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INDIA FIELD SURVEY REPORT

MARCH 1963

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This report is one of a series prepared for the Agency for International Development, U. S. Department of State, under General Electric Contract - A. I. D. REPAS-1 on the Generation and Utilization of Power in Rural Areas of Developing Countries.

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INDIA FIELD SURVEY REPORT

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INTRODUCTION

This report presents the principal findings and recommendations of a Field Survey conducted in India on the Generation and Utilization of Power in Rural Areas during the period April 8 - May 15, 1962. The investigations were carried out by a Survey Team consisting of Dale J. Hekhuis, Economist, Advanced Technology Laboratories, General Electric Company; Paul H. Rosenstein-Roday, Economist, Center for International Studies, Massachusetts Institute of Technology; Kailash K. Singh, Social Psychologist, Lucknow University, India; and Stanton R. Smith, Engineer, Stanford Research Institute.

The over-all objective of the field investigations was to assess the need for and the impact of electrification on rural development, with particular emphasis on the role and significance of small-scale power generating units for village development.

The report sets forth the principal findings of the Survey Team with respect to energy generation and utilization, the need for a power utilization program, and the need for technical support for rural development. It also describes and evaluates some potential pilot project sites which were investigated in the field, and presents recommendations for future work.

Special acknowledgement should be given to the Government of India, whose cooperation and guidance made the field investigations possible. Officials and personnel of the Planning Commission, Central Water and Power Commission, and the State Electricity Boards in particular provided invaluable assistance in selecting field sites, arranging itineraries, and assembling data. Personnel of the Agency for International Development Mission and the Ford Foundation India Program also gave most generously of their time and experience.

This Field Survey Report is one of a series prepared under contract to the Agency for International Development on the Generation and Utilization of Power for Rural Communities in Developing Countries. Additional reports include Small-Scale Power Supplies for Rural Communities in Developing Countries, Cost Analysis of Electricity Supply Systems for Rural Communities, and Analysis of Demand for Electric Power in Rural Communities.

CONCLUSIONS AND RECOMMENDATIONS

SMALL SCALE POWER UNITS FOR ELECTRICITY SUPPLY

Scale of Generation

In the limited number of instances where it was judged that the local generation of electricity could make a productive contribution at the village level--2000 to 3000 population--the field studies showed that a 50-kw unit would be the minimum size required. In addition, it would be advisable at the outset to install excess capacity for future load growth.

Vapor Engine-Generator

On-site field investigations in rural India revealed that a compact, reliable, small-scale (15 kw), closed-cycle, compound vapor engine-generator capable of using alternative indigenous fuels would not be an effective and economical means of supplying electric power. It was found that supplies of local indigenous fuels--wood, rice hulls, dung, straw, leaves, etc.--were insufficient to meet the daily requirements of a vapor engine-generator of adequate size on a dependable basis.

Diesel Engine-Generator

Electric power supplied by small-scale diesel engine-generator is costly, due to the high price of diesel fuel--50 cents per U. S. gallon is a typical price for rural communities in India--which reflects the high tax--up to 50 per cent of the total price--imposed by the Government to discourage consumption of imported petroleum fuels. Consequently, the principal role of small-scale diesel generators in rural India is to supply power on an interim load-building basis awaiting grid connection.

ELECTRICAL ENERGY UTILIZATION

Generally speaking, the on-site investigations revealed only a limited opportunity for the utilization of electric energy supplied by small-scale generating units. These findings are summarized with respect to the use of power in irrigation, agriculture, rural industry, and rural welfare.

Irrigation

The most outstanding contribution electric power can make to rural economic develcpment in India is in water pumping for crop irrigation purposes. Electric pumping is usually too costly, however, unless grid power is available. This is because direct diesel pumping is invariably more economical than electric pump sets supplied with electric energy from a small-scale generating unit.

Agriculture

Uses of power in the agricultural sector include refrigeration-cooling systems for storage and preservation of foodstuffs. Dairy farming and poultry farming are also greatly facilitated by the availability of electricity from the standpoint of cooling and environment control.

Rural Industry

The field investigations revealed little potential for the productive use of electricity by traditional village industries with primitive technologies. Improved technologies may improve the viability of certain types of small industry in large villages. "Scale" considerations give the market town a considerable advantage, relative to the village, as a processing center for food and industrial crops.

Rural Welfare

There is little question that, potentially, electricity can have a considerable impact on the physical and social well-being of a rural community with respect to illumination, communications, educational aids, etc. However, there is some question as to whether these highly desired services can be enjoyed and paid for by the Indian villager without a parallel increase in income. It is to the latter problem that the utilization of power must be primarily directed.

