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Electricity and Rural Development Linkage

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Abstract

This paper discusses the criticality of electricity, the vital modern economic infrastructure, concerning its role in and nexus with rural development. Introducing broad issues in rural infrastructure and local development, emphasis has been laid on the role of electricity as a multi-sectoral catalyst. The relation between agricultural growth and electricity has been discussed with reference to marketisation of water and input use. The important issue of promoting rural industrialisation through 'empowering' enterprises has been raised by making a strong case for enhancing access to electricity that would promote relevant mechanisation/ modernization. This is followed by a critical review of the access, potential demand and utilisation of electricity at the household level and implications for gender, household decision-making and living standards. At the community level possibility of improvement in the crucial services as health facilities, communication (including radio, television and internet), trading, business and transport due to availability of electricity has been underscored. It needs to be recognized, however, that appallingly low access to this energy input by the vast majority of rural households in poverty as also pitiable village connectivity to power are a reflection of the larger structural inefficiencies that undermine the depressed and neglected regions.

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1 Introduction

A distinct outcome of the Indian development trajectory, with Plans and Reforms, has been the downright sidelining of the rural infrastructure, excluding the repeated claims. Even the much-hailed and first-ever *India Infrastructure Report*, brought out in 1996, hardly had touched upon the whole gamut of issues concerning rural infrastructure. If anything, it is only recently that there is an explicit and formally articulated concern at the policy level of the deleterious effects of the deficiencies in infrastructure on rural development. With the laudable exception of telephony, such basic physical infrastructure as roads, transport, drinking water, sanitation and electricity have continued to distance the rural regions from the sphere of development, largely attributable to poor investment in these sectors. As is well known, progress of the social infrastructure is often contingent upon that of the economic infrastructure. The linkages and potential of basic infrastructure in contributing to human welfare and territorial progress have been multifarious and widely acknowledged (see, for instance, Fan *et al*., 2000; Ghosh and De, 2004; and Das, 2005).

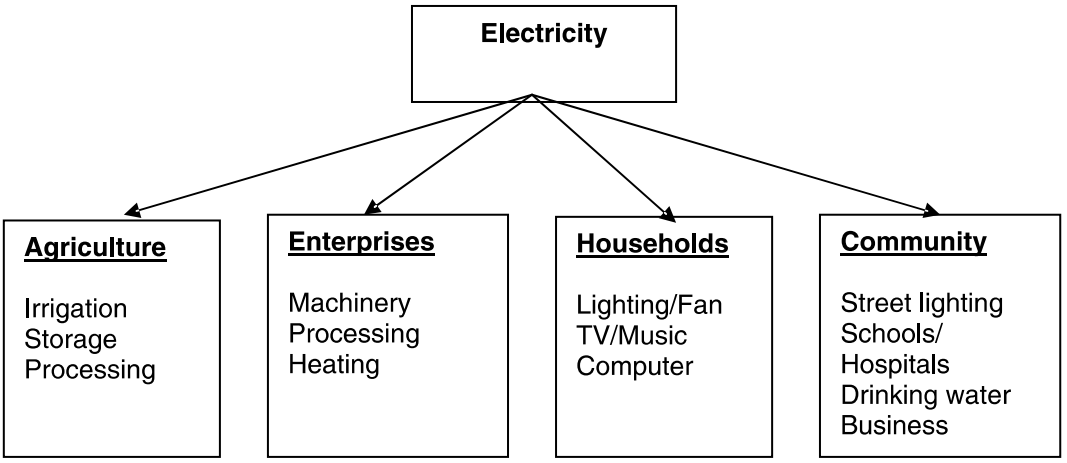
This paper focuses upon the single-most vital modern economic infrastructure, electricity, and its role in and nexus with rural development. The opening section introduces broad issues concerning rural infrastructure and local development, with special emphasis on the role of electricity as a multi-sectoral catalyst. This is followed by a discussion of the linkage between agricultural growth and electricity with special reference to marketisation of water and input use. Next, the crucial question of promoting rural industrialisation through enhanced access to electricity and relevant mechanisation/ modernization has been raised. This is followed by a note on the access, potential demand and utilisation of electricity at the household level and implications for gender, household decision-making and living standards. At the community level, improvement in the crucial services as health facilities, communication (including radio, television and internet), trading, business and transport is possible due to availability of electricity; this has been dealt with briefly. The concluding section summarises the preceding discussions

and suggests how access to electricity can in fact help improve governance at the village level.

