

Improving Electricity Services in Rural India
Special Focus on Electricity in Rajasthan

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Abstract

This report is a result of conversations and interviews with Jaipur-based district staff members of the Jaipur Discom in Rajasthan as well as the Chittorgarh district staff of the discom. No primary survey data was gathered for this report. The report is a follow up of the studies in the Unnao district of Uttar Pradesh and the Raisen district of Madhya Pradesh. The focus of the study is on a single issue: the delivery of electricity services in rural Rajasthan. The current state of electricity services across India can be said to be acute, if not in a crisis mode, impeding both economic and social development. The immediate manifestations of this crisis are severe shortcomings in access to electricity in rural areas and low quality of service. This report attempts to address the key question: What policy reforms may make it feasible, within the envelope of political, institutional and financial acceptability, to bring the benefits of electrification to the rural population?

¹ This report is based on work undertaken for a project entitled ‘Scaling Up Services in Rural India’ that is housed at the Center on Globalization and Sustainable Development (CGSD) of the Earth Institute at Columbia University. CGSD is grateful to The William and Flora Hewlett Foundation for providing financial support to this project and especially thanks Smita Singh, Program Director, Global Development, and Shweta Siraj-Mehta, Program Officer for discussions and their keen interest in this project. The assistance of Samina Akbari of the Earth Institute at Columbia University is gratefully acknowledged.

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Improving Electricity Services in Rural India: Special Focus on Electricity in Rajasthan

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Recommendations

The following recommendations are discussed in this report but are highlighted here.

Rajasthan:

Rajasthan is among the lower population density states in India. In comparison to U.P. M.P. and Gujarat Rajasthan has the lowest population density. The percent of rural households with electricity connections is about 44% whereas the corresponding figures for U. P. and Gujarat are 20% and 72% respectively. The state is served by three Distribution Companies (Discoms), the Ajmer, Jodhpur and Jaipur VVNLs. Transmission and distribution losses in each of these is between 30% and 40% after allowing for RVPN's 4.6% transmission loss. The T &D losses are estimated to be about 45% for the low-tension domestic, non-domestic and agriculture consumers. (Note: T&D losses to the industrial, railway and public water works are smaller). Of the overall supply to the low tension customers, 5% is ascribed to technical losses and the remaining 40% to commercial losses. With some exceptions it is fair to say that while the amount of electricity supplied is growing, T&D losses have yet to show any decline. It is important to note at the outset that in principle with the same tariff structure approximate annual loss of Rs 1,200 crores for FY 05-06 would be eliminated if the commercial losses would be halved.

The author visited several of what seemed to be very successful feeder-level upgrades. In some the distribution cable had been replaced with ABC (Aerial bunched conductor) or with conductor in conduit cable preventing illegal hookups. Elsewhere low voltage distribution line had been replaced with higher voltage line also eliminating possibilities of theft. In other instances, small canister transformers were installed closer to demand points with protected tamper-proof wire from the transformer to the domestic meter. At the time no systematic data was being collected or reported on the benefits of these upgrades, however anecdotally the view was that these measures have had success in reducing theft. The benefits of this approach need to be evaluated with careful monitoring, and compared with the costs to establish if opportunities for replication elsewhere in the state do indeed exist.

Interviews with staff at all levels indicated the very "local" nature of the problems associated with distribution and that multiple different avenues to improve performance (both technical and financial) were indeed available. The fact that performance levels even in some rural feeders vary significantly indicated that well-motivated staff, supported with adequate infrastructure investment and enforcement support can make a difference. Scaling up to the state level would require that appropriate incentives and opportunities for promotion at the Junior Engineer and Assistance Engineer levels tied to performance could be of value. In this regard, the unbundling of the utility with the Discoms squarely in charge of distribution could be very beneficial.

Staffing levels and requirements of individual districts at all levels need to be reviewed and performance based criterion might need to be established to allow the successful units to have more flexible labor rules that can allow to expand/contract according to their particular needs. In discussions with Discom officials at the District level, it appears that a long period of (largely justified hiring freezes) has left a workforce that is now unable to meet the growing demands of system maintenance and enforcement. Timely monitoring, responding to complaints, responding to reported theft and enforcement are key principles behind reducing non-technical losses and improving system reliability.

At the time of the author's visit, "revenue collection franchisee" models that were not input-based were being considered. These were effectively equivalent to a form of "outsourcing" of the high labor cost for last mile functions even though some incentives for higher recovery per unit supply were built-in. It is worth noting that such outsourcing would be possible even without a franchisee scheme. An input-based scheme with greater franchisee autonomy was also under consideration. In principle this scheme would have the appropriate incentives for the franchisee to control losses and to reduce theft. A structural problem however remains with this model or any model that is input-based, when different tariff structures apply to different customers within the same feeder. If agriculture tariffs are to remain significantly different from other domestic tariffs, it is difficult to imagine how input-based franchisee schemes would work as intended unless agriculture feeders are separated from other feeders and strict enforcement is in place to ensure that power from these feeders is not abused. A very detailed survey of every customer (and total electricity supplied and billed) in each feeder from multiple rural feeders in Gujarat also demonstrates that what is frequently lumped under agriculture consumption is actually not the case. The Gujarat study also showed the significant variability from feeder to feeder.

A question that remains regardless of the above discussion is how to manage the agriculture loads of the smallholder farmers- farmers who actually do not have permanently installed motors and essentially move their motor-pump sets on a daily basis (perhaps to irrigate multiple different parcels or to prevent equipment theft). Under these circumstances it is difficult to carry out any form of metering and in fact capacity based tariffs, as were utilized in the past, would have merit. Input based franchisee schemes would be difficult to implement under these circumstances.

Irrigated agriculture is critical to the Indian economy and to Rajasthan as well. However providing free or concessionary electricity for agriculture in the face of a groundwater crisis provides distorted incentives to farmers to overuse groundwater. Hence a nuanced approach to reforming agriculture pumping (AP) tariffs is needed. A move toward greater cost recovery must be accompanied by reliable service that meets specific needs, keeping in mind the groundwater capacity of local agriculture. A two-step approach is proposed, with the first being recommended in the short term in areas where metering of AP with 24-7 supply is not immediately feasible. The first step would be to separate the AP feeders from household single-phase supply. This AP network would then be energized by scheduling power supply when it is needed most through reliable timed delivery (determined by rainfall and soil moisture requirements) in accordance with local agriculture needs and during off-peak hours to reduce cost of supply. The AP feeders would have different tariffs from domestic tariffs, and yet all customers on the AP feeders would have the same applicable tariffs, making accounting at the feeder scale transparent.

The next step would be to move toward agriculture subsidies that are provided directly to the consumer in the form of a “smart card” that incorporates low tariffs for the first block of “lifeline” consumption. Smart-card metering technology, already successfully in use in South Africa, makes it possible to provide the subsidy directly to the consumer as opposed to the service provider. The higher initial investment of such a technology is already cost-effective for consumption levels typical of agriculture. The “lifeline” electricity consumption level would correspond to the demands and sustainable water yields of small farmers in a region. In aggregate, this would then pave the way for substantially higher cost-recovery from agriculture while ensuring that the small farmers growing non water-intensive crops are not adversely impacted. Higher tariffs and cost recovery from high-consumption customers would pave the way for facilitating greater generation capacity as well as reducing the adverse financial impact on industry of subsidizing consumers that are not the intended target of the subsidy. This would also address the poor quality electric supply, which impacts all consumers, small and large.

The lifeline rate approach has also been endorsed for household consumption as described in the August 2006 rural electrification policy. This policy commits to a minimum lifeline consumption of 1 unit per household per day as a merit good by year 2012. This is an excellent start because it recognizes a small but adequate minimum level of consumption that is ensured at a lower cost. There would, however, be considerable administrative overhead in administering these lifeline consumption levels in an input based scheme as there would be yet another lower tariff portion of the feeder supply that would be in the mix along with the agriculture supply. Smart-card metering with built-in subsidies directly to the household would address this issue.