NEED FOR PRODUCTIVE POWER UTILIZATION

In addition to the planning and installation of electricity supply systems, there needs to be a parallel power utilization program aimed at increasing the productivity of agriculture and rural industry. This is because there is no automatic process which insures the productive use of energy once it has been made available. Specific activities of a power utilization program could include education-demonstration programs on power use, wiring, and maintenance of power-using equipment; provision of long term, low interest loans for the purchase of power-using equipment; and a research and development program on power-using equipment for agriculture and rural industry.

NEED FOR IMPROVED TECHNICAL SUPPORT FOR RURAL DEVELOPMENT

The field investigations revealed a need for an improved program of technical support which would (1) identify specific technical requirements; (2) adapt known technologies to the requirements, and (3) provide competent technical information and advice to the farmer and the small industry entrepreneur. In the case of rural industry, improved technologies are needed to bring about increased efficiency and to provide rural employment opportunities. In addition, potential entrepreneurs need to have access to competent techno-economic advice with respect to the types of small industry undertakings which are feasible in rural areas.

RECOMMENDATIONS FOR FUTURE WORK

The principal recommendation for future work which derives from the findings of the field survey investigations is the formulation and implementation of a research-action program on the utilization of power in agriculture and rural industry. Such a program would include the following types of activities:

. Identify opportunities for improving and extending the economic use of electric power in agriculture and rural industry.

. Establish criteria for the electrification of rural communities, with particular reference to the economic development potential of electricity.

. Carry out selective research and development on power-using equipment for agriculture and rural industry.

. Develop and carry out education-demonstration programs on power utilization in the field.

. Devise means for providing long term, low interest loans for the purchase of power-using equipment.

PRINCIPAL FINDINGS

At the outset of the field investigations it was hypothesized that a compact, reliable, small-scale engine-generator--ten to fifteen kilowatts--capable of utilizing alternative indigenous fuels would be an effective and economical means of supplying power for productive purposes to remote rural villages. This hypothesis was not borne out in the field investigations, as will be discussed below with respect to energy utilization and supply.

ELECTRICAL ENERGY UTILIZATION

Generally speaking, the on-site investigations revealed only limited opportunity for the productive application of electric energy supplied by small-scale generating units.* The findings on utilization are discussed below with respect to irrigation, agriculture, rural industry, and rural welfare.

Irrigation

The most outstanding contribution electric power can make to rural economic development in India is in water pumping for crop irrigation purposes. This is because a timely and adequate supply of irrigation water is a basic essential for increased agricultural production in most areas of India. Traditional pumping techniques are often inadequate with respect to coping with peak demands. Bullock-powered water lifting devices, for example, frequently lack sufficient capacity to cope with peak irrigation demands, which can be several times greater than average demand. Furthermore, the available supply of bullock power, in many cases, is simply insufficient to satisfy irrigation requirements for double-cropping.

Where water pumping for irrigation is required, however, electric pumping is usually too costly unless grid power is available. This is because direct diesel pumping is invariably more economical than electric pump sets supplied with electric energy from a small-scale generating unit. This accounts for the large number of diesel pumping sets in rural India where grid power is as yet unavailable.

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* This finding does not necessarily hold for power supplied by overhead transmission line, however.

Further, given the Indian land tenure pattern of three to four acres in many cases, it is difficult to justify either a diesel or an electric pump. The Indian Government is making attempts to consolidate holdings, but in many parts of the Country the size of the holdings is so small that even consolidated holdings will require common sharing of pumped water, an arrangement which has so far been extremely difficult to arrange to the satisfaction of the parties concerned. The social problem is the critical factor here.

Agriculture

Uses of power in the agricultural sector, in addition to irrigation, include refrigeration-cooling systems, such as a walk-in cooler,* for the storage and preservation of foodstuffs. In the course of a field investigation at Bridgmanganj, Uttar Pradesh, for example, a local entrepreneur expressed interest in establishing a cold storage facility for potatoes, should electric power become available.

Other opportunities for power use are in dairy farming and poultry farming, although the feasibility of each of these undertakings in rural India needs further investigation. Nevertheless, the availability of electric power can be particularly instrumental in the establishment of daily farms where bulk cooling is a requirement. Chicken brooding, of course, is dependent on a carefully controlled environment which can be greatly facilitated by the availability of power.

