「インドにおける農村公的雇用保障プログラムが農村労働市場に与える影響」研究会中間報告書

Mid-Term Research Project Report （Project : *Understanding the Impact of Employment Guarantee Programme on Labour Market in India*）

Rural Electrification in Bihar: Progress and Ground Realities

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Abstract

Rural electrification is one of top items on the development agenda for the government of India. Although rural electrification continues under the Rajiv Gandhi Rural Electrification Programme that began in 2005 and the government celebrates its accomplishment of electrifying one *lakh* (100,000) villages, there are serious challenges ahead. This paper, based on our survey in rural Bihar, reveals that the progress of rural electrification may not be as advanced as government statistics indicate. Many villages became de-electrified in the past when inadequate government-provided transformers failed due to insufficient capacity. Some villages were fortunate and have been re-electrified, but many have been left un-electrified; simply waiting for the government

to help has proved to be an ineffective solution. This paper also reports on the issue of illegal connections. Power theft has become rampant in rural areas. As rural electrification progresses, access to electricity is easier than before. Governance is weak in rural areas, so there is virtually no checking and monitoring system for electricity use. These factors motivate some villagers to access electricity illegally. The government's program to provide electricity to all the villages and all the households in rural areas should not be slowed, but side effects such as illegal connections should be taken more seriously. If not, it will make rural electrification unsustainable as it will become another serious burden to India's power sector, which has been running at a loss for decades.

Key Words: rural electrification, illegal connection, de-electrification, RGVVY, caste, landholdings, Bihar, India

1. Introduction

Rural electrification is one of top items on the development agenda for the government of India. Because around 70% of India's total population lives in the country's rural areas, electrical supply to these areas is crucial in terms of both economic and social benefits.[1] Electricity has many economic benefits: it can be used for irrigation pumps, processing agricultural output, storing perishable agricultural goods, and so on.[2] Since agriculture is predominant in the rural economy, electricity can play a crucial role in reducing poverty and promoting rural development. The social benefits that electricity brings are manifold and critically important for well-being. It allows children to study and women to cook at night. It produces cleaner indoor air than biomass fuels, thus

contributing to human health (Barnes et al., 1997; UNDP/WHO, 2009). Furthermore, it gives rural populations access to telecommunication and mass media (Andreas, 2006). It has also been noted that electricity usage has a positive impact on rural women's lives as they can gain time for other activities by using electricity in their daily activities, such as cooking and pumping water (UNDP/World, Bank 2004; World Bank, 2012). Rural electrification has an indirect but important effect on women's participation in the Mahatma Gandhi National Rural Employment Guarantee Scheme (known as NREGA), which aims to reduce rural poverty by providing unskilled manual labor jobs for the poor, since women with some free time can join NREGA and earn wages for their family.[3] According to a recent report, "Electricity not only alleviates poverty in the near term but also holds the potential to do so over the longer run" (World Bank, 2012). Thus, the provision of electricity impacts the lives of rural populations. Because of the diverse nature and extent of the socioeconomic benefits of electricity in rural areas, rural electrification is a critical issue in many developing countries.[4]

In 1947, when India gained independence, only 1500 villages were electrified (Government of India, 2011a). The flagship rural electrification program *Rajiv Gandhi Grameen Vidyutikaran Yojana* (RGGVY: Rajiv Gandhi Rural Electrification Programme[5]) has been the main driver of rural electrification since its introduction in 2005.[6] As of the end of March 2012, more than 90% of all villages in India had access to electricity. Six of the major states (Andhra Pradesh, Punjab, Haryana, Karnataka, Kerala and Tamil Nadu) have attained 100% village-level electrification (Table 1). The rates are high even in low-income states such as Orissa (78.9%), Jharkhand (89.2%), Bihar (89.9%), and Uttar Pradesh (89.9%).

Table 1 State-wise Progress of Rural Electrification

State	Percentage of Village Electrified
Andhra Pradesh	100.0
Assam	96.1
Bihar	89.9
Jharkhand	89.2
Gujrat	99.8
Haryana	100.0
Himachal Pradesh	99.8
Jammu and Kashmir	98.2
Karnataka	100.0
Kerala	100.0
Madhya Pradesh	97.2
Maharashtra	99.9
Orissa	78.9
Punjab	100.0
Rajasthan	96.2
Tamil Nadu	100.0
Uttar Pradesh	88.9
West Bengal	99.7
India	93.9

