Progress and issues in rural electrification in Bihar, India : a preliminary analysis

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Progress and Issues in Rural Electrification in Bihar, India: A Preliminary Analysis

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Abstract: Rural electrification has been an important part of government policy since India gained independence. However, despite the number of electrified villages expanding rapidly in recent years, there are many that still remain un-electrified. This paper addresses the issue of intra-state disparity in access to electricity and examines the determinants of electrification at the village level using data from a survey conducted in rural Bihar, one of the underdeveloped states in India. An econometric analysis demonstrates that small villages in remote locations tend to be considered a low priority in the process of electrification. Electrification at the village level in the more advanced states is no longer an issue, though the challenge of access to electrification at the household level remains. This paper also discusses issues that emerged from interviewing villagers and visiting rural areas, and shows that the actual progress of rural electrification may not be as advanced as government statistics indicate.

Keywords: Rural electrification, Bihar, India
JEL classification: H41, O20, Q40

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Progress and Issues in Rural Electrification in Bihar: A Preliminary Analysis

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1. Introduction

Rural electrification has been an important part of government policy since India gained independence. Because that is where around 70% of India's total population live, electric supplies to rural areas are critically important in terms of both economic and social benefits[2].

As in other developing countries[3], access to electricity in rural areas is limited in India. However, in recent years, due to the government initiatives for rural electrification, the numbers of electrified villages as well as that of electrified households have been rapidly increasing. In 1947 when India gained independence, only 1500 villages were electrified, but the number of electrified villages increased to close of 500,000 as of the end of March 2010, which roughly covers 84 % of all villages in India. From 2005 till today, more than one *lakh* (one hundred thousand) villages have been electrified.

The overall rate of electrification seems high but there is a considerable inter-state gap between advanced and underdeveloped states. For example, Andhra Pradesh, Punjab, Haryana, Kerala and Tamil Nadu have attained 100% electrification, while the rates in Jharkhand (31.1%), Bihar (61.3%), Orissa (62.6%), and Rajasthan (71.5%) remain low. The village level electrification in the advanced states may not be an issue but it still remains a challenge for the underdeveloped states. Furthermore, there exists an intra-state gap in access to electricity. That is; within a state, there are villages where electricity is available and there are villages where electricity is not supplied. My interest lies in this point and this paper attempts to examine what factors makes such a divide.

A couple of papers have examined the determinants of rural electrification in India. A series of research papers by Andreas are the pioneer work on this topic. Based on the 2001 Census data, Andreas (2006) analyzed the influencing factors on the village level electrification.

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[2] See Barnes (1988) for a detailed survey on socio-economic benefits of electrification. In the Indian context, the World Bank (2002) reports that agricultural productivity has declined by 5% to 13% due to the lack of electricity.

[3] According to International Energy Agency, in 2005, 1.57 billion people in developing countries lived every day without electricity (IEA, 2006). This roughly corresponds to one-third of the total population of developing countries.

Andreas (2009) studied the determinants of rural electrification at the household level, employing the 55th National Sample Survey (1999–00) data. These two studies successfully examined the process of rural electrification, and provided important insights. Oda and Tsujita (2011) is another paper that challenged this topic. It particularly paid attention to the determinants of village level electrification in Bihar. Overall, there is a scarcity of literature on this issue.

In basic, this paper is an update and re-examination of Oda and Tsujita (2011). The paper addresses the issue of intra-state disparity in access to electricity and examines the determinants of electrification at the village level using data from a survey conducted in rural Bihar, one of the underdeveloped states in India. An econometric analysis demonstrates that small villages in remote locations tend to be considered a low priority in the process of electrification. Electrification at the village level in the more advanced states is no longer an issue, though the challenge of access to electrification at the household level remains. This paper also discusses issues that emerged from interviewing villagers and visiting rural areas, and shows that the actual progress of rural electrification may not be as advanced as government statistics indicate.

The remainder of the paper is organized as follows: Section 2 briefly provides an overview of the progress of rural electrification in India. Section 3 examines the determinants of electrification at the village level using econometric analyses to describe the influencing factors. Section 4 raises issues that have emerged during our field survey and discusses them. Section 5 presents our concluding remarks.

2. Progress of Rural Electrification

2.1 Definition of Rural Electrification

This section examines the progress of rural electrification. Before proceeding further, there is a need to define what rural electrification is as the definition changed from time to time. Prior to October, 1997, the definition was that "A village should be classified as electrified if electricity is being used within its revenue area for any purpose whatsoever." For example, a village was deemed as electrified if any of its irrigation pumps used electricity. This is because the initial government objective was placed on economic benefits of rural electrification, particularly those gaining from electrifying irrigation pumps. However, the definition was changed in 1997 as follows; "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 accordingly.

Then the definition was further modified in February 2004 and is still in use. In addition

to more emphasis on household electrification, the 2004 new definition takes into account of electrification at *Dalit*'s (outcaste) hamlets and at public facilities[4]. Specifically it includes the following three conditions according to the website of the Ministry of Power, Government of India (http://www.powermin.nic.in); "As per the new 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."