Rural Industry

The field investigations revealed little potential for the productive use of electricity by traditional village industries characterized by primitive technologies, since these industries--weaving, tanning, oil expelling, shoe-making, etc.--cannot begin to compete with the larger and more efficient units in the market towns and cities, regardless of wage scales. Currently, these industries are economically marginal or sub-marginal, the daily income per artisan ranging between Rs. 0.50 to Rs. 1.25, or ten to twenty-five U.S. cents. The only reason that these industries have not been completely wiped out is that the local product is sometimes viewed as having special properties--Ghani oil, for example, is said to be purer, healthier, more tasty and resistant to deterioration than the mill product--or the artisan is willing to pay a heavy price in terms of hard work, undernourishment, and poverty for

*See the report on Refrigeration-Cooling Systems for Rural Communities in Developing Countries, December 1962, prepared under this Contract.

being able to continue with a trade, in the absence of any suitable alternative. Under those special circumstances where it is appropriate to perform certain processing operations at the village level, such as grain grinding or oil expelling in a village that lacks access to a market town, it would appear to be more economical to utilize the shaft power of an internal combustion engine directly rather than to convert shaft power to electric energy to power an electric motor.

This is not to argue against rural industry per se, however. Improved technologies and centralized facilities such as workshops may improve the viability of certain types of small industry in large villages. Furthermore, the district or market town appears to offer considerable promise as a center for rural industry midway between the village and the larger urban community. "Scale" considerations alone give the market town a considerable advantage as a processing center for food, fuel, and industrial crops.

Rural Welfare and Services

There is little question that, potentially, electricity can have a dramatic and substantial impact on the physical and social well-being of a rural community. Electricity can be used to illuminate the home, the school, and the community center; it can power refrigeration-cooling devices; it can supply potable drinking water by electric pump; and it can power a movie projector and a radio.

However, there is some question as to whether these highly desired services can be enjoyed and paid for by the Indian villager without a parallel increase in income. It is to the latter problem that the utilization of power must be directed primarily. Furthermore, since consumer services, taken as a whole, would constitute only a small power load, other uses of power need to be developed so as to achieve as economical a load factor as possible.

This is not to say, of course, that power may not be a worthwhile social and political investment for purposes of improving rural amenities, avoiding dissidence, and achieving social change. It is important to be clear with respect to the costs of providing such services, however, and in the absence of productive applications of power to face up to the possibility that highly subsidized electric services might not prove to be permanent.

ELECTRICAL ENERGY SUPPLY

Scale of Generation

In the limited number of instances where it was judged that the local generation of electrical energy could make a productive contribution at

the village level (population 2000-3000), the field studies showed that a 50-kw unit would be the minimum size required. In addition, it would be advisable at the outset to install excess capacity for future load growth. Further, some reserve or standby capacity should be provided to assure a dependable supply. These requirements are well above those originally estimated, and have substantial implications for the alternative fuels that can be considered.

Fuel Availability

It was found that in almost every site investigated, supplies of local fuels such as wood, rice hulls, dung, straw, leaves, etc. were insufficient to meet the daily requirements of an engine-generator of adequate size on a dependable basis. (Table 1 shows the estimated daily fuel requirements of alternative 15-kw generators, including a closed cycle, compound vapor engine-generator.) Some of these fuels are seasonal in supply, e.g., rice hulls and straw. Some have uses other than as fuel, e.g., agricultural mulch, fertilizer, building materials, or animal feed. Some are concentrated geographically, e.g., coal, where the cost of transporting coal into villages is an effective deterrent to its use. Wood is available in certain areas, as in the State of Orissa, but in general, wood is not available in the quantity required. It should also be pointed out that the limited supply of wood that is available for fuel is generally used for cooking and heating, and that the Government of India has imposed severe limitations on the use of wood for fuels in view of already seriously depleted forests.

Internal Combustion Engines

Widespread distribution systems for diesel fuels have been established in rural India. However, electric power supplied by diesel engine-generator is costly due to the high price of diesel fuel (see Table 2), which reflects the high tax (up to 50 per cent of the total price) imposed by the government to discourage consumption of imported petroleum fuels.

For example, the 225-kw diesel generating station at Malpura in Rajasthan (two 100-kw diesel generating units and one 25-kw standby unit) purchases high-speed diesel fuel at a price of 50 cents per U.S. gallon. In turn, power is sold at a rate of approximately 10 cents per kilowatt-hour for domestic use, and five cents per kilowatt-hour for industrial uses.

Given the high cost of diesel generated power, the State Electricity Boards have been reluctant to install diesel units for rural communities except on an interim load building basis awaiting grid connection. Consequently, there are only a relatively small number of public utility diesel power stations in India (see Table 3).