We strongly advocate that a feeder or sub-station scale pilot be carried out in one of the Discoms in Rajasthan. Pre-programmed pre-paid smart cards would be used in the pilot to provide subsidized or no-cost tariffs up to lifeline consumption levels. The smart-cards would be electronically tagged to meters that would display the current smart-card balance, the rate of usage as well as the total units utilized. There could be separate tariffs up to the lifeline levels for different customers. However beyond the pre-programmed lifeline levels the tariff would be the same regardless of consumer-type on that feeder. ABC or cable in conduit type of conductors would be used to distribute electricity in that pilot. The Discom would be prepared to provide reliable high-quality 24-7 power supply in this pilot. We are prepared to back-stop such an effort.

National Level Recommendations:

The following recommendations discuss national level policy and are touched upon in an earlier report: *Improving Electricity Services in Rural India: An Initial Assessment of Recent Initiatives and Some Recommendations*, December 2005, Vijay Modi.

Adhere to the Electricity Act 2003 (EA2003) with the aim of creating a climate of confidence within the electricity sector that reflects commitment to a long-term plan based on the Act. The effect of this sustained commitment will be to send a clear message to all actors involved of the seriousness for adherence to a policy. This will pave the path for sustained district and state level planning, with emphasis on monitoring and decentralized accountability. This will also

encourage the private sector to vigorously participate in the power sector and take on a profitable role as a franchise for installation and/or distribution.

The RGGVY attempts to bring electrification to millions of households over the next five years. The magnitude of this undertaking is immense, but it also presents a unique opportunity to take advantage of information technologies in implementing social safety nets and low cost of bill collection. For the RGGVY to succeed, a political climate will need to be created that empowers the SEBs to enforce the rules of the EA 2003. This will require that rural household connections receive reliable service, at least during evening hours when domestic rural supply is most needed. One way to carry out this tricky balancing act, while generation capacity constraints and AT&C (aggregate technical and commercial) loss reduction requirements are met, is to ensure reliable timed evening hour supply for domestic use. This would include installation of load-limiters in households that were connected with the Kutir Jyoti scheme or for new households that will be covered under the BPL provisions of the RGGVY. It could also include promoting the use of state-subsidized energy-efficient lighting, such as compact fluorescent lamps, that represent a cost-effective investment for the utility but may not be so for a household. This is however a temporary measure and the goal of GoI is to eventually deliver reliable 24-7 supply to all rural households.

Develop close co-operation with equipment manufacturers, suppliers and contractors so that demand arising from large-scale policy initiatives can be anticipated, allowing time for the development of supply chains in a timely fashion. This will allow for the delivery of the vast volume of meters, limiters, bulbs, and electrical hardware needed during the installation phase (whether carried out by a franchisee or the utility) and the anticipated human resources to ensure that distribution mechanisms are in place for the supply of such hardware. The same applies in contractor skills in carrying out the task. Mechanisms also need to be in place to quickly change financing requirements if the costs of particular materials change.

Reliable 24-7 supply to schools, clinics, hospitals, water schemes (where needed), telecom facilities, government offices, rural markets and small businesses (e.g. grinding and agro-processing) is essential to meeting the services that rural populations need. Many of these institutions are public facilities. A close dialogue with the district officers and the representative local bodies is needed to ensure that the supply to these institutions is reliable, and that costs of supply are accounted for through transparent “subsidies,” or funds transferred between the appropriate government body and the service provider.

There has been substantial investment in the physical electricity infrastructure of the country since independence. There have been numerous programs in the last decade for accelerating rural electrification. These programs have focused on infrastructure investments but not on management; on ambitious coverage targets but not on financing or creating incentives for sustainable maintenance of infrastructure stock; on triage of emergency measures and not on providing reliable services.

Additionally, investment in building management skills within newly created Distribution Companies (Discoms) will be needed. With a missionary zeal on the quality and reliability of electricity supply, it will be possible to charge industry (large and small) tariffs that will ensure

full cost-recovery and more - resources needed to cross-subsidize the social goals of the electricity sector. The economies of scale in power production have a unique advantage in that the cost of captive power for industry and the cost of coping mechanisms adopted by medium level consumers (SMEs, commercial enterprises, shops or wealthy households) is significantly higher than the bulk costs of electricity generation that a large Discom would pay.

Introduction

Rajasthan is the largest state in the country (after the formation of the new state of Chattisgarh from Madhya Pradesh), with a land area of 342,239 km², or 10% of the total area of India. Five new districts have been formed within the state boundaries in the last decade, for a total of 32 districts comprised of 41,353 revenue villages in 241 *tehsils*. The total population of the state is 53.5 million people, and Rajasthan ranks as the 8th most populous state in the country, containing 5% of the nation's total population.² Over three-fourths of Rajasthan's 9.3 million households are located in rural areas.

To gain a sense of the ground realities of rural electricity in the state, the Jalore, Chittaurgarh and Jaipur districts were identified by the Earth Institute at Columbia University for this study. This report is a result of conversations and interviews with Jaipur based staff members of the Jaipur Discom in Rajasthan as well as the Chittorgarh district based staff. While no primary survey data was gathered, the following sources and key stakeholders were consulted to collect relevant information about electricity services in India, and particularly in rural Rajasthan:

Secretary of Energy, Rajasthan
Chairman and MD, RRVPN Ltd.
Collector & District Magistrate, Jalore District, Chittorgarh District
Additional District Magistrate, Chittorgarh District
Deputy Chief Engineer, Jaipur
Chief Engineers, Jaipur
Chief Accounts Officer, Jaipur
Joint Secretary, Ministry of Power
Chairman and Director, Rural Electricity Corporation
Tata Energy Research Institute (TERI)
Planning Commission, active members

A complete list of meetings held in India is included in Appendix 1. These discussions helped in assessing the quality of access and the constraints faced at the field level and were useful in identifying gaps in planning and implementation. Secondary data acquired from the Discoms and discussion with utility officials helped in understanding the point of view of end users as well as providers.

The following tables and figures have been included to provide a background on the status of electricity services in Rajasthan. Table 1 lists geography, demography and rural electrification figures for 2001-2002 and Table 2 lists generation, transmission, distribution and sales figures for the same year. Table 3 provides detailed data on the three Discoms – Jaipur, Jodhpur, and Ajmer Vidyut Vitran Nigam Limited - that service Rajasthan. **Table 4.** compares rural electrification data on the states of Uttar Pradesh, Madhya Pradesh, Gujarat and Rajasthan. The percent of rural Rajasthani households with electricity connections is about 44% in Rajasthan, whereas the corresponding figures for U. P. and Gujarat are 20% and 72% respectively. Rajasthan itself is among the lower population density states in India. In comparison to U.P., M.P. and Gujarat, Rajasthan has the lowest population density.

² Census of India 2001. <http://www.censusindia.net/results/resultsmain.html>. (Accessed September 2006).