Though the new definition still has some problems such as the lack of quality issues, there have been significant improvements over the years.

2.2 Progress of Rural Electrification

In 1947 when India gained independence, only 1500 villages were electrified (Government of India 2011). As of the end of March 2010, 497,398 out of 593,015 villages in India had been electrified (Government of India, 2010). This corresponds to 83.9% of all villages in India[5](See Table 1). The overall rate of electrification is high but there is a considerable inter-state gap. For example, Andhra Pradesh, Punjab, Haryana, Kerala and Tamil Nadu have attained 100% electrification, while the rates in Jharkhand (31.1%), Bihar (61.3%), Orissa (62.6%), and Rajasthan (71.5%) remain low. The village level electrification in the former states may not be an issue but it still remains a challenge for the latter states. There is a high correlation between the level of development and electrification. It is also reminded that the village level electrification is not identical to the household level electrification. Electrification at the household level usually tends to be lower among the states with lower rates of electrification at the village level.

Under the Fifth Five-Year Plan (1975–79), the government launched rural electrification scheme with the start of its Minimum Needs Program. This is the first rural electrification program introduced by the union government. Currently the *Rajiv Gandhi Grameen Vidyutikaran Yojana* (RGGVY: Rajiv Gandhi Rural Electrification Programme), which started in April 2005 as part of the National Common Minimum Program of the United Progress Alliance

[4] Due to this change of definition, the rate of village electrification declined considerably in some states. The rate in Bihar, for example, declines to 30.2% from 61.3% under the new definition (Government of Bihar, 2010).

[5] Although the new definition came into effect in February 2004, it seems that many of the official figures still use the old definition including this figure.

(UPA), the coalition government that came to power in 2004, plays a central role in rural electrification. It 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 programme aims at electrifying one *lakh* villages and providing access to electricity for 2.34 *crore* rural Below Poverty Line households. Under this scheme, there is a provision of 90% capital subsidy by the union government for rural electrification infrastructure and the remaining 10% is soft-loaned by the Rural Electricity Corporation to state governments. It also funds un-electrified BPL households 100% capital subsidy for electrification. The RGGVY has been part of *Bharat Nirman*, which is a time-bound action plan for rural infrastructure by the government[6].

Because of its attractive financial package, rural electrification has been rapidly expanding since the introduction of RGGVY in 2005 as Figure 1 and Table 2 indicate. It can be observed that the annual number of village electrified has increased since 2005. Particularly the village level electrification process has been in place in underdeveloped states such as UP, Bihar and Jharkhand (Table 3). For example, more than 27,000 villages have been electrified in Uttar Pradesh. In Bihar the number is 19,306 while it is 16,849 in Jharkhand. These three states account for close to 70 % of villages electrified under the RGGVY programme since its introduction. A further electrification process (intensive electrification) in already electrified villages has been going on particularly in states where high rates of village level electrification prevail. As on 31st December, 2011, 100,917 un-electrified villages have been electrified and 179.41 *lakh* BPL households gained free electricity connections under the RGGVY programme.[7] Since the targets set by *Bharat Nirman* for the RGGVY programme are to electrify one *lakh* villages and to provide free electricity connections to 175 *lakh* BPL households by March 2012[8], these figures are enough to achieve the targets well before the deadline. Judging from the information so far, rural electrification is making progress under the RGGVY programme.

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[6] 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.

[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] There is a slight difference in the target between RGGVY and *Bharat Nirman*.

Table 1 Current status of electrification at the village level

State	Percentage of Village Electrified
Andhra Pradesh	100.0
Assam	78.6
Bihar	61.3
Jharkhand	31.1
Gujrat	99.7
Haryana	100.0
Himachal Pradesh	98.2
Jammu and Kashmir	98.2
Karnataka	99.9
Kerala	100.0
Madhya Pradesh	96.4
Maharashtra	88.3
Orissa	62.6
Punjab	100.0
Rajasthan	71.5
Tamil Nadu	100.0
Uttar Pradesh	88.3
West Bengal	99.5

Note : Figures as of March 31st, 2010

Source : Ministry of Power's Homepage(http//www.powermin.nic.in).