TABLE 1

Illustrative Daily Fuel Requirements of Alternative 15-kw Engine-Generators Operating at a 30 Per Cent Plant Factor

Plant	Fuel	HHV, btu/ lb.	SFC, lb. / kwh	Plant Efficiency, %	Fuel Rate, lb. / day	Daily Fuel Consumption, million btu	Daily Fuel Cost*, dollars
Diesel engine-generator	High-speed oil	19,000	0.775	23.1	83	1.58	5.85-7.06
	Low-speed oil	18,500	0.795	23.1	85	1.58	2.81-3.92
Gasoline engine-generator	Gasoline	20,750	1.11	14.8	120	2.52	-
Closed cycle, compound vapor engine-generator	Low-speed oil	18,500	1.23	15.0	133	2.48	4.41-6.15
	Bunker C	18,835	1.21	15.0	131	2.48	-
	Coal	11,800	1.93	15.0	210	2.48	-
	Wood	7,750	2.94	15.0	318	2.48	0.82-2.06
	Agric. waste	7,500	3.04	15.0	330	2.48	-

Note:--

In calculating fuel requirements, the best generation efficiencies at rated output are assumed. Actual fuel rates will exceed these values as a power plant installation will rarely operate at peak load and performance.

HHV - Higher Heating Value. SFC - Specific Fuel Consumption.

High-speed diesel fuel is similar to Grade 2D as specified by the American Society for Testing Materials; low-speed diesel fuel is similar to Grade 4D as specified by ASTM.

* Based on high and low fuel prices from Table 2.

TABLE 2

Fuel Prices at Selected Sites in India

Location	Type of Fuel	----Prices---- Rupees	Dollars	Dollars per million btu
Rajasthan				
Jhuntha	Low-speed oil	1.62/gal.	0.28/gal.	1.99
Berat	Low-speed oil	1.62/gal.	0.28/gal.	1.99
	Fuel wood	30-37/ton	6.35-7.85/ton	0.41-0.51
Malpura	Low-speed oil	1.62/gal.	0.28/gal.	1.99
	High-speed oil	2.82/gal.	0.50/gal.	3.85
Maharashtra				
Jammer	Low-speed oil	1.44/gal.	0.25/gal.	1.78
	Fuel wood	40-50/ton	0.47-12.71/ton	0.55-0.83
Paldhi	Low-speed oil	1.44/gal.	0.25/gal.	1.78
	Fuel wood	40-60/ton	8.47-12.71/ton	0.55-0.83
Uttar Pradesh				
Srinagar	High-speed oil	3.30/gal.	0.58/gal.	4.47
Bridgmanganj	Low-speed oil	1.94/gal.	0.34/gal.	2.41
	High-speed oil	2.75/gal.	0.48/gal.	3.70
	Fuel wood	24-43/ton	5.08-9.17/ton	0.33-0.60
Chandrawal	Low-speed oil	1.12/gal.	0.20/gal.	1.42
Nautanwa	Low-speed oil	2.00/gal.	0.35/gal.	2.48
	High-speed oil	3.25/gal.	0.58/gal.	4.47
	Fuel wood	50-60/ton	10.59-12.71/ton	0.69-0.83
Orissa				
Tikabali	Fuel wood	24/ton	5.08/ton	0.33

Note:--

Rupee prices are for imperial gallons.
Dollar prices are for U.S. gallons.

TABLE 3

Capacity of Diesel Power Stations in India
1956*

Plant Capacity (kilowatts)	Number of Stations
Up to 100	124
101 - 250	126
251 - 500	110
501 - 750	54
751 - 1000	25
1001 - 2500	52
2501 - 5000	9
TOTAL	500

Source: Demand for Energy in India, NCAER, 1960, P. 155.

* Since 1960 approximately 250 diesel sets of 100-kw capacity and less have been installed under the Colombo Plan.

Other Power Supplies

Bio-Gas Generator:--The bio-gas generator offers a limited potential as an energy supply and has the added advantage of producing a fertilizer residue. Family-size units of 100 cubic feet daily capacity have been built and tested by the Indian Agricultural Research Institute. Gas production of this unit is sufficient for lighting (four to five cubic feet of gas per hour for a gas lamp) and cooking (10 cubic feet of gas per hour per burner). The Agricultural Research Institute has also constructed a 350-cubic foot unit, and the Planning Research and Action Institute at Lucknow is experimenting with a 1000-cubic foot unit. To gain an appreciation of the significance of these capacities, the following data are cited:

One pound of dung yields about one cubic foot of gas.
One cow produces about 30 pounds of dung per day.
18 cubic feet of gas is required per hp-hour for a converted petrol engine.

