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SOME ECONOMIC FACTORS IN THE EXPANSION OF ELECTRICITY IN THE RURAL AREAS

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The supply of electricity to a village involves, firstly, the transmission at high voltage from the tap off point, secondly, the installation of transformers, thirdly, the transformation of the high voltage to low voltage at the sub-stations, and, fourthly, the distribution at low voltage.

The major components of costs are the high tension and low tension lines. The length of the high tension line required depends upon the distance from the tap off point, and the length of the low tension lines required depends upon the total distance from the distribution transformer. Considerations of cost, therefore, favour the choice of those villages for electrification which are located near the transmission lines.

The generation and distribution of electricity is subject to two constraints; firstly, the demand of the consumer must be met whenever it arises, and, secondly, electricity cannot be stored. These two constraints imply that the capacity of the electrical system must be sufficient to meet the maximum demand.

Given the costs, the price at which electricity can be supplied to the consumer depends upon the demand for electricity. If the kWh of electrical energy produced is small in relation to the installed capacity, then the cost per kWh will be high, but if the kWh generated is large, then the cost per kWh will tend to be lower, because the fixed costs are distributed over a larger number of units. The cost of providing electricity will also be lower if the maximum demands of the various consumer groups are not coincident. If the demands are coincident, then a larger maximum capacity has to be provided, and, consequently, the costs of generation per unit are higher, and therefore the price that has to be charged from the consumer also has to be higher. The second factor, therefore, which influences the choice of a village for electrification is the nature and magnitude of the demand for electricity.

II

The main focus of rural electrification in India is on the provision of electricity for energizing pump sets and operating tube-wells. The progress of rural electrification may, therefore, be seen from the number of villages electrified and the number of tube-wells and pump sets energized. Table I shows that a large number of villages in the country have been electrified up to March 31, 1968. However, when the number of villages electrified is seen against the total number of villages, we find that, except in Madras and Kerala, where 66.2 per cent and 71.7 per cent, respectively, of the total villages have been electrified, the progress in the other States is rather slow. At the extreme end are Nagaland, Orissa and Assam, where the percentage of villages electrified to total number of villages is 1.7 per cent, 1.6 per cent and 0.5 per cent, respectively.

A comparison of the villages already electrified, by population size (Table II) shows that a larger number of villages in the higher population groups have been

TABLE I—PROGRESS OF RURAL ELECTRIFICATION

Sr. No.	State	Total number of villages	Number of villages electrified as on March 31, 1968	Percentage of col. (4) to col. (3)
(1)	(2)	(3)	(4)	(5)
1.	Andhra Pradesh	27,084	4,595	17·0
2.	Assam	25,702	134	0·5
3.	Bihar	67,665	5,773	8·5
4.	Gujarat	18,584	2,594	14·0
5.	Haryana	6,669	1,286	19·3
6.	Jammu & Kashmir	6,559	706	10·8
7.	Kerala	1,573	1,119	71·1
8.	Madhya Pradesh	4,545	1,524	33·5
9.	Madras	14,124	9,354	66·2
10.	Maharashtra	35,851	6,855	19·1
11.	Mysore	26,377	5,622	21·3
12.	Nagaland	814	14	1·7
13.	Orissa	46,466	759	1·6
14.	Punjab	11,947	3,765	31·5
15.	Rajasthan	32,241	1,757	5·4
16.	Uttar Pradesh	1,12,624	11,758	10·4
17.	West Bengal	38,454	1,453	3·8

Source: Report on the Working Group on Power for the Fourth Plan.

electrified as compared with villages in the lower population groups. Again, a comparison of the villages electrified with the total number of villages, by population size (Table III) shows that the smallest percentage of villages have been electrified in the population group 0—499, and the highest percentage of villages have been electrified in the population group 5,000—9,999. The percentage of villages electrified to total villages is of an ascending order for the groups 500—999, 1,000—1,999 and 2,000—4,999.

TABLE II—NUMBER OF VILLAGES ELECTRIFIED IN THE VARIOUS POPULATION GROUPS (1961 CENSUS) AS ON MARCH 31, 1967

Sr. No.	State	Average population per village (1961 Census)	Population groups				
			0—499	500—999	1,000—1,999	2,000—4,999	5,000—9,999
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Andhra Pradesh ..	1,097	295	735	1,397	1,682	338
2.	Assam	426	18	20	30	35	2
3.	Bihar	629	1,182	1,198	1,170	835	128
4.	Gujarat	824	201	332	732	840	134
5.	Haryana	N.A.	273	324	342	270	40
6.	Jammu & Kashmir ..	452	230	200	100	106	5
7.	Kerala	9,117	60	160	500	730	355
8.	Madhya Pradesh ..	394	401	261	295	321	14
9.	Madras	792	621	1,532	2,551	2,228	378
10.	Maharashtra	1,748	1,556	1,520	1,563	1,077	229
11.	Mysore	695	1,635	1,351	1,130	615	105
12.	Nagaland	—	2	3	5	—	—
13.	Orissa	354	137	110	210	163	11
14.	Punjab	406	1,212	1,020	1,040	360	40
15.	Rajasthan	523	563	393	384	275	72
16.	Uttar Pradesh	297	2,640	3,000	2,250	1,720	250
17.	West Bengal	352	200	332	370	350	90