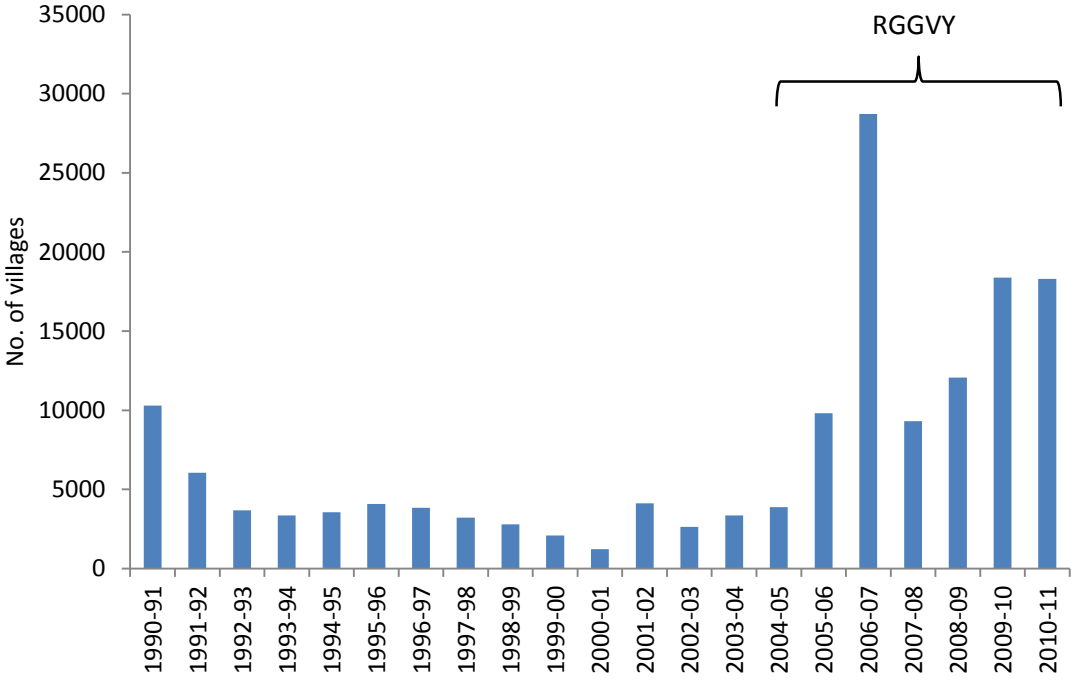
Note: Figure as of March 31, 2012.

Source: Indiastat (http://www.indiastat.com). The original data are from Ministry of Power, Government of India.

Because of attractive financial incentives, rural electrification has expanded rapidly since the introduction of RGGVY, as Figure 1 indicates, especially in underdeveloped states such as Uttar Pradesh, Bihar, and Jharkhand. For example, more than 27,000 villages have been electrified in Uttar Pradesh, 19,306 in Bihar, and 16,849 in Jharkhand. These three states account for nearly 70% of villages electrified under RGGVY.As of 31 December 2011, 100,917 un-electrified villages had been electrified

and 179.41 *lakh* (17.94 million) below poverty line (BPL) households received free electricity connections under RGGVY.[7] A further "intensive electrification" process in already electrified villages is being conducted in states where rates of village level electrification are already high. Since the target set by *Bharat Nirman* for RGGVY is to electrify one *lakh* (100,000) villages and to provide free electricity connections to 175 *lakh* (17.5 million) BPL households by March 2012[8], these figures suggest that the targets were achieved well before the deadline[9], and rural electrification continues to make progress under RGGVY.

Figure 1 The Annual Number of Electrified Villages



Note: The definition of electrification changed in 1997 and 2004.
Source: Government of India (2012)

Judging from these figures, village level electrification has been successful and would seem to not be an issue in India anymore. However, through our village surveys we

observed several problems in rural electrification. In this paper, we discuss two of them; one is the issue of de-electrification, and the other is illegal electricity connections. The organization of the paper is as follows: Section 2 describes the selection of surveyed villages and households; Section 3 discusses de-electrification and re-electrification of villages; Section 4 examines illegal access to electricity; and Section 5 concludes.

2. Selection of Surveyed Villages and Households in Bihar

To investigate the status of rural electrification, we carried out a village-level survey in 80 villages during 2008–09 and 2011–12 with the help of the Asian Development Research Institute. Because of Bihar's three-tiered organization for rural self-government at district, block and village (*gram*) levels, known as the *panchayat* system, we used the following method to select 80 villages to be surveyed.

First, five districts in Bihar state (Bhagalpur, East Champaran, Kishanganj, Madhubani, and Rohtas) were selected, one from each of the five district groupings, in accordance with ranking on the livelihood potential index (Figure 2). This index is compiled on the basis of availability of land per rural household, cropping intensity, agricultural productivity, head of cattle per 1000 people, and percentage of urban population (for details, see ADRI, undated). Since approximately 90% of the state's population resides in rural areas and nearly 80% of its rural workforce is engaged in the agriculture sector, indicators related to farming and farming-related activities were regarded as the most important criteria for measuring livelihoods. A summary of the socioeconomic characteristics of each district is provided in Table 2.