Scholarly studies on rural electrification in India, as even on rural energy, are not only limited but also of relatively restricted scope. That is rather unusual as the transformative potential of electricity has been widely established and there is a near consensus over it across ideology, class and space. Most available literature either deal with the pattern of consumption, availability and distribution of electricity in rural areas or treat electricity as a component of the rural infrastructure while examining the likely impact of infrastructural investment upon regional economic development, or income generation to be specific. So far as primary data-based studies on rural energy are concerned, the major findings include: (a) the household sector, mainly cooking, have been the largest consumer of energy (as compared to the farm sector), although electricity forms a tiny proportion of all the energy consumed; (b) there has been a rise in the use of energy by both the farm and transport sectors; and (c) inability to access affordable energy has contributed importantly to poor quality of life in rural regions.

Even while exclusive studies on the impact of electricity on rural development in the Indian context are hard to come by, a few exercises have held out electricity as one of the key infrastructural components which contributes to agrarian and rural progress. Drawing upon these studies, and wider literature on rural infrastructure, Figure 1 provides a comprehensive picture of contemporary linkages between electricity and rural economy. It needs to be noted that while the four broad sectors/ sites may have greater linkage possibilities, only those activities/ functions have been noted which are widely observed given the current techno-economic limits in the rural context. In fact, so far as alternative energy sources available to the Indian villages are concerned, electricity-driven appliances/ machines are still quite restricted; a great variety of agricultural and industrial activities including heating, drawing water and preliminary processing of crops are still done using human or animal power and other forms locally available energy as bio-based ones. That essentially implies that the use of electricity for a variety of existing and new purposes would crucially hinge upon the overall growth of basic social and economic infrastructure, natural endowments as also its nature and extent of interconnectedness with the modern urban-industrial dynamic.

Figure 1: Electricity and Rural Development Nexus



Both national and global experiences have amply suggested that there exists close correlation between the lack of access to electricity to electricity and rural poverty. Evidently, electricity has been viewed as a pre-requisite for both improving the standard of living and for carrying out productive and economic activities. Electricity as an energy input for essential functions such as drawing water for domestic consumption and irrigation, lighting that extends working and learning hours; powering tiny and small scale rural enterprises; and facilitating community level activities confers substantial benefits on the rural society. In fact, the positive impacts of electricity are "considerably greater due to a bundling of socio-economic benefits (TERI, 2002: 2).

It has been observed that the vulnerable rural population is likely to benefit most even for marginal input of electricity. As indicated in EdF (2002), provision of electricity can result in a rise in the human development index (HDI). The gains from electricity from electricity availability can be greatly enhanced if combined with improvements in other basic infrastructure, especially, concerning the social sectors.

It is interesting to note while the history of modernisation of western capitalist societies, especially, the US and the European industrialized nations, has been eloquent about the 'revolutionary' role played by electricity, the change that ensued was far from restoring the 'Jeffersonian ideal of agrarian values'. "In the

final analysis, electrification *did not* restore the rural way of life; it failed to check migration into cities or stop the decline of small family farms. Use of electricity, however, greatly improved home life and quickened the modernization of farming operations. The ultimate effect was not a revival of an older order but entry into the new" (Brown, 1980: 129, as quoted in Bose, 1993:1-2; emphasis ours).