N. A. = Not available.

Source : Public Electricity Supply : All India Statistics 1966-67, Ministry of Irrigation and Power, New Delhi, 1968.

TABLE III—PERCENTAGE OF VILLAGES ELECTRIFIED TO TOTAL VILLAGES BY SIZE OF POPULATION

Sr. No.	State	Population group				
		0—499	500—999	1,000—1,999	2,000—4,999	5,000—9,999
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Andhra Pradesh ..	2·73	12·60	23·09	42·93	73·80
2.	Assam	0·10	0·40	1·52	8·97	16·67
3.	Bihar	2·79	8·69	15·32	25·01	29·02
4.	Gujarat	2·36	6·27	22·18	63·06	95·04
5.	Haryana	N.A.	N.A.	N.A.	N.A.	N.A.
6.	Jammu & Kashmir ..	5·01	15·15	18·94	92·98	60·48
7.	Madhya Pradesh ..	0·76	2·04	7·74	40·79	50·00
8.	Madras	30·25	47·64	53·47	62·96	84·19
9.	Maharashtra	9·09	14·85	26·23	48·62	75·08
10.	Mysore	11·22	20·85	30·35	42·95	61·05
11.	Nagaland	N.A.	N.A.	N.A.	N.A.	N.A.
12.	Orissa	0·38	1·50	8·36	36·06	68·75
13.	Punjab	N.A.	N.A.	N.A.	N.A.	N.A.
14.	Rajasthan	2·61	5·96	13·08	27·42	76·60
15.	Uttar Pradesh	8·09	11·53	17·58	45·32	81·17
16.	West Bengal	0·90	3·90	7·08	16·23	36·88

N.A. = Not available.

Tables IV, V and VI show the progress of pump sets, private tube-wells and State tube-wells over the Plan periods. It is not enough, however, to view the progress of rural electrification in terms of the number of tube-wells and pump sets energized. It is important to find the distribution of the owner cultivators, who have pump sets, by size of holdings. According to a study conducted by the Programme Evaluation Organisation, "Electric pump sets, as can be expected, had been installed relatively more by large farmers; 57.7 per cent of the electric pump set owners had holdings of more than 10 acres and 28 per cent had holdings between 5 and 10 acres. Only 3.8 per cent of them had holdings below 2.5 acres and this figure includes 0.6 per cent who had no land at all."[1]

1. Report on Evaluation of the Rural Electrification Programme, Programme Evaluation Organisation, Planning Commission, New Delhi, 1965, p. 125.

TABLE IV—PROGRESS OF ELECTRIC PUMP SETS

(*numbers*)

Sr. No.	State	Pre-Plan	At the end of First Plan	At the end of Second Plan	At the end of Third Plan	During 1966-67	Anticipated during 1967-68	Tentative target for 1968-69	Total up to 1969
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1.	Andhra Pradesh	N.A.	N.A.	17,968	57,225	10,630	17,500	13,000	98,355
2.	Assam	—	—	—	—	15	34	1,000	1,049
3.	Bihar	47	697	3,200	10,660	14,012	17,600	25,000	67,272
4.	Gujarat	910	2,825	6,963	17,154	11,301	10,100	10,000	48,555
5.	Haryana	N.A.	743	3,459	15,640	4,433	7,399	4,000	31,472
6.	Jammu & Kashmir	N.A.	10	55	122	11	50	1,030	1,213
7.	Kerala	N.A.	N.A.	2,666	6,957	1,538	1,700	2,000	12,195
8.	Madhya Pradesh	—	30	773	7,309	3,569	6,481	10,000	27,309
9.	Madras	14,373	32,440	1,17,695	2,56,594	32,298	51,746	30,000	3,70,638
10.	Maharashtra	131	294	7,167	44,896	20,675	17,600	24,000	1,07,171
11.	Mysore	2,460	8,003	16,905	42,396	12,325	16,554	20,000	91,275
12.	Nagaland	—	—	—	—	—	—	—	—
13.	Orissa	N.A.	N.A.	N.A.	834	59	100	1,500	2,493
14.	Punjab	N.A.	3,095	8,577	25,296	8,053	10,084	10,000	53,433
15.	Rajasthan	30	47	1,100	6,962	4,003	2,500	3,000	16,465
16.	Uttar Pradesh	747	1,629	3,811	17,591*	12,919	22,900	30,000	83,410
17.	West Bengal	N.A.	N.A.	56	437	369	200	418	1,424
	Total States	18,698	49,813	1,90,395	5,10,073	1,36,210	1,82,498	1,84,948	10,13,729
	Total Union Territories	—	284	1,371	4,158	1,066	1,000	968	7,192
	Grand total	18,698	50,097	1,91,766	5,14,231	1,37,276	1,83,498	1,85,916	10,20,921