Table 2 Socioeconomic Indicators for Surveyed Districts

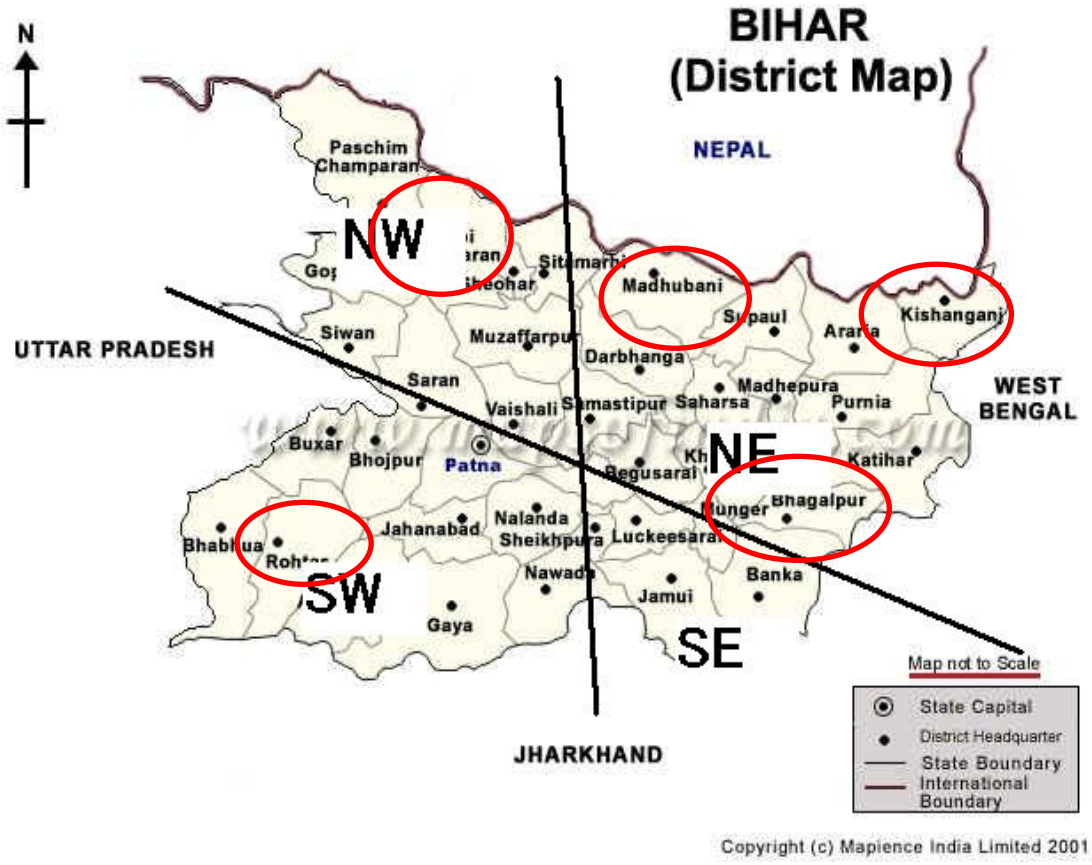
District	Survey year	Rohtas	Kishanganj	Bhagalpur	Madhubani	East Champaran	Bihar
Per capita net district domestic product in 2004/05 prices (INR)	2009/10	11,167	8243	14,396	7584	7640	11,944
Literacy rate (%)	2011	75.59	57.04	64.96	60.9	58.26	63.82
Infant mortality rate (per 1,000 births)	2005	49.28	79.89	66	82.36	80.7	61
Proportion of SCs (%)	2011	18.55	6.69	10.51	13.12	12.78	15.96
Proportion of Muslims (%)	1991	9.4	65.9	16.1	16.7	18.4	15.7
Availability of land per rural household (hectare)	2003/04	0.84	0.57	0.42	0.35	0.47	0.45
Cropping intensity	2003/04	1.43	1.49	1.22	1.41	1.12	1.38
Agricultural productivity (yield of paddy, tons of rice per hectare)	2003/04	2.65	1.5	1.27	1.01	1.39	1.58
Heads of cattle per 1000 people	2005	235	241	197	198	132	196
Percentage of urban population	2011	14.43	9.68	19.79	3.68	7.85	11.3

Source: ADRI (undated); Government of Bihar (2013); Mishra (2012); Singh and Tiwari (undated)

Second, we randomly selected four blocks from each district and four *gram panchayats* (GPs) from each selected block. We then conducted field visits to each GP, during which we selected one village on the basis of two criteria: (1) caste composition, and (2) the population size that best represented a given GP.