With the progress of technology, especially the rise and broad-basing of microelectronics, the criticality of electricity has transcended manifold. Even as late-industrialisation countries, access to and use of electricity for multiple purposes have been highly essential to be enabled vas a competent player in the globalisation process. This is especially the case for rural regions where massive potential to take on the challenge of development remains locked largely due to lack of information and communication. While provision of physical infrastructure must continue to be provided at a fast pace, electricity *per se* can both contribute to and accelerate the efforts at 'catching up' with the so-called mainstream development process.

Notwithstanding such a potential, due to inadequate documentation of the dynamics and impact of village electrification, the history of western nations probably does not proffer a complete idea as to the transformation of rural societies due to availability of electricity. The fact remains that even during the nascent stages of rural electrification in these societies, their socio-economic status was far ahead of that of the Indian villages currently awaiting electrification. The structural/ material conditions are far too challenging and diverse than were the case in the comparable western nations. This is an important distinction to make, pointed out by Bose (1993: 2-4), while discussing potential linkages between electricity and rural development. In fact, as observed by the *World Development Report* a decade back, "as countries develop, infrastructure must adapt to support changing patterns of demand, as the shares of power, roads, and telecommunications in the total stock of infrastructure increase relative to those of such basic services as water and irrigation" (World Bank, 1994: 2-3).

2 Agriculture and Electricity

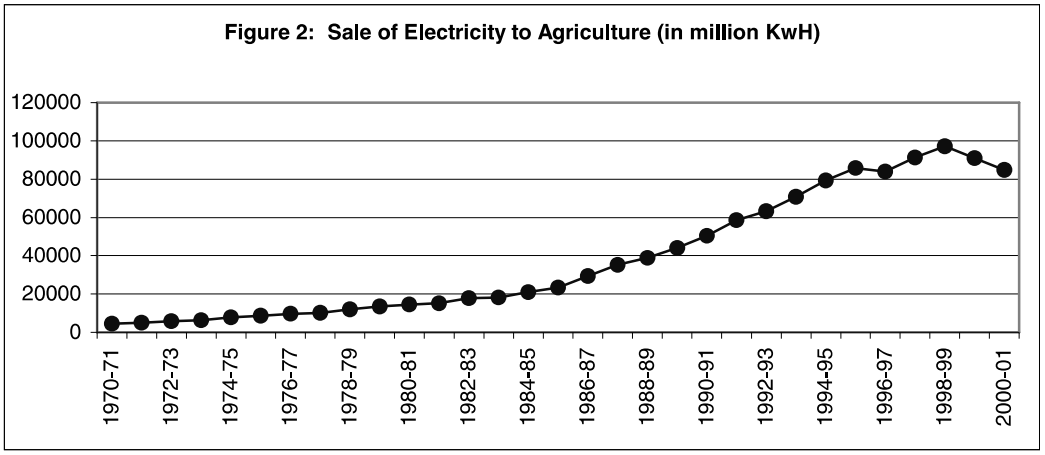
During the late 1960s when monsoon failed for consecutive years, the role of energised pumpsets was underscored to withdraw groundwater for 'stabilising' irrigation (Etienne, 2000). The use of power-driven pumpsets in Indian agriculture has shot up hugely since the 1970s (Table 1). Similar has been the case with sugarcane crushers that functioned far more efficiently than the bullock-driven ones. Moreover, as Figure 2 shows, the sale of electricity to agriculture has risen massively as much as by 19 times, from 4470 million KwH to 84729 million KwH, between 1970-71 and 2000-01. This is a clear indication that electricity has been growing in significance as a preferred input in Indian agriculture, particularly for energizing irrigation pumpsets.