Table 1. Geography, Demography and Rural Electrification Figures - Rajasthan (2001-2002)

Geography, Demography and Rural Electrification Figures - Rajasthan (2001-2002)					
Geography		Demography		Rural electrification & irrigation	
Total area (Km ²)	342,239	Population	53,523,388	*No. hh electrified	3,150,556
Rural area (Km ²)	337,375	*Population Density (persons / sq. km)	156	% of hh electrified	44%
No. of Districts	31	Total no. of hh	9,342,294	No. of villages electrified	36,488
No. of Tehsils	241	No. of rural hhs	7,156,703	No. of energized pump sets	654,182

Source: Annual Report on the Workings of State Electricity Boards & Electricity Departments, Planning Commission, GOI, May 2002

*Source: Department of Energy, Government of Rajasthan, www.rajenergy.com

Census of India, 1991 *Census of India, 2001

Table 2. Rajasthan electricity figures (2001-2002)

Electricity Figures - Rajasthan (2001-2002)	
Generation	
Installed capacity:	
Thermal (MW)	2,014
Hydel (MW)	972
Wind (MW)	6.4
Total (MW)	2,992
Total generation MkWh	11,208
Transmission	
*Length of energized 33kV transmission lines (meters)	28,227,000
*No. of 33/11 kV substations	2,012
*Capacity in MVA (as on 3.31.2004)	8,538
Distribution	
Total customer base (millions)	5.69
*Total connected load (MW)	10,687
*Total no. of employees	36,719
Annual per capita power consumption	335 kWh
T&D losses (Transco)	7,278 MkWh
T&D losses as % of availability (Transco)	28%
Sales	
Total sale of power	18,294 MkWh
**Cost of supply (Transco)	368 Paise/kWh
Average tariff for sale of electricity (Transco)	221 Paise/kWh
Average tariff for agriculture (Transco)	44 Paise/kWh
**Subsidy for agricultural consumers	2,341 Rs. crore
*Subsidy for domestic consumers	580 Rs. crore
**Commercial losses	-2,412 Rs. crore

Source: Annual Report 2001-02, Annual Report on The Working of State Electricity Boards & Electricity Departments, Planning Commission, GOI, May 2002

*Source: Department of Energy, Government of Rajasthan, www.rajenergy.com

Table 3. Workings of Jaipur, Jodhpur and Ajmer Vidyut Vitran Nigam Ltd. (Discoms)

Workings of Jaipur, Jodhpur and Ajmer Vidyut Vitran Nigam Ltd. (Discoms) in Rajasthan					
		Rajasthan	Jaipur Discom	Jodhpur Discom	Ajmer Discom
1	Population	53,523,388	19,602,092	15,317,007	18,604,209
2	Population Density (persons/km ²)	165	270	84	213
3	Number of consumers per employee	168	146	164	132
4	33kV transmission line per consumer (meters)	4.6	3.6	6.6	4.8
5	*33kV transmission line per electrified village (meters)	816	597	1,015	716
6	Number of consumers per 33-11 kV transformer	3,061	3,774	2,618	2,961
7	Domestic connected load per domestic consumer (kW)	0.61	0.91	0.62	0.50
8	**Domestic consumption per domestic consumer (kWh/yr)	637	786	710	647
9	***Effective average load per domestic consumer (kW)	0.07	0.09	0.08	0.07
10	****Effective capacity factor (domestic)	12%	10%	13%	15%
11	Agricultural connected load per agricultural consumer (kW)	4.56	4.00	7.57	5.58
12	**Agricultural consumption per agricultural consumer (kWh/yr)	5,565	4,004	13,510	5,921
13	***Effective average load per agricultural consumer (kW)	0.63	0.46	1.54	0.68
14	****Effective capacity factor (agricultural)	14%	11%	20%	12%
15	Industrial connected load per industrial consumer (kW)	17	16	20	27
16	**Industrial consumption per industrial consumer (kWh/yr)	27,125	35,619	25,829	36,580
17	***Effective average load per industrial consumer (kW)	3.09	4.06	2.95	4.17
18	****Effective capacity factor (industrial)	18%	25%	15%	16%

Source: Department of Energy, Government of Rajasthan, www.rajenergy.com/JprDiscom.htm, www.rajenergy.com/JodDiscom.htm, www.rajenergy.com/AjmDiscom.htm

*Village electrification figures from *Rajasthan Ke Vidyut Vitran Nigmo Ka Pragathi Prathivaidan, 2005-2006*, Jaipur, Jodhpur and Ajmer Vidyut Vitran Nigam Ltd. (Discoms), May-December 2005

**Consumption figures from *Rajasthan Ke Vidyut Vitran Nigmo Ka Pragathi Prathivaidan, 2005-2006*, Jaipur, Jodhpur and Ajmer Vidyut Vitran Nigam Ltd. (Discoms), May-December 2005

***Effective average load per domestic consumer is calculated by dividing Item 8 by 8766 hours/year, and is calculated accordingly for agricultural and industrial consumption

****Effective capacity (domestic) is calculated by dividing Item 9 by Item 7, and is calculated accordingly for agricultural and industrial consumption

Table 4. Statewise Comparison of Electrification Data

	Uttar Pradesh	Madhya Pradesh	Gujarat	Rajasthan
Population density (persons/km ²)*	689	196	258	165
Total # of electricity customers (million)**	9.38	8.14	7.1	5.69
Total number of rural hhs****	20,590,074	8,124,795	5,885,961	7,156,703
Total # of electrified hhs****	4,084,288	5,063,424	4,244,758	3,150,556
% of hh electrified****	20	62	72	44
Total # of inhabited villages***	97,942	52,117	18,066	39,753
Total # of electrified villages	57,042	50,474	17,940	37,276
% of villages electrified***	58	97	99	94
No. of energized pumpsets**	815,498	1,244,719	733,000	654,182

Sources: *Census of India 2001

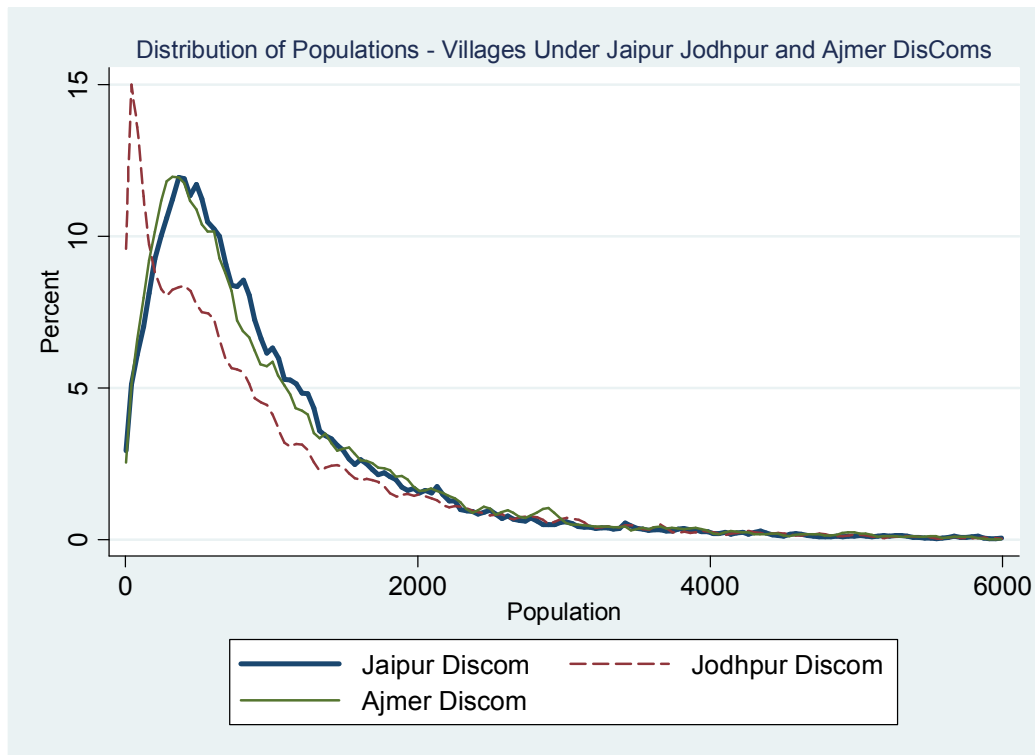
**Annual Report 2001-02, Annual Report on the Working of State Electricity Boards & Electricity Departments, Planning Commission, GOI, May 2002

***Ministry of Power, 2005. http://powermin.nic.in/rural_electrification/states_unelectrified.htm (accessed November 4, 2006)

****Indian NGOs, 2005. <http://www.indianngos.com/issue/rural/power/electrification.htm> (accessed November 5, 2006)

Note here that Jodhpur Discom, which services a semi-arid area, has a very low population density, and hence one would expect that the costs of rural electrification, both initial and recurrent, would be higher in this Discom than elsewhere. Indeed the length of MV distribution line per customer is high in Jodhpur Discom, as is the length of line per electrified village. Moreover, the arid nature of the state leads to higher agriculture loads per agriculture connection. Figure 1 show the distribution of population by village size in each of these Discoms. There is a larger fraction of smaller villages in Jodhpur Discom which combined with larger distances between villages, leads to comparatively higher cost of servicing electric supply in that Discom.