Table 2 Status of BPL households electrification

	2009-10	2010-11	2011-12*	Cumulative achievement under RGGVY		Achievement rate (%)
	Achievement	Achievement	Achievement	Target**	Achievement	
Andhra	566,518	258,751	65,106	2,669,025	2,669,147	100.00
Arunachal	967	9,205	9,841	40,810	20,013	49.04
Assam	189,816	352,237	185,368	994,991	760,139	76.40
Bihar	560,985	641,016	179,708	2,725,632	1,923,806	70.58
Chattisgarh	145,990	196,552	63,625	851,203	497,061	58.40
Gujarat	85,931	420,126	83,319	782,210	784,003	100.23
Haryana	69,453	90,535	20,596	252,555	204,421	80.94
Himachal	148	3,637	5,150	13,196	9,327	70.68
J&K	14,163	8,452	11,532	81,309	42,133	51.82
Jharkhand	555,289	359,213	68,934	1,815,848	1,230,092	67.74
Karnataka	134,949	48,861	45,217	954,673	829,809	86.92
Kerala	6,131	1,117	0	55,755	17,238	30.92
Madhya	75,477	211,816	233,369	1,311,511	597,787	45.58
Maharashtra	429,026	403,387	111,924	1,202,575	1,146,339	95.32
Manipur	1,640	4,397	3,089	107,369	12,482	11.63
Meghalaya	17,832	12,880	16,779	109,696	48,755	44.45
Mizoram	378	8,129	4,412	27,417	12,919	47.12
Nagaland	4,368	13,434	7,966	69,899	25,768	36.86
Orissa	650,678	1,435,007	329,371	3,204,803	2,559,184	79.85
Punjab	19,507	28,890	0	148,860	48,397	32.51
Rajasthan	208,695	255,939	59,643	1,181,621	1,017,382	86.10
Sikkim	66	7,121	1,924	11,458	9,111	79.52
Tripura	22,085	36,886	14,895	123,037	73,866	60.04
Tamilnadu	383,533	115,044	4,083	502,865	502,956	100.02
Uttar	157,263	15,818	28,698	900,662	900,618	100.00
Uttarakhand	72,382	19,596	3,967	233,509	229,237	98.17
West Bengal	345,198	925,309	402,898	2,641,101	1,769,805	67.01
Total	4,718,468	5,883,355	1,961,414	23,013,590	17,941,795	77.96

Note : *Up to 31st December, 2011. ** Revised Coverage (Provisional)

Source : Ministry of Power's Homepage(http//www.powermin.nic.in).

Table 3 Number of un-electrified/electrified villages where electrification works are completed under RGGVY

State	No. of Un-electrified & De-electrified Villages where Electrification has been completed	No. of Perviously Electrified Villages where Intensive Electrification has been completed	Total
Andhra Pradesh	0	19822	19822
Arunachal Pradesh	738	494	1232
Assam	5371	6039	11410
Bihar	19306	2229	21535
Chhattisgarh	126	7557	7683
Gujarat	0	5430	5430
Haryana	0	3095	3095
Himachal Pradesh	72	915	987
Jammu & Kashmir	58	1388	1446
Jharkhand	16849	4768	21617
Karnataka	55	10910	10965
Kerala	0	22	22
Madhya Pradesh	303	8954	9257
Maharashtra	0	19112	19112
Manipur	102	36	138
Meghalaya	566	1372	1938
Mizoram	56	198	254
Nagalanad	75	482	557
Orrisa	12840	16540	29380
Rajasthan	3862	26507	30369
Sikkim	0	36	36
Tamil Nadu	0	3040	3040
Tripura	74	271	345
Uttar Pradesh	27666	469	28135
Uttarakhand	1405	1439	2844
West Bengal	4142	8820	12962
Total	93666	149945	243611

Note : Figures up to 2nd March, 2012.

Source : Ministry of Power's Homepage(http//www.powermin.nic.in).

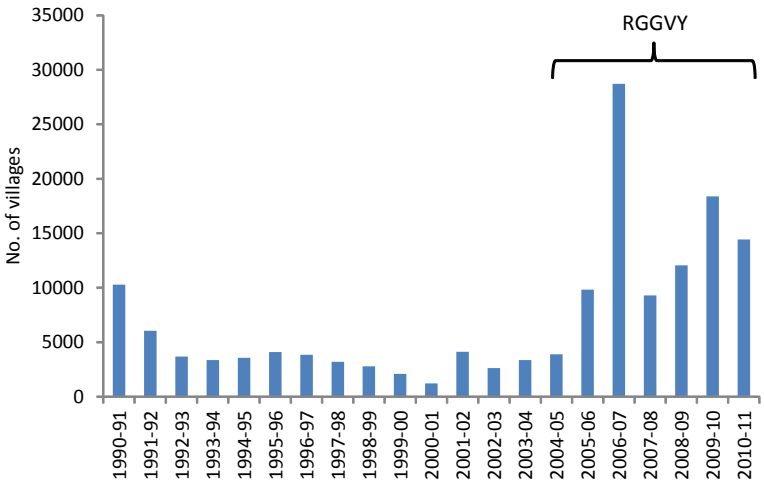

Figure 1 Annual number of village electrified since 1990-91

Note : The number of village electrified in 2010-11 is the figure up to Feb 15, 2011.
The definition of electrification changed in 1997 and 2004.

Source : Government of India (2010).

3. Determinants of Rural Electrification Revisited:

Government statistics indicate that more than 80% of all the villages in India have so far been electrified. There are, however, many un-electrified villages, and there exists a wide inter-state disparity among the richer and poorer states in access to electricity. Rural electrification is still a challenge in the underdeveloped states such as Bihar and Orissa, where the rate of village-level electrification remains low. While the existing gap between the rich and poor states in the progress of electrification is understandable because it is mainly due to the level of development, an important research question that needs to be addressed is what factors determine the electrification of villages in poor states. Are there any differences between electrified and un-electrified villages? If so, what characteristics of the village influence the authority's decision to electrify it?