Table 1: Growth of Use of Power-driven Irrigation Pumpsets and Sugarcane Crushers in India, 1951-2001

Year	Irrigation Pumpsets (in '000)	Sugarcane Crushers (in '00)
1951	26	213
1956	47	233
1961	160	333
1966	415	451
1972	1618	872
1977	2438	1089
1982	3568	1204
1987	4517	1558
1992	6403	58610*
2000-01	13142	NA

Notes: * Unclear if this includes sugarcane crushers driven by bullocks.
NA: Not available

Source: *Statistical Abstract of India*, various issues and CMIE (2004: 49)



Source: CMIE (2003: 133)

Interestingly, going by the share of value of electricity in total inputs in agriculture, there has been a rise since the 1960s, though not without fluctuations. While that might reflect more of price fluctuations in the input, a steady increase in the number of users of electricity in agriculture certainly is evidence of its widespread and growing acceptability in the rural economy. The number of such consumers has risen significantly from about 15.3 lakh in 1970-71 to a huge 1.2 crore by 1999-2000 (CMIE, 2003: 136).

While it may be difficult to establish the exact links between electricity and farm productivity, the rise in cropping intensity, multiple cropping, shift towards high-valued crops and gross cropped and irrigated areas all point to the impetus provided by availability of electricity in rural areas. Access to groundwater, the limit to exploit which is yet to be formally legislated, has enhanced the demand for electricity manifold suggesting a strong linkage between electricity and agriculture development, wherein the former harnesses the latter. Covering a 15-year period starting 1966, Barnes and Binswanger (1986) have emphasized the contribution of rural electrification in enhancing farm productivity, via a massive rise in the use of energised pumpsets. An increase in the cropping intensity and diversification towards high valued (water intensive) crops could be possible with an increasing net profit by the farmers. Similarly, many studies, for example, Bhatia (1999), Chand and Chauhan (2002) and Singh (2004) have found correlation between an increase in electricity use and productivity rise in agriculture. The rapid increase in power consumption in agriculture has also

been due to the fact that power supply to the farm sector in India is highly subsidized (Kumar, 1997: 51).

The apparently innocuous nexus between electricity, water and agricultural growth, nevertheless, has come to be intensely debated as the implications of promoting such a linkage encompasses financial and environmental issues. Use of electricity, unbridled as often observed in the countryside, for irrigation purposes can potentially overexploit groundwater bodies and render aquifers unworthy. For instance, the crisis of drinking water scarcity in northern Gujarat has been directly related to the excessive pumping of groundwater for commercial crops (Bhatia 1992). A disturbing aspect of use of electricity for pumping water is also that the affluent farmer can have a larger control of the groundwater, which, essentially, is a common property resource. An extreme, but fairly widespread, form of private control of groundwater has been the large scale development of markets for water in rural India (Shah, 1993; Sant and Dixit, 1996; and Dubash, 2002).

Whereas non-affordability prevents a large section of small and marginal farmers to go in for using energized pumps for irrigation purposes, this has also increased their dependence upon those selling groundwater. A rise in the incidence of investment in a variety of water extraction machines (WEMs) and laying of underground pipelines has been observed from different parts of the country, including eastern UP, western MP, Gujarat and Maharashtra. The implications of the emergence of private property rights in groundwater go beyond oligopolistic nature of the market; those reflect the structural deficiencies of a rural society.

3 Rural Industrialisation and Electricity

As is widely documented, the prime focus of promoting cottage and village industries has been, rightly, to create vast job opportunities, encourage rural entrepreneurs/ artisans and utilise physical resources available locally. Almost all Industrial Policy Resolutions (IPRs) and most Plan documents had, in fact, identified a whole gamut of factors, institutional, financial and infrastructural support, which were essential for promoting industrialisation in rural areas. As noted in the first IPR of 1948, these inputs included cheap power, technical advice, organised marketing and necessary safeguards against intensive

competition by large producers as also education of the workers in the use of the best available techniques (Vepa, 1971:16). What is remarkable about such a policy *perspective* is that it clearly recognised the need for electricity at the very early phase of development planning. However, contrary to pronouncements, the use of electricity in rural enterprises has been abysmally low; for instance, field studies conducted in rural Gujarat, an industrially advanced state, suggest the same (Kothari and Dadi, 1977; and Sharan, 1987). While that reflects the state of availability of electricity in Indian villages, an additional limitation of the rural industrialisation strategy remained a certain 'obsession' with certain 'old' techniques of production which had tremendous scope and necessity for upgradation.