N.A. = Not available.

* Includes 7,675 State tube-wells.

Source: Report of the Working Group for Formulation of Fourth Five-Year Plan Proposals on Minor Irrigation and Rural Electrification, Ministry of Food, Agriculture, Community Development and Co-operation, Government of India, New Delhi.

TABLE V—PROGRESS OF PRIVATE TUBE-WELLS INCLUDING FILTER POINTS

(*numbers*)

Sr. No.	State	Pre-Plan	During First Plan	During Second Plan	During Third Plan	At the end of Third Plan	During 1966-67	Anticipated during 1967-68	Target for 1968-69	Total up to 1969
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Andhra Pradesh ..	16,197	2,160	4,735	2,922	26,014	539	580	742	27,875
2.	Assam	—	—	—	—	—	—	—	100	100
3.	Bihar	1,973	116	1,320	1,860	5,269	1,107	2,881	8,000	7,257
4.	Gujarat	—	12	9	N.A.	21	—	—	—	21
5.	Haryana	Included in Punjab			—	15,319	435	2,590	5,000	23,344
6.	Jammu & Kashmir ..	—	—	—	—	—	—	—	—	—
7.	Kerala	—	—	160	108	268	—	18	—	286
8.	Madhya Pradesh ..	—	—	—	—	—	—	—	1,000	1,000
9.	Madras	N.A.	2,649	3,037	8,509	14,195	2,903	3,200	3,600	23,898
10.	Maharashtra	—	—	—	—	—	—	—	—	—
11.	Mysore	—	—	—	—	—	—	—	2,000	2,000
12.	Nagaland	—	—	—	—	—	—	—	—	—
13.	Orissa	—	—	—	3	3	—	—	167	170
14.	Punjab	N.A.	3,838	8,216	29,031	25,766*	4,153	7,000	7,100	44,019
15.	Rajasthan	—	5	67	141	213	54	60	120	449
16.	Uttar Pradesh	2,350	416	1,837	21,545	26,148	24,996	38,784	28,000	1,09,928
17.	West Bengal	—	—	—	—	—	—	200	20,000	20,200
	Total	20,520	9,196	19,381	64,119	1,13,216	34,187	47,313	75,829	2,70,545

N.A. = Not available.
* Includes 42 private tube-wells installed in the area transferred to Himachal Pradesh.

TABLE VI—PROGRESS OF STATE TUBE-WELLS

(*numbers*)

Sr. No.	State	Pre-Plan	During First Plan	During Second Plan	During Third Plan	At the end of Third Plan	During 1966-67	Anticipated during 1967-68	Target for 1968-69	Total up to 1969
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Andhra Pradesh ..	—	—	2	9	11	—	—	—	11
2.	Assam	—	—	8	16	24	—	—	—	24
3.	Bihar	180	767	31	47	1,025	68	58	175	1,326
4.	Gujarat	22	366	228	94	710	61	70	185	1,026
5.	Haryana	—	Included in Punjab		—	898	—	—	70	968
6.	Jammu & Kashmir ..	—	—	—	—	—	—	20	25	45
7.	Kerala	—	—	—	—	—	—	—	—	—
8.	Madras	—	—	3	20	23	—	2	10	35
9.	Madhya Pradesh ..	—	15	39	19	73	—	10	25	108
10.	Maharashtra	—	—	2	1	3	—	—	—	3
11.	Mysore	—	—	—	—	—	—	—	—	—
12.	Nagaland	—	—	—	—	—	—	—	—	—
13.	Orissa	—	1	7	75	83	42	80	68	273
14.	Punjab	—	574	910	86	672	—	—	50	722
15.	Rajasthan..	—	—	—	12	12	—	15	25	52
16.	Uttar Pradesh ..	2,305	2,387	1,844	1,736	8,272	428	412	570	9,682
17.	West Bengal	—	36	59	385	480	290	342	367	1,479
	Total States	2,507	4,146	3,133	2,500	12,286	889	1,009	1,570	15,754

Note : Figures are provisional and subject to check by the State Governments.