Despite its importance, there is a scarcity of literature on the determinants of rural electrification. Exceptions are Andreas (2006, 2009) and Oda and Tsujita (2011). Andreas (2006) examines the factors influencing rural electrification at the village level and Andreas (2009) looks at the determinants at the household level. These studies are basically cross-state analyses of rural electrification based on the data of the 2001 Census and the 55th National Sample Survey (1999–00), respectively. Oda and Tsujita (2011), based on their survey in Bihar, analyzed the impact of village characteristics on electrification and changes after the activation of rural electrification projects initiated by the central government.

3.1 Selection of Surveyed Villages in Bihar and the Status of Electrification

To examine the determinants of rural electrification at the village level, a survey was conducted in 146 villages in five districts in Bihar in 2009–10 with the help of the Asian Development Research Institute (ADRI), Patna, Bihar. Villages were selected based on the three-tiered rural self-government system in Bihar (*pancyayat* system) of district, block, and village (*gram*). First, we selected five districts: one from each of the five groupings of districts, in accordance with their rankings on the livelihood potential index, which is based on the availability of land per rural household, cropping intensity, agriculture productivity, bovine per thousand capita, and the percentage of urban population (for details see ADRI, undated). The five selected districts in order of their position on the livelihood potential index (figures in parenthesis) from high to low were Supaul (5), Gaya (12), Banka (26), Saran (Chhapra) (28), and Samastipur (36) (see Figure 2 for their locations). We then randomly selected four blocks in each district, then four *Gram Panchayats* (GP) in each block. Finally, during our field visit we selected one revenue village in each GP based on two criteria: (1) the caste composition and (2) population size that best

represented the particular GP. Our interviews were mainly with *Mukhiyas* (the head of a GP) and/or village leaders. Of 146 villages, 24 were selected from Supaul, 21 from Samastipur, 26 from Gaya, 19 from Saran, and 56 from Banka. Throughout this paper, the villages are kept anonymous to protect their privacy.

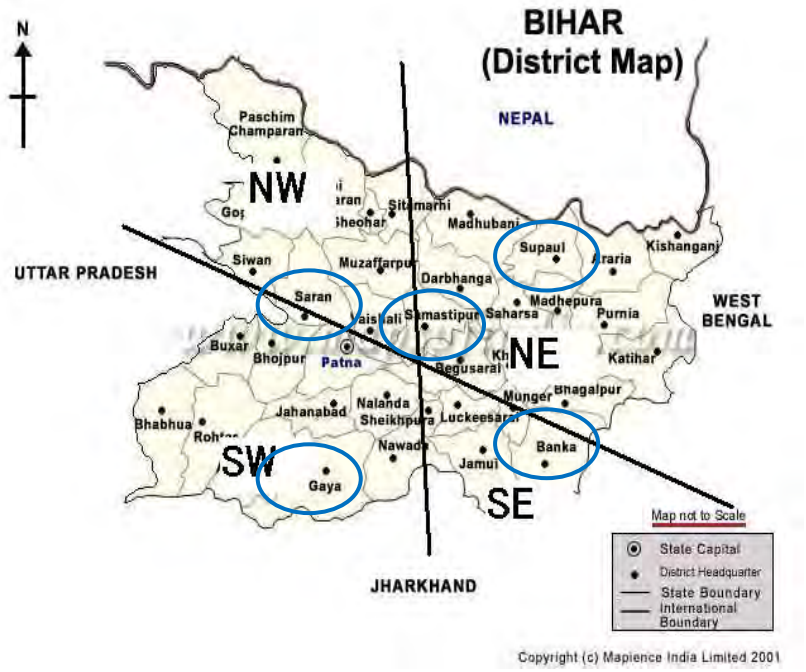

Figure 2 Location of survey districts

Source: Mapience India limited

Table 4 shows the status of village-level electrification. In the table, two different definitions of electrification are employed: one is that a village is considered electrified if at least one household has access to electricity (figures on the left of each column) and the other is that a village is considered electrified if more than 10% of the total households are electrified (figures on the right of each column). The former is the definition introduced in 1997 and the latter is part of the definition introduced in 2004.

We found that 67 of the 146 villages (45.9%) were considered electrified under the old definition, while 54 (37.0%) were considered electrified under the new definition. We will discuss more on this in detail in a latter section. These figures are below the latest official figure for village electrification (61.3%). Furthermore, there is a wide inequality in terms of the level of electrification among the survey districts, ranging from 8.3% in Supaul to 84.2% in Saran.

A village that is labeled as electrified does not mean that all the households are provided with electricity. The proportion of electrified households, in fact, remains low in most villages (Figure 3). In more than 50% of villages where at least one household is electrified (35 out of 67

villages), less than 30% of the total households were electrified. Higher rates of household electrification were observed in Gaya and Saran districts. In fact, villages with more than 80% household electrification were only found in these two districts. These two districts also achieved high rates of village-level electrification.