Village-level surveys were carried out in all selected villages, the components of which included questions on socioeconomic characteristics; physical infrastructure, including electricity, water, and sanitation; road conditions; housing; access to social services, including education, healthcare, and the public distribution system; land and agriculture; labor and migration; implementation of government schemes; *panchayat* election history; and social aspects of the community.

Figure 2 Sample District Map



To obtain information on illegal electric connections, household-level interviews were conducted in 2011–12 in 14 electrified villages selected randomly from the 80 sampled villages in the five districts. From each village, 50 households were selected as sample households. After excluding non-response households and households providing incomplete data, the number of valid sampled households was 692 in the 14 villages (149 households from Bhagalpur, 99 from East Champaran, 147 from Kishanganj, 98 from Madhubani, and 199 from Rohtas). A social and economic profile of sample households is presented in Table 3.

Table 3 Brief Profile of Sample Villages and Households

	Bhagalpur	East Champaran	Kishanganj	Madhubani	Rohtas	Total
All households	149	99	147	98	199	692
General Hindu	1	16	0	15	21	53
OBCs	13	14	2	10	106	145
EBCs	52	45	39	21	16	173
SCs	1	22	52	10	56	141
Muslims	82	2	54	42	0	180
% landholding households	16.1%	42.4%	36.1%	41.8%	68.3%	42.1%
Average size of household landholdings (acre)	0.159	0.753	0.525	0.567	1.728	0.829
	(0.509)	(1.681)	(1.428)	(1.192)	(3.537)	(2.238)
Average size of household (people)	5.860	5.710	5.200	5.63	6.645	5.889
	(2.422)	(2.952)	(2.346)	(2.321)	(2.919)	(2.670)

Note: Figures in parentheses indicate standard deviations.
Source: IDE-ADRI survey 2011-12.

3. Village-level Electrification, De-electrification, and Re-electrification

While the official statistics indicate steady progress in rural electrification, the reality on the ground differs from the report published by the Ministry of Power (MOP). Table 4 shows a comparison of village-level electrification between 2008–09 and 2011–12. Overall, the number of electrified villages increased from 41 to 46 within roughly three years. However, a closer look at the data reveals that electrification progress varies by district. For example, Kishanganji, the most backward among the sample districts, actually benefitted from the RGGVY program, with the number of electrified villages increasing from 4 to 11 (of 16) villages, while it declined due to de-electrification from 14 to 9 villages in Rohtas district, the most affluent among the districts and where electrification for agricultural purposes had started as early as the 1960s. This evidence shows the success of RGGVY in bringing electricity to villages in underdeveloped districts, which is the main objective of the program, but it also confirms a looming issue of de-electrification.

It is likely that many of these de-electrified villages are still counted as

electrified villages in the official figures, as pointed out by Oda (2012), who reports that MOP considers villages as being electrified if a transformer has ever been installed. The actual situation at the local level contradicts official information released by the government, and this may cast doubt on the credibility of the figures published by the MOP.

Table 4 Comparison of Village-level Electrification Status in 2008-09 and 2011-12

2008-09						
District	Rohtas	Kishanganji	Bhagalpur	Madhubani	East Champaran	Total
No. of electrified Villages	14	4	10	6	7	41
No. of unelectrified Villages	2	12	6	10	9	39
Rate of electrification (%)	87.5	25.0	62.5	37.5	43.8	51.3
2011-12						
District	Rohtas	Kishanganji	Bhagalpur	Madhubani	East Champaran	Total
No. of electrified Villages	9	11	11	8	7	46
No. of unelectrified Villages	7	5	5	8	9	34
Rate of electrification (%)	56.3	68.8	68.8	50.0	43.8	57.5

Source: IDE-ADRI Surveys 2008-09 and 2011-12.

In our 80 sample villages, 40 villages had experienced de-electrification at least once in the past. The main reason for de-electrification was failure of the installed transformer (See Table 5). Transformers in all 40 de-electrified villages burned out due to excessive load. The load capacity of transformers provided by the government is 16

kVA, which is not sufficient to support the existing and rising demand for electricity. The other major reason is theft of wire, transformers, and transformer coils. Commonly in rural areas, these items are stolen to collect metal to sell for cash.

Table 5 Reasons for de-electrification (Multiple Answers)

Reasons	No. of villages
Transformer burned out	40
Theft of wire	13
Theft of transformer	2
Wire fell down	2
Theft of transformer coil	1
Flood	1
No electricity supply	1

Note: The number of de-electrified villages is 40.