Source : Report of the Working Group for Formulation of Fourth Five-Year Plan Proposals on Minor Irrigation and Rural Electrification, *op. cit.*

III

The above analysis shows that, because of the financial constraints, a relatively small percentage of the total villages has been electrified and the choice has been in favour of the larger villages. Within the villages that have been electrified, the comparatively larger cultivators have benefited from the electrification. It is necessary therefore to consider the methods by which it is possible to extend electricity (*a*) to a larger number of villages, (*b*) to the small villages and (*c*) to the small cultivator.

The Electricity Boards sanction schemes for rural electrification only if they can get returns of 10 to 18 per cent on the capital invested. This rate of return is insisted upon to some extent because of the rate of interest that the Electricity Boards have to pay on the loans raised for rural electrification. The loans are received by the Electricity Boards from three sources: firstly, loans from the commercial banks at about 8 per cent rate of interest ; secondly, from the State Governments and, thirdly, from the Central Government through the State Government. Whether the loans are obtained from the Central Government or from the open market by the State Governments, the State Governments add their own service charges. These charges vary from State to State. It is necessary to determine the minimum service charges and to standardize the rates of interest charged. If the rates of interest to be paid by the Electricity Boards are reduced, then they can also consider expansion of schemes with lower rates of interest. Since the rate of interest charged by the commercial banks is higher than the rate of interest charged by Government, the State Governments may consider subsidizing the Electricity Boards to the extent of the differentce in the rate of interest charged by the commercial banks and the rate of interest charged by the State Governments.

Another method by which rural electrification can be extended over a large area is by improving the rate of return on investment in rural electrification. One way to do this is by a change in the accounting procedure. Different States follow different practices in allocating the capital cost of rural electrification to non-rural electrification schemes. The differences in the accounting practices of the different State Governments need to be carefully examined with the objective of finding out the most appropriate method of allocating the maximum amount of capital cost of rural electrification to schemes of non-rural electrification. This method in effect means, firstly, a subsidization of the programme of rural electrification by the urban sector and, secondly, a reduction in the capital cost over which the returns need to be calculated and this, in turn, means an increase in the rate of return on the capital invested in rural electrification.

In view of the difficult financial position, some of the State Electricity Boards have introduced a Consumer Deposit Scheme. The amount required to be deposited covers an amount equivalent to the whole or part of the estimated cost of extending the supply line to the rural areas. This deposit is either returned later with interest, or adjusted against the monthly supply bill of the consumer. The deposit scheme helps to raise funds, but it is likely to benefit only the large cultivator. The deposit scheme can also help the small cultivator if the commercial banks lend to the cultivators the amounts required for the deposit. The

amounts may be sanctioned on a guarantee by the State Government. In order to reduce their own financial liability, the State Governments may extend the guarantee only to small farmers as the large farmers can find alternative sources of finance.

The panchayats can also help in the extension of rural electrification and the utilization of electricity by the small farmer. The panchayats can give the electricity deposit to the State Electricity Boards and also purchase the pump sets. These pump sets may then be given on hire to the cultivators who have wells, and the cultivators who hire the pump sets may be given the right to sell water at fixed rates to the other cultivators. The finances of the panchayats, however, are not likely to be adequate for the electricity deposits and the purchase of pump sets. The panchayats may, therefore, either be financed by the commercial banks on a State guarantee or they may be given specific grants or loans by the *Panchayat Samitis*.

While the methods suggested above help the small farmer, the problem of the small village still remains. The small village can be covered by rural electrification if the village approach is given up in favour of an 'area' or 'cluster' approach.

The methods suggested above will help in the expansion of the programme of rural electrification, and substantially extend the benefits of the programme to the small village and the small cultivator.

INVESTMENT: REVENUE RATIO OF RURAL ELECTRIFICATION VERSUS AGRICULTURAL ELECTRIFICATION*

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Introduction

To the Indian farmers electricity is by no chance a luxury; it is a vital necessity—a life-giving energy for increasing agricultural production and productivity through lift irrigation, more efficient processing of farm production, establishment of cottage industries and what is more, for giving them a source of security and developing a forward outlook. Throughout the country, there is huge demand for electricity in the villages. Until the start of the Third Plan, rural electrification programme in India was mainly conceived for electrifying villages for lighting purposes but not for energizing pump sets. The programme for energizing pump sets has been given priority since 1966-67.

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