Table 4 Status of village level electrification

	Supaul		Samastipur		Gaya		Saran		Banka		Total	
Total number of villages	24	24	21	21	26	26	19	19	56	56	146	146
Electrified villages	2	2	16	11	16	13	16	16	17	12	67	54
Un-electrified villages	22	22	5	10	10	13	3	3	39	44	79	92
Rate of electrification (%)	8.3	8.3	76.2	52.4	61.5	50.0	84.2	84.2	30.4	21.4	45.9	37.0

Note : Figures on the left of each column were calculated by using the definition that if at least one household has access to electricity the village is considered electrified. The figures on the right were calculated by using the definition that if more than 10% of households are electrified, the village is considered electrified.

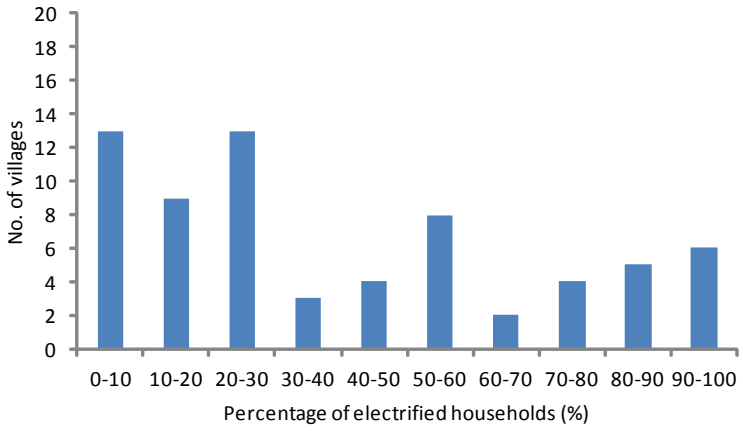

Figure 3 Status of household-level electrification

3.2 Estimation and Results

Methodology and Variables

To estimate the determinants of electrification at the village-level using our survey data, we employed a Probit estimation technique. The dependent variable was a binary variable indicating whether a village was electrified or not. The value of the dependent variable took "1" if a village was electrified and "0" if it was not. We used two definitions of electrification: one was that a village was considered electrified if at least one household had access to electricity (the old definition), and the other was that a village was considered electrified if more than 10% of the total households were electrified (the new definition).

The explanatory variables were the characteristics of the village, consisting of the number of households, the number of registered voters, social classes, and the remoteness of the village. The number of households was included to assess whether village size affects the process of

electrification. The number of registered voters can be considered representative of village size, but it is included here for another reason. During our field survey, we heard several times stories of the connection between electrification and politics, which we will discuss later. To capture the impact of political factors on village electrification, the number of voters was employed in estimation. The social-class variables included the ratios of SC (Scheduled Castes) and Muslim households in the village. SCs and Muslims, who make up approximately 15.7% and 16.5% of the state population, respectively, are often regarded as socio-economically backward classes. The purpose of including these as explanatory variables was to assess whether social and economic backwardness affects the process of electrification. The variable used for the remoteness of villages was the kilometer-distance from Patna, the capital of Bihar State, to the block where the village is located. A summary of the statistics of the variables is given in Table 5.

Table 5 Summary of descriptive statistics of explanatory variables

Variable	Obs	Mean	Std. Dev.	Min	Max
No. of households	146	269.9	266.8	10	1850
No. of voters (per hundred)	146	8.5	9.6	1	75
Percentage share of SC population (%)	146	24.3	30.1	0	100
Percentage share of Muslim population (%)	146	11.5	24.9	0	100
Distance from Patna to block (km)	146	194.2	100.6	79.8	292

Estimation Results and Interpretation

The results of the analysis are presented in Table 6. Since the estimated results using the old definition and the results using the 2004 new definition of electrification are similar, we report the figures of the latter case here. The results using the old definition are shown in Appendix. The EQ (1) column shows the estimated parameters on the number of households, the share of SC population, the share of Muslim population, and the distance from Patna to the block of the village. The size of the village in terms of household numbers has a significant positive explanatory power. As Andreas (2006) points out, there is a tendency for the authority to favor larger villages because of the large pool of potential electricity consumers and cost effectiveness of connection. The distance from Patna to the block of the village, which represents the remoteness of the village, is negative and statistically significant, meaning that the location of the village affects electrification. This result is consistent with the findings of Andreas (2006, 2009) and Oda and Tsujita (2011). Villages in remote areas tend to be un-electrified due to cost ineffectiveness and technical difficulties.[13] These results indicate that small, remote villages are

[13] Chakrabarti and Chakrabarti (2002) report that the cost of electricity supply through a conventional grid connection increases considerably as the distance from the grid to the village increases.

not financially attractive to electricity providers. This problem has been recognized by both the central and the Bihar governments and some actions have been taken. The central government launched the Decentralized Distributed Generation (DDG) project as part of RGGVY, which is meant to supply electricity from conventional or renewable sources such as biomass to villages where the supply through grid connection is either not feasible or not cost effective (Government of India, 2009). The government of Bihar has also documented the difficulty of supplying electricity through the conventional grid and proposed the idea of generating electricity on location through non-conventional systems such as solar power or wind power (Government of Bihar, 2008).

