Rajasthan.

This research paper aims to evaluate options to enhance energy efficiency in Rajasthan – specifically in power distribution and agriculture irrigation pumping. The two interventions analysed are High Voltage Distribution System (HVDS): Conversion of low tension lines feeding agriculture consumers to HVDS and HVDS and Energy Efficient Pumpsets (EEPS): Intervention 1 plus replacement of inefficient pump sets with efficient ones.

Solutions

Interventions	BCR	Benefit (INR Crores)	Cost (INR Crores)
HVDS - Upgrade agricultural power distribution	2.31	45,350	19,655
HVDS and EEPS - Energy efficient agricultural water pumps	3.44	90,780	26,386

Total costs and benefits are discounted at 5%

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High Voltage Distribution System (HVDS)

The Problem

Power distribution is the weakest link in the Indian power system due to low investments in this sector and poor financial health of SEBs and DISCOMs. The distribution system is characterized by technical and commercial inefficiency, resulting into high losses, frequent interruptions, poor voltage level and dissatisfied consumers (Bansal, Gill and Gupta, 2012). AT&C losses in India were 24 percent in FY16 (PFC report, 2017), significantly higher than the established international norms (Kapure and Mahajan, 2016).

AT&C losses in Rajasthan have reduced over the years from 41 percent in FY05 to 27.7 percent in FY16, nevertheless they were still high compared to pan India average and other states.

Among other sectors, agriculture is identified as one of the major inefficient users of electricity. One of the major reasons for high losses was the adoption of low tension distribution network spread over long distances to serve disperse and relatively small individual agriculture connections. This resulted not only in high technical losses but also high commercial losses by enabling easy tapping into the network. Theft of power was further facilitated by unmetered supply and flat tariff.

The Solution

The HVDS intervention aims to upgrade LT agricultural network to HVDS by replacing existing transformers (mostly 100/63 kVA) with smaller capacity 3-phase distribution transformers (16/25 kVA) close to the consumer load points (APEPDCL, 2016; USAID, 2010).

Implementation of HVDS will improve voltage profile, reduce LT Line losses, and lower the chances of failure of distribution transformer and pumpset burn-out. The intervention is proposed to be implemented by the respective Discoms in network serving agricultural consumers.

The life of the project has been assumed to be 25 years as heavy capital investment infrastructure projects usually have long gestation period.

Costs

The total cost of HVDS has two components. First, the cost of conversion of existing LT lines to HT lines. Second, cost of instalment of 25kVA HVDS transformer for each agriculture consumer. No incremental opex was required due to implementation of this intervention. Therefore, the total cost of HVDS at 5 percent discount rate were estimated to be ₹ 19,655 Crore.

Benefits

Energy savings due to lower AT&C losses, mitigated carbon and savings from lower failure of DTR and pump sets were considered. The total benefit of HVDS at 5 percent discount rate was estimated to be ₹ 45,350 Crores..

HVDS and Energy Efficient Pumpsets (EEPS)

The Problem

The agriculture sector is one of the major and most inefficient power consumers in India due to unmetered supply and zero marginal tariff. The irrigation pumpsets used are generally very inefficient with operating efficiency level of 30% or less. The energy consumption is high mainly due to improper selection and installation, use of high-friction piping, lack of proper maintenance and frequent repairs.

Demand for water for agriculture is expected to increase from 470 Billion Cubic Meters (BCM) in 1985 to 740 BCM in 2025 (EESL, 2014). However, the actual availability of the water will reduce from 83% to 69%, resulting in increasing stress on water availability and thereby on famers (EESL, 2014). Such a scenario will likely increase energy intensity of pumping due to declining with water table.

The Solution

Under this intervention, inefficient irrigation pumpsets (1.2 million) are proposed to be replaced with high energy efficient (5 star rated) EEPS of 12 HP capacity on an average. HVDS (1st intervention) is a pre-condition to implement EEPS in order to ensure that pumps deliver the expected savings. Old inefficient pumps will be taken away and destroyed to

ensure that they are not reused through grey market sales.

This intervention may be implemented by the Bureau of Energy Efficiency (BEE) or Energy Efficiency Services Ltd (EESL) in collaboration with respective Discoms. Alternatively, private energy services companies (ESCO) may be enlisted for the job. There were 12.5 lakh pumpsets in 2015. All the pumpsets were proposed to be replaced in 2018 and the life of the project is assumed to be 25 years.

Costs

The total cost of energy efficient pump sets has two components. First, cost of energy efficient pumpset which includes installation cost. Second, cost of metering and related accessories. Total cost of EEPS at 5 percent discount rate were estimated to be ₹ 26,386 Crores.

Benefits

The total benefit of intervention is the sum of direct and social benefits due to HVDS and EEPS. Direct as well as indirect benefits were considered including energy savings, avoided carbon emission as well as reduction in failure of distribution transformers (DTR) and pumpsets. The total benefit of EEPS at 5 percent discount rate were estimated to be ₹ 90,780 Crores.