Source: IDE-ADRI Survey 2011-12.

The survey suggests that once the village becomes de-electrified it is not easy to electrify again. Only 18 villages were re-electrified out of 40 de-electrified villages. Some villages were re-electrified through the ordinary process of the RGGVY, but the majority were not. As Table 6 indicates, villagers' efforts were necessary to get the village re-electrified in the majority of cases. Simply waiting for the government scheme is time-consuming, and there is no guarantee of success if no additional effort is made. One example is that some villages that were de-electrified in the early 1980s remained un-electrified at the time of the survey.

Table 6 Reasons for re-electrification (Multiple Answers)

Reasons	No. of villages
Villagers' joint efforts	8
Government scheme, such as RGVVY or a rehabilitation program	5
Money collected by villagers to repair a transformer or purchase a new transformer	5
Help of local MLA, MP, or politician	4

Note: The number of re-electrified villages is 18.

Source: IDE-ADRI Survey 2011-12.

In five of the sampled villages, re-electrification occurred not by asking the government for assistance but by collecting money to repair or purchase a new transformer. One village collected as much as Rs. 112,000 to buy a transformer with a higher capacity. This method of re-electrification process is not simple. It requires leadership, and the village needs to be in agreement. Assisting in this, it is reasonable to suppose that most villagers have mutual interests, such as improving agricultural productivity by electrifying irrigation pumps and other agricultural equipment.[10]

Political power also plays an important role. The effects of political influence in the process of electrification seem to have been reduced since the introduction of the RGGVY, but there is a lot of anecdotal evidence that it is still important, as we found in our survey. Respondents from four villages said that they approached local members of the legislative assembly, members of Parliament, or other political figures for the purpose of soliciting them to re-electrify the village.

De-electrification and re-electrification of villages make it difficult to accurately describe the state of rural electrification. In our 80 sample villages, we found that 34 villages were un-electrified at the time of the survey and 13 villages had never been electrified, as shown in Table 4. That means 21 villages that were once electrified became de-electrified and remained in that condition until the time of survey. This

highlights the need to distinguish between villages that have never been electrified and villages that were once electrified but became de-electrified later when examining such issues as the determinants of electrification. The former type of village differs fundamentally from the latter type, and the two types should not be grouped together as un-electrified villages.

4. Illegal Connections and Power Theft in Villages

Power theft is recognized as a serious problem in many developing countries, but the official data show that it is extreme in India. Power loss, which can be calculated as the ratio of power charged and paid for to the total power generated, averages 12.2% in developing countries[11,12], but averages 28% in India (Government of India, 2012) with the rate much higher in some states, such as Bihar at around 50%. These figures include technical losses in transmission and distribution, but theft is considered the major component of power loss. The related high level of revenue loss poses a serious threat to the financial condition of India's power sector, which has run in the red for decades. Reducing power loss is therefore one of the most important agenda items in power sector reform.

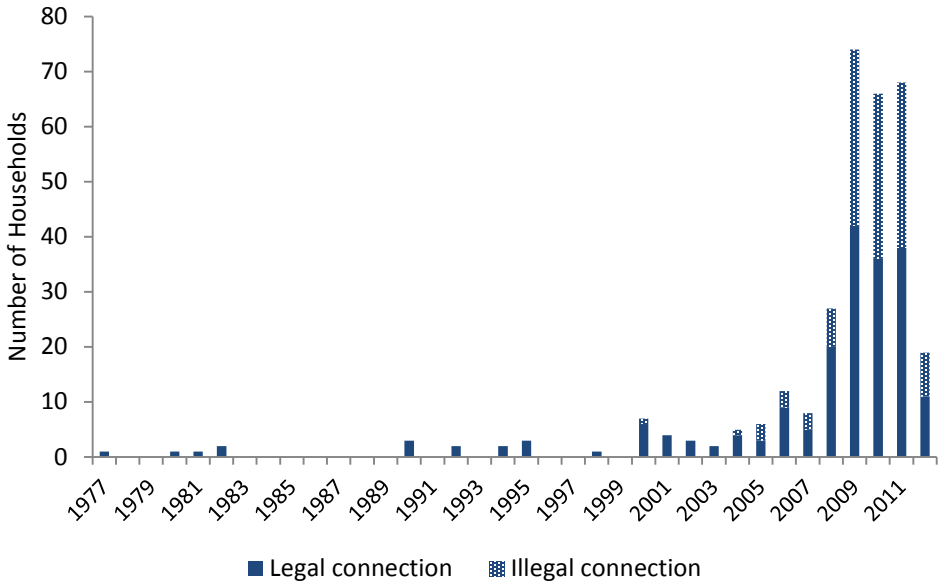
Power theft has also become common recently in rural areas. Overuse and misuse of electricity intended for agricultural purposes have both been observed. Because the electricity for agricultural use is heavily subsidized (it was free of charge for a specific number of hours a day in Punjab and Tamil Nadu in the past), many farmers try to take advantage of the policy. A newer phenomenon in rural areas is power theft for household use. As rural electrification progresses, access to electricity becomes easier than before. Governance is also weak in rural areas, with virtually no checking