The estimates of variables representing social classes were not significant. This result is consistent with those reported by Oda and Tsujita (2011). One might expect that villages with a higher ratio of SC and/or Muslim households would tend to be un-electrified because of their low social status; however, there is no such tendency. There are a couple of possible explanations. First, there is a difference between village electrification and household electrification. Because of their weaker social status, their access to electricity might be limited, but it does not necessarily mean that the village with a higher ratio of SC or Muslim population receives a low priority. Second, the increased political participation of socially backward classes can influence the provision of infrastructure (Banerjee and Somanathan, 2007), diluting negative impacts that might arise from their socially weaker status. Third, there has been a rapid expansion of rural electrification under the RGGVY. In Bihar, the number of villages electrified in 2004–05, just before the introduction of the RGGVY, was 134. This number increased to 1,600 in 2005–06 and to 8,415 in 2006–07 (Government of India, 2010). It is assumed that easily accessible villages, regardless of what social class dominates in the village, were electrified during the period of rapid expansion, making the social characteristics of the village less important for electrification.[14] What becomes clear from this econometric exercise is that small villages in remote locations tend to not be prioritized in the process of electrification.

EQ (2) (Table 6) uses the number of registered voters, instead of the number of households. The figure in the table indicates a positive and significant impact of the number of registered voters on electrification. There are two results here, depending on how the variable is interpreted. If the variable is considered to approximate the size of the village, the result is the same as that using the number of households in the village. As size increases, the village tends to be electrified. If, however, the number of registered voters is considered to indicate a political factor, then villages with larger numbers of voters receive a high priority by exercising their voting power to influence the decision on village electrification through local politicians. It is

[14] Oda and Tsujita (2011) examined the impact of village characteristics on electrification and changes after the launch of the RGVVY and they came to the same conclusion.

difficult to isolate only the impact of political factors, but the result might suggest that political influence affects rural electrification to some extent.

Table 6 Probit regression of determinants of rural electrification

Variable	EQ (1)	EQ (2)
No. of households	0.0013 ***	
	(0.0005)	
No. of voters		0.0293 **
		(0.0115)
Ratio of SC population	-0.0021	-0.0021
	(0.0044)	(0.0043)
Ratio of Muslim population	0.0048	0.0046
	(0.0049)	(0.0049)
Distance from Patna to block	-0.0058 ***	-0.0062 ***
	(0.0012)	(0.0012)
Constant	0.3562	0.5489 *
	(0.3436)	(0.3150)
No. of observations	146	146
Pseudo R-square	0.2137	0.2017

* indicates significance at the 10% level.
** indicates significance at the 5% level.
*** indicates significance at the 1% level; standard errors appear in parentheses.
Note : Villages were considered electrified if more than 10% of the total households had access to electricity

4. Issues and Discussion

In this section, we discuss several issues on rural electrification that need careful attention. Government statistics show that electrification has reached more than 80% of India's villages. After the introduction of RGGVY, there has been a rapid expansion of electrification, even in backward states like Bihar and Orissa. The union government announced that the one-*lakh* villages will all have been electrified by 31st January 2012.[15] This is one of the targets of *Bharat Nirman*, which is the union government's action plan regarding rural infrastructure. The timing of the completion is well before the deadline of 31 March 2012, so it appears that the process of rural electrification is progressing. However, despite the process of electrification being in place, we have encountered many issues through interviews with villagers and visits to rural areas in Bihar that show that actually the progress is not as advanced as the government statistics indicate. The sections below are based on our survey carried out in Rohtas and East Champaran in 2011, and in Madhubani in 2012.

4.1 Household Electrification

We visited four villages in the East Champaran district. Only one village, village A, among the four was using electricity at the time of survey. In village A, electricity had been available since

[15] See the web site of the Ministry of Power (http://www.powermin.nic.in/).

1995. The remaining villages had either never been electrified or had been de-electrified.[16] In village A, we examined electrification at the household level by using a randomly chosen sample of 50 households in accordance with the social class structure of the village. Village A is dominated in terms of number of households by the two Extremely Backward Classes (EBCs), *Bind* and *Mallah*, followed by Other Backward Classes (OBCs), most of which are *Kurmi*, SC (*Musahar* and *Dusadh*), and General Hindu (*Bhumihar*).

The numbers of electrified and un-electrified households by social class in Village A are shown in Table 7. The overall household electrification rate was 30%. Though the sample size was small, it shows a clear tendency that rate of electrification increases according to social status. None of the SC households were electrified and only 22% (7 out of 31 households) of EBC households were electrified, while 67% (2 out of 3 households) of general Hindu households and 60% (6 out of 10 households) of OBC households were electrified. The RGGVY has assigned the priority to supply electricity to BPL households by providing a connection free of charge. In this village and elsewhere, BPL households are considered equivalent to EBC and SC households. Village A has been electrified since 1995, but it appears that BPLs are not receiving the benefits that they are supposed to receive under the RGGVY.