Figure 1. Distribution of populations - Villages under Jaipur, Jodhpur and Ajmer Discoms



Source: Census of India 2001 village level data and VD Data 1999, Census Organisation

Electricity, Irrigation and Agricultural Sector Reforms

As India's Ministry of Agriculture reports, around 70% of the population of India is dependent upon agriculture. That 72% of India's population is rural implies that around 50% of the total population of the country is dependent upon agriculture³ and that agriculture still largely determines the economic status of most of India's people. This section analyzes the relationship between irrigation and electrification in the state of Rajasthan according to data collected by the Census Organisation of India, to demonstrate that lack of access to electricity may be hampering Rajasthan's, and India's, agricultural potential. The relationship between the agricultural sector and the impending groundwater crisis is also touched upon.

Village level VD data⁴ shows that at least 32,223 villages (78% of all revenue villages) have access to power supply. This of course does not imply that most households are electrified.⁵ Figure 2 illustrates the percentage of rural households that report electricity as the primary source of lighting. Across rural Rajasthan, 44% of households use electricity as the main source of lighting, mirroring the national figure and implying that at least this proportion of rural households are electrified. In order to understand the relationship between household level electrification and village level access to electricity, Figure 3 illustrates the penetration rate of electricity to the household level for all villages with access to electricity. The overall penetration rate in the state is 48%, with a maximum of 69% in the Kota district and a minimum of only 27% in the Barmer District. The semi-arid areas covered by the Jodhpur Discom have a particularly low population density, and these are the areas with the least access and lowest penetration rates.

Figure 4 illustrates the proportion of irrigable land⁶ that is irrigated by district. When paired with Figure 3, we see that the lowest penetration areas generally have a lower proportion of irrigated land. These figures show the strong spatial variation of access to electricity and irrigation in the state. While comparing district-wise aggregates does not reveal a strong correlation between access to electricity and the proportion of land that is irrigated, analyzing village level data across the state without attention to district borders reveals that a correlation does exist.

It is useful here to compare villages with access to power to those without access, in conjunction with irrigation. In villages across the state that have access to power supply, 31% of irrigable

³The Regional Data Exchange System on Food and Agriculture Statistics in Asia and Pacific Countries. <http://www.faorap-apcas.org/india/index.htm>. (Accessed August 2006).

⁴ The findings in this section were calculated using village level data from the Census of India 2001 and village level data from the Village Directory (VD data), one of the traditional compilations of the Census Organisation. The VD Data covers all 41,353 revenue villages in the state of Rajasthan. Access to electricity has been determined using the Census of India 2001 household amenities table "Distribution of Households by Source of Lighting" data on electricity use, and VD Data binary data for availability of "power supply" to each village.⁴ Country level data has not been calculated and is cited where it appears.

⁵ VD Data for access to power supply was unavailable for 1,600 (4%) of 41,353 villages.

⁶ "Irrigable land" in the discussion of irrigation in Rajasthan is comprised of the "total irrigated" and "total un-irrigated" area of villages, as defined in the VD data. "Culturable waste (including gauchar and groves)" and "Area not available for cultivation" (which comprise the remainder of total geographic area of each village) have been excluded from "irrigable land." Proportion of "irrigated land" in this discussion refers to the proportion of land that is irrigated to total irrigable land. The analysis of electrification and irrigation data resulted in some problems in comparing data sets that did not use identical definitions.

land (in aggregate) is irrigated. By comparison, in villages lacking power supply, only 19% of irrigable land (in aggregate) is irrigated (see Table 5). The notable decrease in the proportion of land irrigated in villages that lack power verifies that greater access to electricity correlates with an increase in irrigation, and thus with the improvements in livelihoods that access to irrigation provides - at least in the short term.

The long term impact of groundwater pumping in the absence of a good understanding of the groundwater potential can lead to a precarious and potentially catastrophic situation. The close link between groundwater pumping and decline in water levels needs to be better understood so that electricity strategies does not lead to a groundwater crisis. This may already be happening in some parts of the state. A recent study by the Central Groundwater Board of India states that of the 5,723 blocks that comprise India, more than 1,000 are considered overexploited (or dark) or critical. A substantial number of the blocks are already dark in Rajasthan, thus posing a challenge for using groundwater development to boost agriculture production.

Irrigated agriculture is nonetheless critical to the Indian economy. However providing free or concessionary electricity for agriculture in the face of a groundwater crisis provides farmers with distorted incentives. A nuanced approach to reforming agriculture pumping (AP) tariffs is needed. A move toward greater cost recovery must be accompanied by reliable service that meets specific needs, while keeping in mind the groundwater capacity of local agriculture. A two-step approach is proposed, with the first being recommended in the short term in areas where metering of AP with 24-7 supply is not immediately feasible. The first step would be to separate the three-phase AP supply from household single-phase supply and then this AP network would be then energized by scheduling power supply when it is needed most, through reliable timed-delivery (determined by rainfall and soil moisture requirements) in accordance with local agricultural needs and during off-peak hours to reduce cost of supply. This will allow the system to better meet agricultural needs while at the same time reducing the supply of electricity for agriculture, and hence effectively curtailing agriculture subsidies (allowing flat-rate tariffs to become closer to cost recovery). At the same time, this would reduce wasteful use of energy and groundwater.

This approach will require co-ordination of the utility with local agriculture and water experts along with a campaign including community dialogue that would promote the benefits of such an approach. This approach has been advocated in Shah (2001), and as suggested in the Tata-IWMI water policy briefing “if well managed, such a strategy could cut wasteful use of groundwater by 12-18 km³ of water/year in western and peninsular India alone, reducing power use in groundwater extraction by some 2-3 billion kWh of power—valued at Rs 4,000-6,000 crores/year (US\$0.8 billion-1.2 billion/year). Plus, it could actually improve farmer satisfaction with the power industry.”

Any such reforms depend, however, on a commitment by SEBs, Discoms and franchisees, transmission, generation as well as consumers to implement policy changes. For this to work, government must create a climate of confidence within the electricity sector that reflects commitment to a long term plan based on the Electricity Act 2003. The effect of this sustained commitment will be to send a clear message to all actors involved of the seriousness for adherence to a policy. This will pave the path for sustained district and state level planning, with

emphasis on monitoring and decentralized accountability. This will also encourage the private sector to vigorously participate in the power sector and take on a profitable role as a franchise for installation and/or distribution.

As the livelihoods of many farmers are now intricately linked to electricity and groundwater, change will require efforts at multiple fronts. These include participatory discussions with farmers backed by technical analysis. Management of energy and water at watershed or Panchayat level with parallel efforts that help reduce water and energy consumption, and efforts to introduce crops that are less water intensive are also indeed needed. The role of metering in monitoring and cost recovery, recent developments in franchisee models and related policy recommendations are discussed in the following section.