and monitoring systems. These factors motivate some villagers to access electricity illegally. The issue of power theft is looming in rural areas and is increasingly becoming another burden on India's power sector.

Among 46 electrified villages from the 80 villages sampled in 2011–12, all villages report that not every household in the village is legally connected to electricity, though the degree of power theft varies. In several villages, more than 70% of households were illegally connected. Surprisingly, we found illegally connected households in one un-electrified village, where we assume that they had extended wires to a neighboring village for electricity.

Figure 3 depicts the progress of electrification (both legal and illegal connections) among sample households. As indicated, illegal connections have been increasing rapidly along with the progress of rural electrification since the introduction of RGGVY in 2005. This is simply because access to electricity has become easier and the demand for electricity has increased at the household level for uses such as mobile phone charging.

Figure 3 Progress of Rural Electrification at the Household Level



Source: IDE-ADRI Survey 2011-12.

We found that 339 of the 692 households in the sample (49.0%) received electricity, either legally or illegally, and 333 (51.0%) were un-electrified at the time of our 2011–12 survey (Table 7).[13] Among 339 so-called electrified households, 205 households had legal access to electricity while 134 had illegal connections. Some 40% of sample households were therefore illegally electrified. The degree of illegal connections seems to vary by region. The rate of illegal connections is high in Rohtas, where agriculture is most important among the five sampled districts. Out of 145 electrified households, 86, or nearly 60% of them, have illegal electricity connections. East Champaran, Kishanganji, and Madhubani, which are considered backward districts, have lower rates of illegal connections, with only one household found to be connected illegally. In Rohtas, some villages have been electrified for agricultural purposes since the 1960s, so that households which used to be legally connected learned over time how to make illegal connections, so illegal connections are more widespread in this district than in

others. In contrast, in East Champaran, Kishanganji, and Madhubani, electrification has just started so villagers are not as aware of how to make illegal connections, or they are reluctant to do so.

Table 7 Status of Electrification at the Household Level in 2011-12 Survey

	Bhagalpur	East Champaran	Kishanganj	Madhubani	Rohtas	Total
Size of sample	149	99	147	98	199	692
Electrified ((1)+(2))	86	19	60	29	145	339
Legal connection (1)	*61*	*18*	*42*	*25*	*59*	*205*
Illegal connection (2)	*25*	*1*	*18*	*4*	*86*	*134*
Unelectrified	63	80	87	69	54	353
Rate of Electrification						
Electrified ((1)+(2))	57.7%	19.2%	40.8%	29.6%	72.9%	49.0%
Legal connection (1)	*40.9%*	*18.2%*	*28.6%*	*25.5%*	*29.6%*	*29.6%*
Illegal connection (2)	*16.8%*	*1.0%*	*12.2%*	*4.1%*	*43.2%*	*19.4%*
Unelectrified	42.3%	80.8%	59.2%	70.4%	27.1%	51.0%

Source: IDE-ADRI Survey 2011-12.

An interesting question is whether household choice over legal and illegal connections correlates with social and economic characteristics. First, we briefly examine the relation between social class and legal/illegal access to electricity. We classify sample households by social class—General Hindu, Other Backward Caste (OBC), Extremely Backward Caste (EBC), Scheduled Caste (SC), or Muslim—and also sort them according to electrification status—legally connected, illegally connected, or un-electrified. It is evident from Table 8 that rates of electrification are comparatively higher among General Hindu and OBC households than among SC and Muslim households. As for legality of electricity access, illegal connections are seen more among General Hindu and OBC households, probably due to having more access to formal legal electricity, which makes it easier to connect illegally.