There is a relationship between land ownership and household electrification (Table 8). While land ownership and social classes are inter-related, it seems that land ownership is a necessary condition for household electrification. Only 2 out of 27 landless households had access to electricity. Five out of 10 EBC landholders were electrified, the ratio of which is higher than the rate of electrification among overall EBCs. All electrified OBCs are landowners. However, landownership itself does not guarantee electrification as 10 out of 23 landowner households are un-electrified, and even one general Hindu landowner had no access to electricity, although the landholding was just 0.07 acre, which can be interpreted as nearly landless. In fact, the landholding size of un-electrified households (0.31 acre) was on average much lower than that of electrified households (1.73 acre). The difference is statistically significant at the 1% level. This indicates a positive correlation between the size of land ownership, which is often related to social class and electrification.

One may wonder why BPLs, in which many EBCs and SCs are included, are not electrified even though the village has been wired for such a long time. To examine this, we approached several BPLs and noticed that corruption prevails where electricity connections are concerned. One respondent claimed that the head of the village (*Mukhiya*) demanded Rs 9000 from him for an electricity connection. Another respondent in another village says that the person in charge of

[16] Village B was electrified in 1965, but de-electrified in 2008. Village C had never been electrified village. Village D was recently electrified, but none of the households had yet been electrified.

connections at the electricity distribution station demanded Rs 2000 per household. These amounts are more than what BPLs are willing or able to pay, resulting in their households remaining un-electrified. Under the RGGVY programme, BPL connections are supposed to be 100% subsidized and therefore free of charge; however, the reality is that many people are trying to exploit the socially weaker section of the population. That is; nothing is free in rural India.

This survey highlights the fact that village electrification does not mean that all households in the village have access to electricity and that social class as well as landholding does matter in getting access to electricity. It also points to the prevalence of corruption in rural electrification.

Table 7 Household Electrification and Social Class

	General Hindu	OBC	EBC	SC	Total
No. of electrified households	2	6	7 (1)	0	8
No. of un-electrified households	1	4	24 (1)	6	11
Total	3	10	31 (2)	6	19

Note : Figures in parenthesis are the number of Muslim households

Table 8 Household Electrification and Landownership

	Landowner					Landless					Total
	General Hindu	OBC	EBC	SC	Sub Total	General Hindu	OBC	EBC	SC	Sub Total	
No. of electrified households	2	6	5 (1)	0	13	0	0	2	0	2	15
No. of un-electrified households	1	3	5	1	10	0	1	19 (1)	5	25	35
Total	3	9	10 (1)	1	23	0	1	21 (1)	5	27	50

Note : Figures in parenthesis are the number of Muslim households

4.2 Electrification by Definition

As already discussed, the Indian government introduced a new definition of rural electrification in 2004, which included significant changes. The 1997 definition of rural electrification was that a village was considered electrified if electricity was used in the inhabited locality of the village. However, under the new definition, "a village is considered 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.; and

3) the number of households electrified is at least 10% of the total number of households in the village."

(Issued by MOP, vide their letter No. 42/1/2001-D(RE) dated 5 February 2004 and its corrigendum vide letter no. 42/1/2001-D(RE) dated 17 February 2004.)

The new definition came into effect in 2004–05; however, it remains unclear which definition has been used in the government statistics on the number of electrified villages. Oda and Tsujita (2011) argues that the number of electrified villages would be much less if the new definition of electrification was adopted. They found that only 4 out of 80 government primary or middle schools were electrified in their survey of five districts in Bihar. Likewise, *Panchayat* offices were not electrified in many villages. To my knowledge, none of the offices were electrified in our survey villages. Picture 1 is a photo of the *Panchayat* office in a village in Madhubani. As you can see, the office is not connected to the distribution lines, which are high over the office building. A solar panel for lighting has been installed adjacent to the office. Government schools in the village are not electrified either. This village satisfies two conditions: (1) and (3), but fails to satisfy (2). The village is not deemed to be electrified by the 2004 definition of electrification; however, the village is listed as an electrified village in the official RGGVY website (http://rggvy.gov.in/rggvy/rggvyportal/electrification_status.jsp, accessed on 9 March 2012). This brings into question which definition was used for assessing whether a village was electrified or not.

Picture 1 A photo of the *Panchayat* office in a village in Madhubani district
Note: The photo was taken in a village in Madhubani in March 2012.

4.3 Progress of the RGGVY: Reality

In the sub-section above, we reported a case where the electrification status of a village differs from reality. We examine it in more detail here. Table 9 shows the status of village-level electrification from two sides: the upper row shows the status confirmed by our field survey and the lower row shows the status quoted from the RGGVY website, administered by the MOP. On the RGGVY website, Village A and Village B are defined as already electrified and that intensive electrification is under way. Village D is also deemed as electrified. However, according to our survey, none of the villages should be considered electrified under the 2004

new definition. Village A is receiving an electric supply, but it fails to satisfy two of the three conditions specified in the new definition. In village D, a transformer has been installed and the supply of electricity has started, but electricity is not yet being distributed to the households. Village B and Village C are currently un-electrified. These facts contradict the official information released by the government, casting serious doubt on the credibility of the figures published by the MOP. It is my opinion that the MOP counts villages where a transformer has been installed under the RGGVY programme as being electrified. The MOP simply assumes that the rest of the work will then be taken care of by the implementing state utility agencies such as Distribution Company (DISCOM), State Electricity Board, or Power Department.