Wind Power:--In those limited number of areas in India where wind speeds are sufficient, windmills can be effectively employed for water pumping. The use of windmills for electricity generation is a different matter, however, and their principal justification would be to supply isolated farmsteads with five to ten kilowatts of power.

Solar Power:--Solar power appears impractical for near-future rural electrification. Substantial research and development remain to be done to increase conversion efficiencies and to reduce equipment costs in order to compete with presently available power generating equipment.

NEED FOR PRODUCTIVE POWER UTILIZATION

One of the major findings of the field Survey Team is the need for more effectively relating rural electrification efforts with rural development programs. In other words, in addition to the installation of an electric supply system, there needs to be a parallel power utilization program aimed at increasing the productivity of agriculture and rural industry. It is in the latter two areas where there is least awareness of the development potential of electricity by the rural population. By contrast, the use of power for consumer services is most apparent to village communities. This was brought out repeatedly during the course of the field investigations.

It is quite understandable, of course, that the State Electricity Boards have tended to concentrate their efforts on generating, transmitting, and distributing electricity given the tremendous demands placed on these organizations for supplying power, for installing new capacity, and for electrifying additional areas--rural and urban. Nevertheless, it needs to be recognized that the supply of energy is only half the job, and that there is no automatic process which insures the productive use of electricity once it has been made available.

The following lists some of the tasks and problems which might be addressed in a power utilization program. Some suggestions are also advanced relative to the implementation of such a program.

Tasks and Problems

1. Identify opportunities for improving and extending the economic application of electric power in agriculture and rural industry. In this connection, power utilization "profiles" might be developed for the farm, the village, the market town, and the district. The development of such profiles would, of course, require the services of agricultural and rural industry specialists.

2. Identify opportunities for the centralized consumption of power in rural communities. Consumption of small quantities of power at widely dispersed points is costly and could be overcome to a degree by grouping certain power-consuming activities, e.g., workshop, industrial estate, crop processing facilities, cold storage, dairying, etc.

3. Establish criteria for the electrification of rural communities with particular reference to the economic development potential of electricity. The objective would be to bring about, insofar as practicable, a selective approach to the electrification of rural communities.

The following are some suggestions for the possible implementation of a power utilization program.

1. Conduct a continuing education-demonstration program on power use, electric wiring, and maintenance of power-using equipment. Both the Tennessee Valley Authority and the Puerto Rican Water Resources Authority have found such a program indispensable in rural electrification projects.

2. Provide low interest, long term loans for the purchase of power-using equipment. The minimum current interest rate for rural loans in India approximates 4-1/2 per cent.

3. Conduct a research and development program on power-using equipment for agriculture and rural industry.

NEED FOR IMPROVED TECHNICAL SUPPORT FOR RURAL DEVELOPMENT

Throughout the course of the field investigations the need for a more effective program of technical support for rural development became increasingly apparent, particularly when questions on power utilization came up. More specifically, the on-site investigations strongly suggest that a program of technical support is required which would: (1) identify specific technical requirements; (2) adapt known technologies to the requirements, and (3) provide competent technical information and advice to the farmer and the small industry entrepreneur. Each of these dimensions of technical support is discussed below.

Technical Requirements

First and foremost in a program of technical support is the identification of valid, specific (not general) technical requirements in the agricultural, small industry, and service areas of the rural sector. The necessity of accomplishing this initial step is well

illustrated, as indicated above, by the rejection of an hypothesized requirement for a 15-kw generator capable of utilizing alternative indigenous fuels. Moreover, until the requirements are specified in terms meaningful to the engineer, there can be no coherent program of research and development on equipment and processes tailored to the rural environment.

Adaptive Engineering

Surprisingly little adaptive engineering--adapting technology to the particular needs and environments of the newly developing countries--has been accomplished. This was apparent from the field surveys and at a recent Conference on Engineering Research for the Developing Countries.* Nevertheless, a useful beginning has been made by a few forward looking organizations. One of these is the Planning Research and Action Institute (PRAI) of Uttar Pradesh, India. Over the past several years, PRAI, with limited funding, has undertaken to carry out pilot project experimentation in the following areas:

1. Small-scale manufacture of crystal sugar.
2. Food processing.
3. Paddy processing.
4. Pottery.
5. Tanning.

The objective of these projects has been to bring about increased efficiency through technological improvement and to provide increased rural employment opportunities. A brief description of the crystal sugar project which involved a direct engineering attack on the improvement of a small-scale process will illustrate the approach.