Even when products are manufactured in the rural sector, as in the modern small industry in the urban space, these have to compete in the wider market place; product diversification, consistency of product quality, efficiency of production and desired volume all assume importance in the sphere of competitiveness. This is applicable also for the artisanal production, which has to retain its business logic, while preserving the essence of the traditional craft. Very simply, unless the business effectively responds to the nature and pattern of market demand, initiatives for industrialisation may be difficult to sustain (Das, 2004: 424-427). In fact, as strongly articulated by Papola and Misra (1980: 1745), "It is likely that with increasing income levels the consumption pattern would grow more urban-based. If village industries are to cater to the local needs, it seems necessary that technology of the traditional industries is refurbished to meet new demands; and new products are introduced for manufacturing in the rural areas. An approach based on an emphasis on traditional products and technology is highly unlikely to succeed as a mode of rural industrialisation for income and employment generation".

A move favouring technology upgradation is often construed as anti-labour, especially in a labour-surplus economy like India. However, in a fast advancing technological context, the rural enterprises cannot be left to fend for themselves in the low value added and low-end market. In fact, serious policy intervention is essential that promote introduction of power-driven technologies which enhance both the quality and quantity of output or hasten a process, reduce drudgery and are worker-friendly. Even simple, intermediate level tools can remarkably improve productivity and, hence, earnings. This is particularly applicable to the craft-based activities where enhancing labour productivity *per se* can go a long

way in promoting the craft. Incidentally, there is no dearth of such domestically-designed electricity-propelled machines/ motors/ appliances (often designed and developed at state research facilities) which would ensure efficient production and save on both time and cost.

The national electricity policy must address this issue of providing electricity at least at the rural cluster level and charging at a reasonable rate to encourage village enterprises to adopt better technologies and improve conditions of work. The broad-basing and decentralized management of infrastructure, including electricity, can, in fact, create greater opportunity for work even in remote and depressed regions (Kabra, 2004: 47-48). One sure outcome would be that it would encourage rural entrepreneurship.

4 Electricity and the Domains of the Household and Community

Through the data presented in Table 2, an attempt has been made to critically look into the nature, utility and implications of official statistics on electricity availability in rural households as also villages. Information on only those states have been considered where the proportion of households having electricity is below the All-India corresponding figure; with the exception of Tripura, in these states the proportion of villages covered by electricity is also lower than that of the national figure. Coincidentally, almost all of them are also part of the chronically lagging eastern and north eastern region of India. As has been pointed out in Panda (2004), the coverage statistics concerning villages could be highly misleading as it denotes only connectivity; by definition, even a single connection would enlist a village as covered. In fact, as may be observed from the table, while the proportion of villages covered ranges between 52 and 96 per cent, the same ranges as low as between 5 and 32 per cent in case of households. Further, by focusing on the type of wiring done, the last three columns indicate that quite a large proportion of the households have only a temporary connection. What is still unknown from the data on electricity is the actual hours per day of supply and the voltage available in the villages. In fact, despite a growing household demand for energy consumption in the rural areas, electricity is yet to reach another 80,000 villages.

Table 2: Villages and Households Having Electricity in Selected States

State	Villages (%)	Households (%)	Number of households* by type of electric wiring per 1000 households**		
			Conduit	Fixed to walls	Temporary
Bihar	71.3[a]	5.1	6	327	644
Jharkhand	NA	10.0	37	441	522
Assam	77.3[b]	16.5	127	548	307
Orissa	79.5[c]	19.4	149	473	375
Uttar Pradesh	56.9[d]	19.8	55	223	698
West Bengal	83.5[b]	20.3	56	669	274
Meghalaya	52.2[e]	30.3	91	554	351
Tripura	95.6[f]	31.8	21	468	501
All India	84.0	43.5	247	403	347