One problem is the transformer provided by the RGGVY. During our visit to villages, we often came across the situation in which the transformer had overloaded and the village was therefore de-electrified. Village B's de-electrification is an example of this. Villagers complain that the capacity of the transformer provided by the RGGVY is too small to meet the demand for electricity in the village. In this case, the village is recorded as electrified at the time of transformer installment, but when the transformer broke, it became un- or de-electrified. The official RGGVY records still show the village as electrified, but a gap has been created between the official information and reality.

Table 9 Status of village electrification: A comparison

	Village A	Village B	Village C	Village D
Current Status verified by the author's visit to the villages	Electrified in 1995. Lower castes/SC hamlet are not electrified.	Electrified in 1965, but de-electrified in 2008	Unelectrified	Electrified in 2010, but no household has so far been electrified.
Current Status shown on the RGGVY website	Under process of intensive electrification (Electrified)	Under process of intensive electrification (Electrified)	N/A	Electrified

Note : Shading indicates that the village is electrified.
Source : Author's observation and the RGGVY website (http://rggvy.gov.in), accessed on 13th March 2012.

4.4 Political Influence and Other Issues

Politics plays an important role in electrification. Though political influence in the process of electrification seems to have been reduced in recent years after the introduction of the RGGVY, there is a lot of anecdotal evidence that it still exists. We came across several stories during our survey and we learned that villages from which a Member of Parliament (MP) or a Member of Legislative Assembly (MLA) is elected tend to be electrified. Moreover, there are cases where villages with the most political power receive an electric supply on a priority basis. Another finding is that *Mukhiya*'s houses tend to have electricity connections. One extreme case we came across is that there was a village where only the *Mukhiya*'s house was electrified. We also heard that a village was electrified just a couple of days before a visit by the Chief Minister.

These stories are enough to recognize the political influence on rural electrification.

Another major issue is the condition of the electricity supply. Even though many villages are receiving electricity, the supply is limited in terms of quantity and quality. There are wide variations from village to village in the quantity of electricity received. Eight hours' supply a day is the norm to be deemed as electrified, but there are many villages that only receive a few hours' supply a day in bad months.[17] This situation has brought about a new business: a private generator *wallah* (a person who generates electricity). Typically, villagers buy small quantities of electricity, which are enough to power a light bulb at night. At a village in Madhubani the fee was Rs 75 per bulb per month. Generator businesses bridge the gap between what villagers want and what the government can provide. The business has been mushrooming in many villages where the supply of electricity is constrained or there is no electric connection.

5. Concluding Remarks

It has become clear from this study that small villages in remote locations are left out of the process of electrification, and that the progress of rural electrification may not be as advanced as government statistics indicate. While rural electrification is continuing under the RGGVY and the government celebrates its accomplishment in connection to one-*lakh* villages, there are a lot of challenges ahead.

The mushrooming generator business teaches us something important. Of course, it is not sustainable from a long-term perspective, and it is ironic to see this type of business when the coverage of rural electrification is expanding, but it fills the existing gap in the supply of electricity. That is why the business is taking place. What we can learn from this business is the importance of the decentralized distribution of electricity rather than the conventional connection through the national/local grids. Particularly, the decentralized distribution of electricity is needed in small villages in remote locations where grid access is financially and technically difficult.

One positive development is the installation of solar panels in various locations. We observed that solar panels have been installed in *Dalit Basti* hamlets, *Panchayat* offices, and primary schools (Picture 2). Though the solar panels can't generate much electricity, they are enough to power lights after dark.

Rural electrification is a long and continuing process. Both union and state government efforts, along with the cooperation of local authorities, are indispensable for lighting all households.

[17] See Oda and Tsujita (2011) for more details.

Picture 2 A photo of a solar panel installed at a primary school in Rohtas

Note: The photo was taken in a village in Rohtas in January 2012.

Appendix

Probit regression of determinants of rural electrification with the old definition of electrification

Variable	EQ (3)	EQ (4)
No. of households	0.0015 ***	***
	(0.0005)	
No. of voters		0.0595
		(0.0200)
Ratio of SC population	-0.0031	-0.0021
	(0.0043)	(0.0043)
Ratio of Muslim population	0.0015	0.0014
	(0.0050)	(0.0050)
Distance from Patna to block	-0.0064 ***	-0.0066 ***
	(0.0012)	(0.0012)
Constant	0.7768 **	0.7319 **
	(0.3517)	(0.3502)
No. of observations	146	146
Pseudo R-square	0.2396	0.2629

* indicates significance at the 10% level.

** indicates significance at the 5% level.

*** indicates significance at the 1% level; standard errors appear in parentheses

Note: Villages were considered electrified if at least one of the total households had access to electricity

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