Figure 2. Proportion of households that report electricity as primary source of lighting

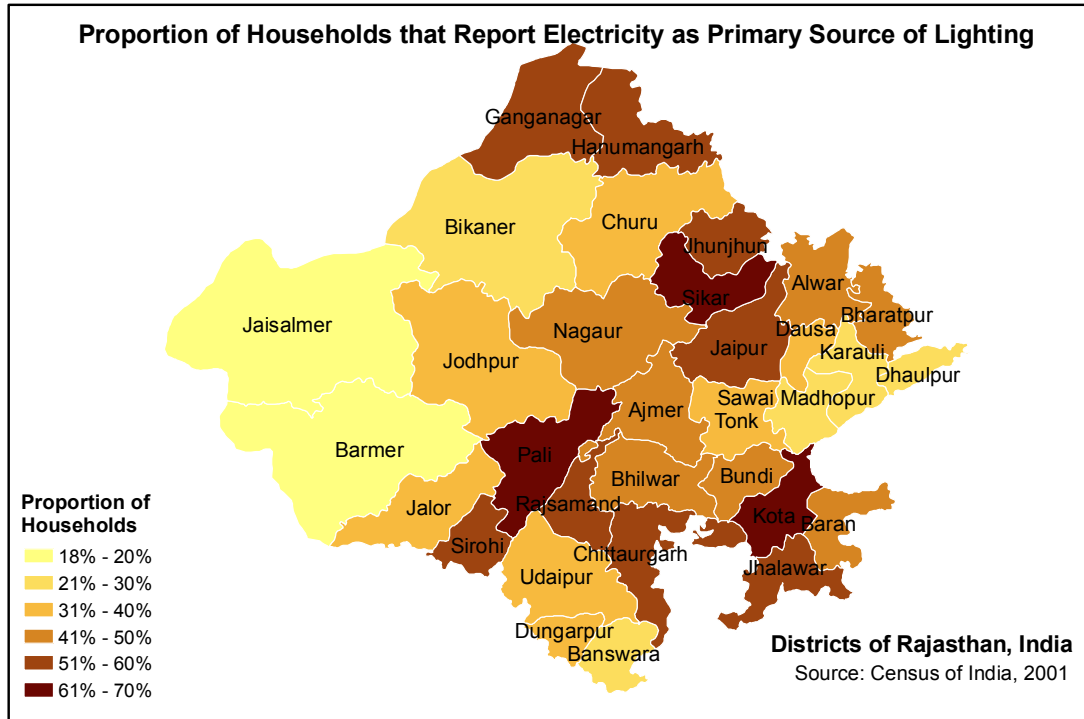


Figure 3. Penetration rate of electricity in electrified villages

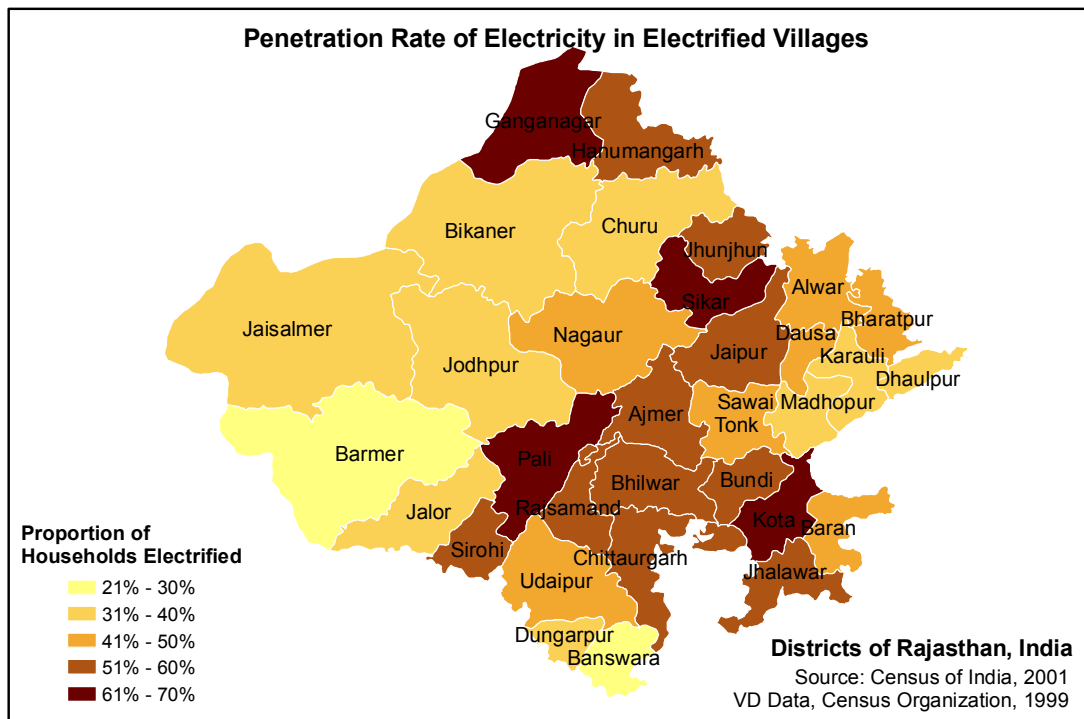


Figure 4. Proportion of irrigated land to total irrigable land by Districts of Rajasthan, India

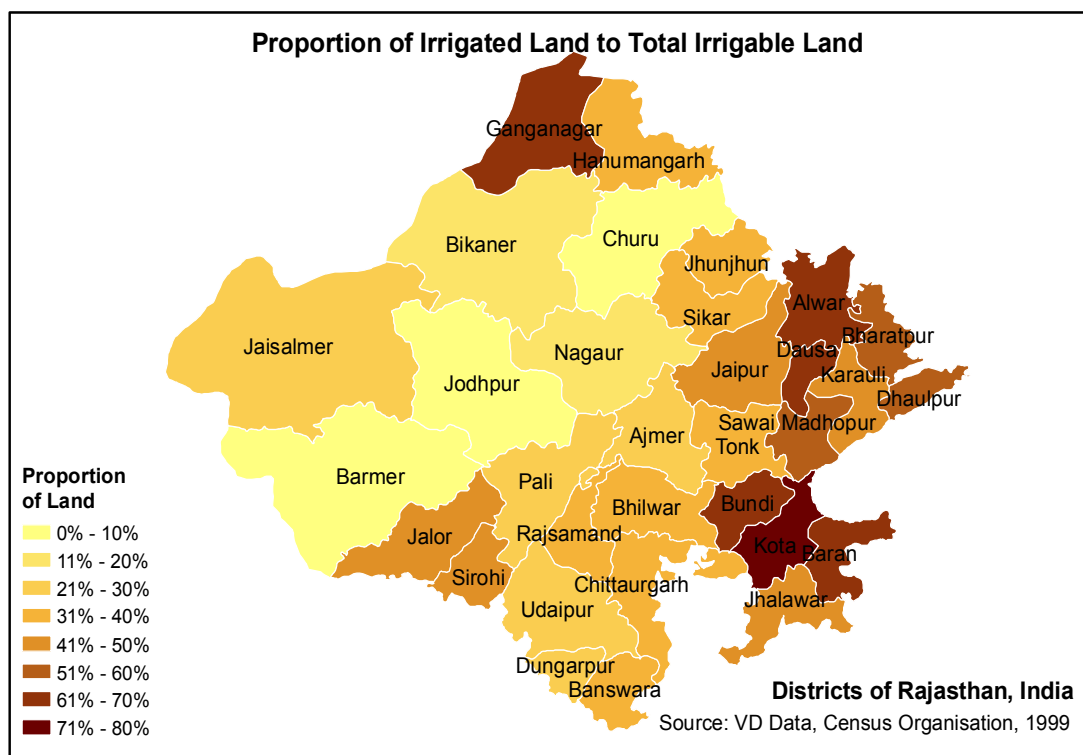


Table 5. Proportion of irrigable land that is irrigated by access to power supply

Proportion of Land Irrigated by Access to Power Supply Villages of Rajasthan, India		
Power Supply	Number of Villages ⁷	% of Total Irrigable Land Area that is Irrigated
Available	32,223	31%
Not Available	7,530	19%

Source: Village level VD Data 1999, Census Organisation

⁷ Excludes 1,600 villages (4% of villages) for which power supply data was unavailable.

The Role of Metering

While we have not ourselves conducted an in-depth feeder by feeder survey in Rajasthan, a recent study of the adequacy, reliability and accuracy of metering and billing systems in the state of Gujarat provides a granular review of related issues. Table 6 summarizes key information from circle by circle feeder level data reported in 2001 in *A Survey Report on the Metering System in the State of Gujarat* by the Power Systems Group. While the report surveys both urban and rural feeders, this discussion refers only to measurements taken on rural feeders. The data measured includes the total number of consumers per feeder by circle, energy outlay, total energy billed, energy billed to agricultural consumers, and total number of agricultural consumers, among other data not discussed here.