Notes: * Not reported (22 in Bihar; 1 in Jharkhand; 18 in Assam; 3 in Orissa; 25 in UP; 1 in WB; 3 in Meghalaya; 10 in Tripura; and 3 in All India)
** Using electricity as primary source of energy for lighting

a: Achievement as per 1981 *Census*. As on 30.11.2003.
b: As on 31.12.2003.
c: As on 30.6.2003.
d: Cumulative achievement have been recast by UPPCL as per definition of village electrification notified by the Government of India in October, 1997. As a result there has been a downward revision from the earlier figure of 77405 (which was based on old definition) to 54951. As on 31.8.2003.
e: As on 31.10.2003.
f: As on 30.11.2003.

NA: Not available

Sources: For villages, http://cea.nic.in/data/opt2_village.htm
For households, *Census of India 2001, Tables on Houses, Household Amenities and Assets*, Government of India, Delhi.
For type of wiring, *Housing Condition in India: Housing Stock and Constructions, July-December 2002*, NSS Report No. 488, 58th Round, A-57, National Sample Survey Organisation, New Delhi, 2004

Eventually, at the household level electricity is yet to emerge as a major component of energy (Sharan, 1987 and Giriappa, 1991). Cooking, the major fuel consuming activity, hardly uses electricity, which accounted for a meagre 0.16 per cent of total fuel cost in 1991; firewood (71.7 per cent) remains the dominant fuel, followed by cowdung cake (19.6 per cent) in Indian villages (CMIE, 1996). The typical use of electricity has been for lighting purposes, although there is a growing preference for the same for fan, television, tape-recorder and music systems, as has been recorded in numerous village level studies, while collecting information on household assets. Moreover, rural electrification has contributed to ensuring efficient medical services, drinking water supply, functioning of schools and other community organisations (Rao, 2002: 66).

Supply irregularities notwithstanding, electricity has certainly enhanced the possibility of working and learning beyond sundown. A perceptible development has been that television viewing in villages has been growing very fast especially, since the mid-1990s (Singhal and Rogers, 2001; and *Doordarshan India 2002*, a publication of the Prasar Bharati); this has been partly because the prices of the instruments have fallen remarkably over the years. Although computers are yet to spread in villages, electricity holds massive potential for actuating the so called communication revolution in rural India.

Similarly, at the village level, electricity has been mostly used for street lighting which has facilitated community activity, including facilitating business, telephony and holding public functions. Increased access to information and possibilities of communication, in effect, can contribute positively to better governance in rural areas.

5 Concluding Observations

The transformative character of electricity has been historically established across societies. It has immensely impacted patterns of work as well as productivity in almost all sectors and spaces of human activity. Being a powerful economic infrastructure with multifarious utility, this has tremendous potential to positively contribute to promoting social infrastructure. In rural societies, as hinted in this paper, electricity has been used for various productive purposes in agriculture, enterprises and at the household and community spheres.

While the significance of linkage between electricity and rural development is most obvious, poor or no access to the key economic infrastructure in large parts of rural India calls for a serious relook into the policy strategy, management 'on the ground', financing and technological options available. The Electricity Act, 2003 with its emphasis upon reforms, privatization, unbundling, time-bound restructuring of the State Electricity Boards and introduction of anti-theft laws promises to be a major break from the decades-old dismal state-run system (Dev, 2001; Dwivedi, 2002; Verma, 2004; and Rastogi, 2004: 23-30). Success in infrastructure service provisioning, including electricity, in rural areas is eventually conditioned by a variety of institutional challenges encountered at the local level (World Bank, 2004: 175-177). However, it needs to be recognized that appallingly low access to this energy input by the vast majority of rural households in poverty as also pitiable village connectivity to power are a reflection of the larger structural inefficiencies that face the depressed and neglected regions. Electricity *per se* would fail to bring in development so long as other vital economic and social infrastructure is in short supply.

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