Table 8 Household Electrification and Social Classes

	General		OBC		EBC		SC		Muslim		Total	
Electrified households	31	58.5%	90	63.8%	85	49.1%	57	39.3%	76	42.2%	339	49.0%
Legal connection	*17*	*32.1%*	*51*	*36.2%*	*67*	*38.7%*	*25*	*17.2%*	*45*	*25.0%*	*205*	*29.6%*
Illegal connection	*14*	*26.4%*	*39*	*27.7%*	*18*	*10.4%*	*32*	*22.1%*	*31*	*17.2%*	*134*	*19.4%*
Unelectrified households	22	41.5%	51	36.2%	88	50.9%	88	60.7%	104	57.8%	353	51.0%
Total	53	100.0%	141	100.0%	173	100.0%	145	100.0%	180	100.0%	692	100.0%

Source: IDE-ADRI Survey 2011-12.

Second, we look at the relationship between landholding and access to electricity. For this analysis, we further divide Table 8 into two parts: one for landowners, and the other for landless households (Table 9). This division by landholding indicates that landholding households are more electrified than landless households, at 59.5% and 41.4%, respectively. Landholding households have more electricity access in all social classes except in the Muslim group.

Table 9 Cross-tabulation of Household-level Electrification Status by Landholding and Social Class

	Landowners											
	General		OBC		EBC		SC		Muslim		Sub-TTL	
Electrified households	30	62.5%	76	66.1%	36	64.3%	12	50.0%	19	39.6%	173	59.5%
Legal connection	*16*	*33.3%*	*41*	*35.7%*	*31*	*55.4%*	*3*	*12.5%*	*14*	*29.2%*	*105*	*36.1%*
Illegal connection	*14*	*29.2%*	*35*	*30.4%*	*5*	*8.9%*	*9*	*37.5%*	*5*	*10.4%*	*68*	*23.4%*
Unelectrified households	18	37.5%	39	33.9%	20	35.7%	12	50.0%	29	60.4%	118	40.5%
Total	48	100.0%	115	100.0%	56	100.0%	24	100.0%	48	100.0%	291	100.0%

	Landless											
	General		OBC		EBC		SC		Muslim		Sub-TTL	
Electrified households	1	20.0%	14	53.8%	49	41.9%	45	37.2%	57	43.2%	166	41.4%
Legal connection	*1*	*20.0%*	*10*	*38.5%*	*36*	*30.8%*	*22*	*18.2%*	*31*	*23.5%*	*100*	*24.9%*
Illegal connection	*0*	*0.0%*	*4*	*15.4%*	*13*	*11.1%*	*23*	*19.0%*	*26*	*19.7%*	*66*	*16.5%*
Unelectrified households	4	80.0%	12	46.2%	68	58.1%	76	62.8%	75	56.8%	235	58.6%
Total	5	100.0%	26	100.0%	117	100.0%	121	100.0%	132	100.0%	401	100.0%

Source: IDE-ADRI Survey 2011-12.

As for illegal connections, landholding households tend to engage more in illegal access to electricity, probably for the same reason as above (i.e., more access to electrical supply). A cross-tabulation of social classes and landownership reveals that landed General Hindu, OBC, and SC households have higher rates of illegal

connections than landed EBCs and Muslims, and landless households are relatively more often connected legally, regardless of social class.

5. Summary and Conclusion

This paper, based on our survey in rural Bihar, reveals that the progress of rural electrification may not be as advanced as government statistics indicate. Due to the insufficient load capacity of government-provided transformers, many villages became de-electrified in the past. Some villages recovered and got re-electrified, but many have been left un-electrified. While rural electrification is continuing under the RGGVY and the government celebrates its accomplishment of connecting electricity to one *lakh* (100,000) villages, there are many challenges ahead.

During our survey in several villages we came across privately installed wires from a local diesel-powered electrical generator. Typically, villagers buy small quantities of electricity from a *generator wallah* (a person who owns an electrical generator) to power a light bulb at night. This kind of business is mushrooming.

The story of such private generator businesses has some important policy implications. Of course, it is not sustainable from a long-term perspective, and it is ironic to see this type of business growing while coverage of rural electrification is expanding, but it clearly fills a gap in the supply of electricity. What we can learn from this business is the importance of the decentralized distribution of electricity rather than the conventional connection through national and local grids. In particular, the decentralized distribution of electricity or use of renewable energy (such as solar power) is needed in small villages in remote locations, where grid access is financially and technically difficult.

We also report the issue of illegal connections. As far as we know, no papers in the past have discussed this increasing phenomenon in rural areas. Power loss is a critical issue in India's power sector. For the sector to be financially sound, the reduction of power loss is essential. Efforts have been made in this regard, for example, by privatizing the power sector. In some areas, the effort has borne fruit, as in Delhi, where power loss was reduced considerably after power distribution was privatized. Nevertheless, what we report here must be seen as bad news. Illegal electricity connections are damaging the power sector reform process and the magnitude of the problem is still not exactly known. The government's program to provide electricity to all villages and households in rural areas should not be slowed, but side effects, such as illegal connections, must be addressed to make rural electrification sustainable.