Data from this report allows us to highlight flaws in the current conception that inadequate cost recovery is a symptom of high consumption by the agricultural sector. In five of eight circles, less than thirty percent of the energy sent out on rural feeders was billed to consumers. In the Bharuch and Bhavnagar circles, the percent billed sinks as low as 2%. This discrepancy is frequently claimed to be unbilled agricultural consumption (perhaps due to flat rates based on motor horsepower). This detailed survey, however, provides clues to the inaccuracy of this assumption. If one calculates the amount of agricultural energy per agricultural consumer (assuming the number of agriculture consumers per feeder are accurate), per consumer figures reveal consumption levels that are impossibly high. Because the implied motor and pump capacities of these consumers are impossibly large, this analysis suggests that the source of the unbilled consumption lies elsewhere. The Gujarat report points to multiple such possibilities.

A combination of unsealed meters, improper meter connections inadequate metering, absence of proper education and training among the field staff, and corruption among the staff are all cited as reasons for improper billing, and may account for much of the electricity usage that has been attributed to agriculture. The study provides a range of specific examples of how theft is carried out and the subsequent impact on the billing system. In the case of three phase service connection, the authors point out, there is a tendency for consumers to transfer loads to the healthy phase during power supply interruption, causing an overloading of the current coil in the healthy phase. Though phase-splitting by agricultural consumers is mentioned in the Anand Circle for use of three phase pumps when three phase supply is unavailable from the utility, the authors note that theft cases in that feeder survey were anomalous because most meters there were sealed, while all other surveyed feeders had significant numbers of unsealed meters. These observations point toward the need for wide-spread reforms in metering practices and technology.

This author visited several of what seemed to be very successful feeder-level upgrades in Rajasthan where distribution cables had been replaced with insulated conductors, where small transformers with tamper proof wiring had been installed closer to demand points. There was no systematic data being collected on the benefits of these upgrades. What was anecdotally learnt was that these measures have led to dramatic successes in reducing theft, and that, with careful monitoring, there are tremendous opportunities for replication elsewhere in the state. These

measures are however only likely to succeed if incentives along with suitable technology backstops are available. Technical backstops are available in the form of tamper-proof meters, on the pole metering, and feeder level meters. Incentives, however, must also be in place for the utility staff to participate in enforcing rules, rather than actually being in collusion with consumers to promote under-billing.

Table 6. Circle-level Survey of Rural Feeders in the State of Gujarat

Rural Feeders	Total No. of Consumers	Energy Sent Out	Energy Billed	% Energy Billed (Non-Agri.)	Energy Billed To or Calculated For Agriculture	Total No. of Agri. Consumers	Energy (kWh) per Agri. Consumer	Estimated Pump kW per Agri. Consumer***
Anand Circle	1,922	5730,000	4,950,000	86%	NA	81	NA	NA
Bharuch Circle	2,936	60,970,000	1,097,900	2%	497,746	28	17,777	18
Mehsana Circle	19,650	7,053,600	6,430,524	91%	4,391,493	64	68,617	69
Palanpur Circle	2,689	9,820,000	1,924,598	20%	6,956,711	132	52,702	53
Bhavnagar Circle	1,126	16,551,100	389,238	2%	*13,884,431	62	3,223,942	3,224
Amreli Circle	2,611	3,909,840	1,151,071	29%	**2,162,127	332	6,512	6.5
Junagadh Circle	1,239	4,966,100	4,548,948	92%	3,798,921	315	12,060	12
Rajkot Circle	1,938	9,048,100	501,421	6%	1,892,415	293	6,459	6.5

Source: *A Survey Report on the Metering System in the State of Gujarat. Power Systems Group, 2001.* This survey also contains information on urban and industrial metering.

*For the indicated figure to hold, HP shall be as high as 5,000 HP for 62 consumers, which is nearly impossible.

**i.e. maximum 3hrs supply to agriculture.

*** Assuming 1,000 hrs per year of supply

RRGVY and Recent Advancements in Rural Electrification Policy

In accordance with the Electricity Act 2003, the central government launched the ambitious 'Rajiv Gandhi Grameen Vidhyutikaran Yojana (RRGVY)' scheme in April 2005 with the goal of electrifying all un-electrified villages and providing access to electricity to all households in the following five years. Agreements have been signed with 27 states for participation in the RRGVY in 581 districts. The Rural Electricity Commission has already signed MOUs with POWERGRID, NHPC & DVC for providing services in twelve states for implementation of rural electrification projects. Details of two exciting new policies published by the Ministry of Power in August 2006, aimed at a) reaching the goals set out by the RRGVY and b) providing minimum lifeline consumption to domestic users are reproduced below.

Rural Electrification Policy, Resolution No.44/26/05-RE (Vol-II)

Excerpted from Rural Electrification Policy, Resolution No.44/26/05-RE (Vol-II), August 23, 2006.

These National Policies for [a] Permitting Stand Alone Systems and [b] Rural Electrification and Bulk Power Purchase & Management of Local Distribution in Rural Areas, have been prepared and framed-up through an extensive consultative process undertaken by the Ministry of Power, Government of India, involving not only the State Governments and the State Electricity Regulatory Commissions, but also other stakeholders such as non-Governmental organizations, technology providers, existing utilities etc.

Goals

The Policy aims at :

- Provision of access to electricity to all households by year 2009.
- Quality and reliable power supply at reasonable rates.
- Minimum lifeline consumption of 1 unit per household per day as a merit good by year 2012.

The progress of Rural Electrification would be reviewed in terms of the achievements vis-à-vis the above Goal.

Grid connectivity is the normal way of electrification of villages. While this policy covers distribution network upto 33/11 or 66/11 KV level, appropriate development and augmentation of sub-transmission and transmission system at higher voltage levels will also be necessary.

For villages/habitations, where grid connectivity would not be feasible or not cost effective, off-grid solutions based on stand-alone systems may be taken up for supply of electricity so that every household gets access to electricity. Where neither standalone systems nor grid connectivity is feasible and if only alternative is to use isolated lighting technologies like solar photovoltaic, these may be adopted. However such remote villages may not be designated as electrified till the time appropriate solutions are found to provide electricity in these villages to meet the requirements of the definition of village electrification.

Decentralised distributed generation facilities together with local distribution network may be based either on conventional or non-conventional methods of electricity generation whichever is more suitable and economical. Non-conventional sources of energy could be utilized even where grid connectivity exists provided it is found to be cost effective.

The State Governments should, within 6 months prepare and notify a Rural Electrification Plan to achieve the goal of providing access to all households. The Rural Electrification Plan should map and detail the electrification delivery mechanisms (grid or stand alone) considering inter alia the available technologies, environmental norms, fuel availability, number of un-electrified households, distance from the existing grid etc. The Plan may be linked to and integrated with District Development Plans as and when such plans become available. The Plan should also be intimated to the Appropriate Commission.

Source: Rural Electrification Policy, Resolution No.44/26/05-RE (Vol-II), August 23, 2006.
http://powermin.nic.in/whats_new/pdf/RE%20Policy.pdf (accessed October 10, 2006)

To reach all households by 2009, the policy states that off-grid solutions based on stand-alone systems may be taken up for provision of electricity to villages or habitations where grid connectivity is not feasible or cost effective. It also emphasizes that remote villages may not be considered “electrified” until they reach the requirements of the definition of village electrification, whether they are serviced through grid or stand-alone power. In efforts to foster small and medium scale industries, the policy makes allowances for standalone systems of up to 1 MW which are based on cost-effective proven technologies and use locally available resources such as biomass. These projects would have automatic approval for some land use changes, pollution and safety clearances.

The lifeline rate approach is now being endorsed for household consumption. The commitment to a minimum lifeline consumption of 1 unit per household per day as a merit good by year 2012 is an excellent start because it recognizes a small but adequate minimum level of consumption, ensured at a lower cost. There would, however, be considerable administrative overhead in administering these lifeline consumption levels in an input based scheme as there would be yet another lower tariff portion of the feeder supply in addition to the already hard to manage agricultural supply. Smart-card metering with built-in subsidies directly to the household, described in the next section, would address this issue.