Subsequent to the development of the large-scale or vacuum pan sugar industry in India in 1932, the term "Khandsari" came to denote the old indigenous process of white sugar manufacture. The essential difference between the two processes is that in one case the boiling of the juice is carried out in a vacuum and in the other case, the boiling is done in an open pan. In the vacuum process, sugar recovery is about 9.5 per cent, while the open pan process achieves only five to 5.8 per cent. As a consequence of technical investigations carried out by PRAI, based on research conducted by the National Sugar Institute, an open pan sulphitation process was developed which now

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* Conference on Engineering Research for the Developing Countries, co-sponsored by the Engineering Foundation and the Engineers Joint Council, Tilton, New Hampshire, July 23-27, 1962.

has a recovery rate of eight per cent. Such a unit can be established for a crushing capacity of 30-60 tons per day. All of the machinery is fabricated within the Country, and individual units can be dispersed easily in sugarcane areas where transport facilities are not well developed. In terms of investment, approximately 100 small-scale open pan sulphitation units are equivalent to a single vacuum pan unit. Further, the open pan process is labor intensive, requiring eight men per 100 maunds of cane processed in comparison with one man per 100 maunds processed by the vacuum methods.

Recently in discussions between PRAI and personnel of the Advanced Technology Laboratories, General Electric Company, it became apparent that a new type of water still developed by the Laboratory, which operates at atmospheric pressure and temperatures considerably below the boiling point, has considerable potential for improving the thermal efficiency of the open pan sulphitation process. Given an input of cane juice, the still can concentrate the cane to a thick consistency and yield distilled water as a by-product.

This encounter between a U. S. laboratory and an Indian research institute suggests a cooperative research relationship that might prove highly rewarding to both. For example, a possible cooperative venture might take the following form:

Indian Institute	U. S. Laboratory
1. Identifies specific requirement.	
2. Works up specifications.	
	3. Identifies alternate technical approaches.
	4. Conducts systems engineering analyses.
	5. Builds a prototype device.
6. Conducts field tests.	
7. Suggests equipment modifications.	
	8. Modifies equipment.
9. Performs technical and economic evaluation.	

Technical Information and Advice

During visits to specific rural communities questions were asked repeatedly and advice frequently sought by local farmers and entrepreneurs as to the feasibility and cost of a certain industry, the advantages of a particular process, etc. In Raipur a question was the

feasibility of establishing a unit for processing chillies. In Bridgmanganj and Nautanwa there was much interest by local investors with respect to the possibility of setting up a tannery. In Srinagar the bricks and mortar of a potential industrial estate had been put in place by the government but it was unclear as to what types of industrial activity might be advisable and attractive to potential local entrepreneurs. In Dobhi, potential investors were at a loss to identify the types of small industry opportunities which might be open to them.

Discussions with the individuals concerned revealed that several had made repeated attempts to obtain information but had either failed or obtained only partial data. Some had considered using a private consultant but had not done so. Most simply were unaware as to the specific type of information they required.

The point of this discussion is that : (1) potential entrepreneurs are frequently unaware of the technical options open to them; (2) an effective mechanism apparently has not been developed to supply this information; and (3) if (2) were available and used in an imaginative way, it might be possible to induce local investment. At the least, further exploration would appear justifiable.

SELECTED SITE EVALUATIONS

One of the specific tasks of the field survey team was to identify and evaluate specific sites for possible pilot project undertakings on the generation and utilization of electric power in village communities. It was during the course of these site investigations, in conjunction with visits to already electrified communities, that the survey team became increasingly concerned with the need for increasing the productive utilization of electric power, i.e., using power to increase the output and income of the community.

Four sites have been selected to portray the types of situations investigated during the course of the field survey. One site--Dobhi, in Uttar Pradesh--is already supplied with power by transmission line. In this case, the problem is to build up and diversify the power load. Another site--Malpura, in Rajasthan--is currently supplied with power by a 225-kw diesel generator installation. Again, the problem is to develop productive uses of power and to build up the load. The third situation is a cluster of villages in Rajasthan which are currently without power. The question is whether the introduction of power could have a productive impact on the community, and if so, what type of power supply system is suitable and feasible. The fourth site--the village of Bridgmanganj in Uttar Pradesh--is a community of 3500, currently without electric power. A potential combination of agricultural and small industry uses of power coupled with the possibility of local investment in new enterprises suggests that this community might respond well to a pilot electrification project.

It should be pointed out, of course, that the foregoing sites can only be set forth as possible types of contenders for pilot electrification projects. Additional investigation and analysis would be required before specific selections could be made.