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[1] See Barnes (1988) for a detailed survey on the socioeconomic benefits of electrification.

[2] In the Indian context, the World Bank (2002) reports that agricultural productivity declined by

5–13% due to the lack of electricity.

[3] The Mahatma Gandhi National Rural Employment Guarantee Act, enacted in 2005 (popularly known as NREGA), aims to improve the livelihood of the adult rural population by providing unskilled manual work for 100 days per household per financial year. The, daily wage is generally more than the statutory minimum wage. More importantly, women are paid the same daily wage as men, which is not usual for agriculture work in rural areas. See Ravallion et. al. (1993), Gaiha (1997), and Khera (2011) for more details.

[4] There is no doubt that electrification can contribute to economic and social development in the rural economy, but it should be noted that there have been debates about the cost-effectiveness of investment, affordability for rural consumers, and the socioeconomic and environmental impacts (Barnes, 1988; Bhattacharyya, 2006). There is also a tension inherent to the expansion of electricity services to rural areas while the country's generating capacity fails to meet existing electricity demand.

[5] RGGVY merged several electrification programs, such as *Kutir Jyoti Yojana* (launched in 1988–89), and the Accelerated Electrification of One-*Lakh* (one hundred thousand) Villages and One-*Crore* (ten million) Households (launched in 2004–05). The RGGVY program aims to electrify one *lakh* villages and provide access to electricity for 2.34 *crore* rural BPL households. Under this scheme, there is provision for a 90% capital subsidy by the Union government for rural electrification infrastructure, with the remaining 10% is soft-loaned by the Rural Electricity Corporation to State governments. The program also funds un-electrified BPL households with a 100% capital subsidy for electrification.

[6] Prior to October 1997, a village was defined as electrified if, "electricity is being used within its revenue area for any purpose whatsoever." For example, a village was considered as electrified if any of its irrigation pumps used electricity. This is because the initial government priority was to realize the economic benefits of rural electrification, particularly those from electrifying irrigation pumps. However, the definition was changed in 1997 to the following: "A village will be deemed to be electrified if the electricity is used in the inhabited locality, within the revenue boundary of the village for any purpose whatsoever." The change reflected the increasing awareness of social aspects of rural electrification and the shift of the main target of electrification from villages to households. The new definition came into effect in February 2004. As per the new 2004 definition, "a village would be declared as electrified, if 1) Basic infrastructure such as Distribution Transformer and Distribution lines are provided in the inhabited locality as well as the *Dalit Basti* hamlet where it exists; 2) Electricity is provided to public places like Schools, *Panchayat* Office, Health Centers, Dispensaries, Community centers, etc.; 3) The number of households electrified should be at least 10% of the total number of households in the village." (Ministry of Power, Government of India, http://www.powermin.nic.in)

[7] Figures are from the website of the Ministry of Power, Government of India (http://www.powermin.nic.in/), accessed on March 14, 2012. There is some discrepancy in data. In Table 3, the number is a little bit short of one *lakh*.

[8] Under *Bharat Nirman*, action plans for rural infrastructure in the areas of irrigation, road, rural housing, rural water supply, rural electrification, and rural telecommunication connectivity are proposed. Visit *Bharat Nirman*'s website (http://www.bharatnirman.gov.in) for more details.

[9] There is a slight difference of target between RGGVY and *Bharat Nirman*.

[10] Oda and Tsujita (2011) found (using their own Bihari village survey data) that villages with a functional agricultural cooperative, which is used as an instrumental variable for cohesion or unitedness of village, tend to be electrified.

[11] India's figure comes from Government of India (2011b). The average rate of power loss of developing counties is obtained from the World Bank data website

(http://data.worldbank.org/indicators).

[12] Power loss is defined in India as the Aggregate Technical and Commercial Losses. The technical losses occur in transmission and distribution due to aging and deteriorated transmission lines and transformers. The commercial losses are due to power theft, non-payment of bills, misuse of electricity, and so on.

[13] These figures are well above the Census figure for rural household electrification, which reports 10.4% of rural households in Bihar receiving electricity. This is primarily because (1) our study considers only electrified villages, and un-electrified villages were dropped from our sample, and (2) the definition of electrification used for the Census is different from ours. If un-electrified villages were included in the sample, the overall rate of household electrification would be 34.2%. In the Census, households are considered electrified if the major source of lighting is electricity. Since electrical supplies in Bihar are unstable and limited, many households might answer that the major source of lighting is not electricity, even though they received electricity. This would create a gap in the rate of electrification between the Census figure and the figure obtained from our field survey.