The policy entitled Rural Electrification and Bulk Power Purchase & Management of Local Distribution in Rural Areas, outlined further in the cited document, describes deployment of franchisees for local distribution in rural areas as necessary in order to ensure revenue sustainability and improve services to the consumers. The goal of franchisee arrangements is described as “a mechanism to ensure that commercial losses reduce, energy supplied is billed and revenue is collected.” The following section details franchisee models that are already being implemented in the state of Rajasthan in efforts to reach these goals.

Franchisee Models and the State of Rajasthan

Power sector reforms as prescribed under the RGGVY and discussed above are underway in a number of states. As franchisee involvement increases, states have adopted a range of models of franchisee deployment with varying units, outlined in Appendix 2. Table 7 details two sets of franchisee models that were being considered under the Jaipur Vidyut Vitran Nigam Ltd. (Discom) in the state of Rajasthan at the time of the author's visit.

Models IA through ID are revenue collection models working at different levels of the network. These models provide tailored input-based options to attract franchisees providing power to rural and domestic urban users, where physical distances between households and the number of users may vary. In these models, the Discom ensures installation and maintenance of the physical assets and provides power supply through a metered gateway such as a feeder or a transformer. Tariffs differ per user group in these models, while the electricity supplied remains the same.

The outsourcing of services that these models present is sound within the constraints of differential tariffs for different categories of users (e.g. agricultural, domestic, etc.). Within these models, compensation for each franchisee includes a monthly fixed amount for providing service (independent of the amount of electricity supplied). In addition, the franchisee receives an incentive equal to 10% of the improvement in per kWh revenue increase beyond an assured increase in per kWh revenue. Table 8 provides a detailed explanation of this incentive structure.

While these models present incentives for franchisees, it may in fact create a distorted incentive structure for the franchisee. State legislated differential tariffs imply that the price per unit provided to an agricultural consumer is much lower than that provided to a domestic or industrial consumer due to heavy subsidies for the agricultural sector. Electricity subsidy to agriculture falls outside the scope of what can be affected by new franchising schemes or reforms. With this in mind, we observe that incentives for Model I schemes are based on the price per unit of electricity provided by the franchisee. As detailed in Table 8, the incentive structure is dependent upon the revenue per unit of total power supplied, regardless of the mix of users. The revenue per unit supplied would accordingly decrease if the number or consumption of low-paying (agricultural) users were to increase, causing a decrease in the overall revenue per unit of electricity distributed by the franchisee. This would create an incentive for the franchisee to inadequately serve customers who pay the lower tariffs. Additionally, the inter-annual variability of climate driven electricity consumption by agricultural users also impacts the financial incentives of the franchisee for reasons beyond the consumers' control. Thus, an incentive system based on the increase in revenue per unit above a baseline may discourage franchisees from supporting new or existing low-tariff connections. While this may be beneficial to the utility financially, it would negate the intended purpose (whether political and/or economic) of providing low tariff electricity to agriculture.

This system may also allow users to abuse differential tariffs by, for example, using power slated for agriculture in the domestic setting. One approach to addressing these problems is to separate agricultural and domestic feeders altogether. A separate agricultural feeder would remove the possibility of disincentive for franchisees to take on agricultural consumers as discussed above,

and could actually create incentive to increase the number of low-paying agriculture consumers being serviced. These feeders could then provide reliable timed supply as discussed earlier. This method would, though, require the Discom to trust the franchisee to manage theft on the additional agriculture feeder. As the detailed survey of feeders in Gujarat discussed in the previous section shows, there is significant variability from feeder to feeder. Separation of agriculture feeders from domestic loads, with some of the measures described above would actually lead to better monitoring of non-agriculture loads, increased cost recovery and improved system reliability.

The primary benefit of this franchisee scheme in the short term appears to be the effective “outsourcing” of high labor cost for last mile functions. True input based schemes with greater franchisee autonomy have not been tested and will remain a difficult proposition as long as different customers are being supplied with electricity at different tariffs within the same geographic locale. Technologies such as capacitor banks may make it feasible to use motor loads on domestic wires.

Another solution is to employ a single tariff for all users, but to provide a fixed initial amount of free or low-cost electricity to agricultural users. This agriculture “lifeline” consumption could be provided through timed supply and ideally would be in accordance with the local groundwater potential. This could be administered through an “electricity credit” (or possibly a simple cash transfer) provided to the farmer.

The next step would be to move toward agriculture subsidies that are provided directly to the consumer in the form of a “smart card” that incorporates low tariffs for the first block of “lifeline” consumption. Smart-card metering technology, already successfully being used in South Africa, makes it possible to provide the subsidy directly to the consumer as opposed to the service provider. The higher initial investment of such a technology is already cost-effective for consumption levels typical of agriculture. The “lifeline” electricity consumption level would correspond to the demands and sustainable water yields of small farmers in a region. In aggregate, this would then pave the way for substantially higher cost-recovery from agriculture while ensuring that the small farmers growing non water-intensive crops are not adversely impacted. Higher cost recovery would pave the way for facilitating greater generation capacity as well as reducing the adverse impact on industry of higher tariffs and poor quality supply.

Model II is a hardware and service model that targets rural consumers at the 11 KV feeder level where the Feeder Renovation Programme (FRP)⁹ has not been undertaken (detailed in Table 7). Here the franchisee would be responsible for all operation and maintenance of the network. The pit-fall of Model II is that the Discom’s management responsibilities would be very high, increasing associated transaction costs, which could negate the benefits of franchising in the first place. If political factors prevent the implementation of new franchisee models that transfer both management and service responsibilities to the franchisee from the Discom (as described in Model II), then outsourcing services alone (as described in Model I) is a desirable alternative.

⁹ According to documents by the Jodhpur Discom, Works under the FRP include erection and augmentation of 11KV & L.T. lines and S/S, installation of 1-ph. & 3-ph. transformer, AB Cable, replacement of meters and service lines on 11 KV rural feeder (1-ph. & 3-ph. Transformer and meters shall be supplied by Nigam).

Table 7. Jaipur Vidyut Nigam Ltd. - Highlights of Franchisee Models

	Target Population	Network Unit	Franchisee responsibilities	Discom Responsibilities	Provisions from Discom to Franchisee
Model I(A)	Domestic consumers of urban areas	Distribution transformer	<ul style="list-style-type: none"> Meter reading / spot billing Bill distribution Revenue collection Disconnection and reconnection Curbing of theft and malpractice and informing of Discom authorities of unauthorized load extension Redressal of consumer complaints and grievances Maintenance of log sheets 	<ul style="list-style-type: none"> Release and processing of new connections Billing State directed works Replacement of distribution transformers Monitoring of connections for theft and malpractice Capital investment for system improvements 	<ul style="list-style-type: none"> Fixed O&M charge payable to Franchisee every month at a rate quoted by the Franchisee Power supply to distribution transformer The incentive equal to 10% of the improvement in revenue earning beyond the assured revenue improvement (10% of the total of revenue realized per unit energy input for base year + 10%)
Model I(B)	Domestic consumers of urban areas, in towns with populations over 5,000	11 KV feeder	As in Model 1(A)	As in Model 1(A)	As in Model 1(A)
Model I(C)	Consumers of rural areas	11 KV feeder of a 3/11 KV station	As in Model 1(A)	As in Model 1(A)	As in Model 1(A)
Model I(D)	Consumers of rural areas	33/11 KV substation with its 11 KV outgoing feeders	As in Model 1(A) In addition: Operations and maintenance of 33/11 KV substation per procedures prescribed by the Discom	As in Model 1(A)	As in Model 1(A)
Model II	Consumers of rural areas	11 KV rural feeders where the Feeder Renovation Programme (FRP) has not been undertaken	As in Model 1(A) In addition: <ul style="list-style-type: none"> System improvements meant to increase revenue earnings Bill generation (computerized with software provided by Discom) Operation and maintenance of lines and substations Replacement of distribution transformers 	<ul style="list-style-type: none"> Release and processing of new connections Billing State directed works Replacement of distribution transformers where delay in replacement is beyond 72 hours or where the failure of the distribution transformer is above the average rate of failure and Franchisee is unable to replace it. Expenditures incurred by the Discom would be deducted from the fixed charges paid to the Franchisee 	<ul style="list-style-type: none"> Fixed O&M charge payable to Franchisee every month at a rate quoted by the Franchisee Assets (i.e. 11 KV, LT line, distribution transformer etc.) would be handed over to the Franchisee on "right of use" basis