DOBHI (UTTAR PRADESH)

Dobhi is a little over 20 miles from Varanasi and about 25 miles from Jaunpur, the district headquarters. A pucca road connects Dobhi with Varanasi and Azamgarh. It is also connected with Aunrihar, about 12 miles east, by rail and by road. Aunrihar is an important junction on the meter gage railway line connecting Varanasi, Jaunpur, Gorakhpur and the large cities in the State of Bihar.

Dobhi is a development block with a cultivated area of about 27,000 acres. The soil is very fertile, and agriculture is the chief occupation of the people. The average landholding is relatively small, for Dobhi is one of the heavily populated areas of Uttar Pradesh. The chief crops of the area are paddy, maize, wheat, barley, peas, and sugarcane. Sanai, a fibre crop, is also grown widely.

The land in Dobhi has been traditionally owned by a clan of Rajputs called the Raghuvanshis, who settled in this area some 300 years back. In spite of the years that have since elapsed, the Raghuvanshis are still conscious of their common origin, and have often cooperated in tackling problems of common interest.

The Small-Scale Crystal Sugar Unit

The above is well illustrated in the case of the sugar mill which has now been in existence since 1960. Prominent people of the area persuaded the Government to sanction a sugar mill for Dobhi and once this was agreed to, they raised the required share capital of Rs. 50,000 by selling shares to villagers. No one was allowed to purchase more than ten shares. Every shareholder was to have an equal voice in voting on matters regarding the mill. Shares were sold mostly to sugarcane cultivators who wanted an outlet for their produce. A few others have bought shares and are entitled to dividends, but bonuses (division of profits after dividends) go only to shareholders who supply cane. There is an annual meeting of shareholders to ratify decisions of the Board of Directors concerning fiscal matters and to choose nine directors. Two directors are appointed to the Board by the State Government, making a total of 11 directors. The directors meet several times a year. The main responsibility of procuring the cane, processing the sugar, and dealing with the markets is in the hands of a full-time manager. The present manager is a U.P. government official, who has been lent to the mill for a three-year period. In order to aid the cooperative in getting started, the State paid his salary for the first year. Not all the capital needed for the building and the equipment came from the cultivators. The State Government also bought 50,000 rupees in shares and is a partner of the local people in the development. Another 50,000 rupees was borrowed from banks. The official name of the organization is "The Dobhi Sugarcane Processing Society, Ltd., Bajrangnagar".

During the first year of operation, it crushed 24,000 maunds of sugarcane, a good performance in view of the many difficulties and breakdowns involved in shaking down the mill. Unfortunately, during

the second year, a failure of the sugarcane crop created a cane shortage and only 25,000 maunds were available for the mill. It is hoped that during the coming crushing season the losses incurred during the previous years will be wiped out.

The plant is permitted to use sufficient electric power to develop 75 horsepower.

Potential for Rural Industry

Except for the sugar mill and a few flour mills, there are no mechanised industries in Dobhi to date. Inquiries from the local people suggest, however, that some industries may have possibilities. These are: Handloom Sarees:--Varanasi is famous for the manufacture of silk and handloom sarees. Some workers from Dobhi have been working in Varanasi. There is reason to believe that if facilities are available, the people in Dobhi, who have been trained in the art at Varanasi, would like to start the industry in Dobhi itself. A few individuals such as Murtaza, Ishaq, Dhunmum and Ghani belonging to the village of Lewarua, only half a mile from Bajrangnagar, are reported to be skilled in saree-making; Manufacture of Utensils:--A few villagers in village Bishunpur adjoining the sugar mill, have been working in Varanasi where utensil-making is a thriving business. It was reported that these individuals--Ram Surat, Raghu Ram and Ram Nandan--are interested in taking up utensil-making in Bishunpur itself provided facilities became available; Fibre and Cardboard Industry:--Dobhi produces fibre plants in large quantity. These are hemp, sanai, bamboo and straw. In view of the availability of raw materials, a fibre and cardboard industry might be started; Implement Industry:--In view of the fact that the area around Dobhi is predominantly agricultural and the fact that farm implements and tools have to be imported from distant places, there may be scope for an implements industry.

Industrial Estate

It was reported that a proposal for establishing an industrial estate at Bajrangnagar has been submitted to the Government. If sanctioned, the estate would solve a great many difficulties that arise in the way of industrial enterprises in rural areas. Abundant land is available near the sugar mill, and the people seem anxious to cooperate in any venture that promises development of the area.

Other Possibilities

Since the development block has been in existence, a large number of families have taken to spinning of yarn. The Block Development

Officer stated that yarn in large quantities is sold, and a number of families are able to meet part of their cloth requirement by its sale. It would seem that if weaving could also be started, there may be scope for handlooms as well as powerlooms.