Source: Documents acquired from Jaipur Vidyut Nigam Limited (Commercial Wing) in February 2006

Table 8. Details of the Incentive Structure for Model I Franchisee Models

Terminology	Definition	Details
Base year	2005-2006	
XE	Fixed charges payable to franchisee every month by Discom	This fixed charge is independent of the amount of electricity supplied by franchisee and will be quoted by the franchisee.
XR	Revenue realized per unit energy input for base year	This amount is the average Rs/kWh earned by the franchisee for the total power provided to all consumers (agricultural, domestic, etc.) in the base year. Because the agricultural tariff is lower than other tariffs, the differential tariffs are applied and averaged here to calculate the total Rs./kWh.
XAR	Assured revenue return = $XR + (10\% * XR)$	The above Rs/kWh in the base year plus 10%.
Incentive	10% of the improvement in revenue earning beyond the assured revenue improvement = $10\% * (\text{Current per unit price} - XAR)$	The incentive offered to the franchisee is equal to 10% of the following: the difference between the Rs/kWh for the <i>current</i> year (calculated in the same way as was calculated for the base year in XR), and XAR (Rs/kWh in the base year plus 10%).

Source: Based on documents acquired directly from Jaipur Vidyut Nigam Limited (Commercial Wing) in February 2006

Creating Incentives Within the Discoms

The Discoms are currently the repository of local knowledge on all aspects of distribution. They are familiar with the local geography, the mix of consumers served by each feeder, their demand profiles, and technical details including the reliability of the distribution system. With some additional investment, they would also know precisely what the input is to each feeder. If the proper incentive structure were in place to reward staff, they could undertake many appropriate actions to improve system reliability and to reduce theft.

One such measure is to implement the use of higher voltage distribution lines directly to domestic consumers in villages/towns, using small canister transformers at the end of such lines. These small transformers would serve a handful of customers and the line length that is at usable voltages would be of limited length, made of insulated/protected conductors that would preclude opportunities for illegal hookups. Moreover, the length of line that needs to be monitored would be much shorter. Indian villages are nucleated settlements where the use of insulated conductors along the entire low voltage distribution is also feasible. Both of these measures have recently been implemented by the Discom staff on rural feeders near Chittaurgarh with considerable success, though no data was available of the precise benefits of these measures.

The Discom staff could also respond to reports of illegal hookups and theft if they are appropriately backed in their enforcement efforts by the local police. The local staff pointed to such co-operation being available when there was an incentive structures to remunerate the police department with part of the reconnection charges recovered by the utility in such cases.

Investment in building management skills within newly created Discoms will also be needed. Staffing levels and requirements of individual districts at all levels need to be reviewed and performance based criterion might need to be established to allow successful units to have more flexible labor rules that allows them to expand/contract according to their particular needs. In discussions with Discom officials in Chittaurgarh, it appears that a long period of largely justified hiring freezes has left a workforce that is now unable to meet the growing demands of system maintenance and enforcement. Timely monitoring, responding to complaints and responding to reported theft and enforcement is a key principle behind reducing non-technical losses and improving system reliability.

There has been substantial investment in the physical electricity infrastructure of the country since independence. There have been numerous programs in just the last decade for accelerating rural electrification. These programs have focused on infrastructure investments but not on management; on ambitious coverage targets but not on financing or creating incentives for sustainable maintenance of infrastructure stock; on triage of emergency measures and not on providing reliable services. The windfall, if any, from reduced subsidies will have to be invested back in the maintenance of the crumbling infrastructure, in modernization of the system for transparent accounting and in new infrastructure.

The current state of affairs pertaining to electricity is a reflection of past policies. In addition to the measures discussed above, communication with the consumer is critically important. An

ongoing dialogue with the community and community leaders is critical to ensure that the efforts and measures that the utility wishes to undertake are understood by consumers, and that consumers are assured that they are the key stakeholders in the process. This is especially important in the transition phase when changes are being implemented.

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Appendix 1 . Meetings in India, February – March 2006

Mahesh	Buch	National Centre for Human Settlements and Environment
Gaurav	Bhatiani	USAID
Ravindra	Dholakia	IIM Ahmedabad, Professor
Shubhashis	Gangopadhyay	India Development Foundation, Director
Ashutosh	Gupta	Collector & District Magistrate, Chittorgarh District
Gajendra	Haldea	Adviser to DCH (Infrastructure), Planning Commission, India
Arvind	Jadhav	Ministry Of Power, Govt. of India, Joint Secretary
A.K.	Lakhina	Rural Electricity Corporation, Chairman and Director
Yaduvendra	Mathur	Government of Rajasthan, Secretary (Energy)
	Padmanabhan	USAID
Shreemat	Pandey	RRVPN Ltd., Chairman / MD
Kirit	Parikh	Planning Commission, Member
K S	Rathore	Collector & District Magistrate, Jalore District
S K	Sarkar	Tata Energy Research Institute (TERI)
Surya	Sethi	Planning Commission, Adviser (Power & Energy)
R S	Shekhawat	Additional District Magistrate, Chittorgarh District

Chief Engineer, Jaipur Discom (J/Z) Jaipur
(P&RE) Jaipur
Dy. Chief Engineer (MM) Jaipur
FA & COA, Jaipur
Chief Accounts Officer Jaipur
Superintending Engineers (JPDC), Jaipur
(M&P), Jaipur
(RE), Jaipur
(JCC), Jaipur
(Plan), Jaipur
(MM), Jaipur
(Proc.), Jaipur
(TW), Jaipur
(Comml.), Jaipur

Appendix 2. State-wise Details of Franchisee Deployed / In the Process of Being Deployed

State	Model	Unit and Nos	Village / Coverage
Assam	Revenue-Collection	Distribution Transformer (ST) Cluster of DTs	306 villages individual entrepreneurs
Bihar	Revenue-Collection	Distribution Transformer (ST) Cluster of DTs	NIT issue for 14,370 RGGVY villages and 20091 other villages
Chattisgarh	Revenue-Collection	Cluster of villages in a block	NIT issue for 1188 RGGVY villages and 18532 other villages
Haryana	Input Based	Distribution Transformer	NIT issued for 1 district
Karnataka	Revenue-Based	Micro Feeders in Gram Panchayat	3425 Gram Vidyut Pratinidhi covering 17125 Villages 40 Nos covering 800 villages
	Input Based	11KV Feeders	
Nagaland	Input Based	Individual Village	285 villages (Village Energy Management Board)
Punjab	Revenue-Collection	11 KV Feeders	NIT issued for all feeders except agricultural pumpset feeders
Rajasthan	Input Based	11 KV Feeders	NIT issued for 252 Feeders covering 1350 villages in one discom
Uttar Pradesh	Revenue-Collection Input Based	Cluster of villages 33/11 KV Substations	500 villages NIT invited for 15 Substations
Uttaranchal	Revenue-Collection	Village	Self Help Groups (Women participation) engaged in 2361 villages
West Bengal	Revenue - In 1 st phase	Cluster of villages, minimum 600 consumers	130 Self Help Groups in 677 mouzas

Source: MoP document entitled *National Programme of Franchisees under the RGGVY-Scheme of RE Infrastructure & Household Electrification*. http://powermin.nic.in/JSP_SERVLETS/internal.jsp. (accessed on October 10, 2006).