Potential Investors

There are a number of persons in Dobhi who have finances to invest in productive enterprises. So far, however, none of them have taken initiative in the matter, probably because they do not have the necessary technical know-how. Prominent among the potential investors are:

1. Chandrabali Sahu of village Tarain.
2. Ram Pher Singh of village Narainpur.
3. Hansraj Singh of village Narainpur.
4. Ram Saran Singh of village Kusumhi.

There are several other potential investors in Dobhi but they are likely to show interest only whan a definite proposition is made to them.

Prominent Individuals of the Area

1. Birbal Singh, an ex-Member of the Parliament, and at present Vice Chancellor, Kashi Vidyapeeth, Varanasi.
2. Kanchan Singh, a very wealthy man.
3. Fateh Bahadur Singh, the brother of the former M. L. A. and the President of the sugar mill.
4. Batuk Singh, Financial Adviser, Government of Bihar.
5. Chandrika Singh, one of the managers of Shankar Sewing Machine.
6. Ram Lagan Singh.
7. Ram Kunwar Singh.
8. Lal Bahadur Singh, M. L. A.

Principal Impressions

The following is outstanding about Dobhi: First, it is located in a heavily populated area and the pressure on land is intense. The people are generally very poor, but those interested in or capable of making sizeable investments on productive enterprises will not be found wanting. Second, the influential people of the area are traditionally agriculturists and have little experience in industry or trade. Following the abolition of zamindari, which hit the landowners quite severely, there is now a keen appreciation of the necessity of finding alternatives to agriculture. The ex-zamindars as a whole are greatly dissatisfied

with what they have and would be eager to participate in new enterprises which meet their felt needs. Thus, potentially, the response to a development program should be quite good. On the other hand, the large majority of the people have small savings and cannot be expected to raise sizeable capital for industries. Third, the influential people in Dobhi have been traditionally united by the bonds of common ancestry. They are used to working together and can be reasonably expected to cooperate with an external agency attempting to promote their economic and social well-being. Fourth, the Planning Research and Action Institute of the State Government is taking interest in the area. The sugar mill has been put up with the help of Institute personnel, and it is reported that new projects, such as one on cow dung gas, are to be undertaken in the future. There is, therefore, scope for collaborating with an agency already working there.

Dobhi refers to a community development block and to an area. The place most suited for the location of pilot projects is Bajrangnagar where the sugar mill is located. Bajrangnagar is on the Varanasi-Azamgarh road and is only three miles from the railway station. If the industrial estate is sanctioned, it will most likely be located at Bajrangnagar.

MALPURA (RAJASTHAN)

Malpura is located at a distance of 58 miles from Jaipur on the road to Toda Raisingh. It has a population of 11,000. It is also connected by railroad with Jaipur and Toda Raisingh. There is an electric generating plant in operation, set up in 1960 under the Colombo Plan. Two 100-kw and one 25-kw generators are operated on diesel fuel. The diesel engines are 1,000 rpm Catterpillar units; the generators were manufactured by Kato.

Utilization Pattern

The industrial connected load includes the following:

6 flour mills	60 hp
1 ice candy unit	6 hp
1 saw mill	10 hp
2 well pumps	6 hp
1 cinema	1 hp
1 ginning factory	10 hp
	93 hp

The connected load for residential lighting is about 98 kw for 250 connections. The evening peak load is about 50 kw. The generators are shut down during 0630-1200 and 2400-0400.

A combination flour mill-cotton ginning facility was visited. The entire facility is powered by means of a 10-hp motor with belt drives for a single flour mill and two cotton gins. The flour mill has a capacity of 400 pounds of flour per hour, and the charge is 10 annas for grinding 80 pounds of grain. The flour mill operates for about an hour or two per day. This reflects the existence of five other flour mills in Malpura. There are two additional cotton gins in Malpura, which are powered by diesel engines.

There is a small saw mill powered by a 10-hp motor. The saw mill also has a 26-hp S. D. Nanda, 300-rpm diesel engine, which is five years old. The purchase cost of the diesel was 5,000 rupees. Mr. Bansimal, the proprietor of the mill, indicated that he was having difficulty in getting a reliable amount of electric power. As a consequence, he depends heavily on his 26-hp diesel for shaft power. He indicated that if it hadn't been for the diesel engine, he would have had to go out of business.

Electricity is also being used for street lighting, to operate a cinema and for a tubewell. Taking all the load into account, it is clear that electricity is not being fully used and that its availability is not necessarily giving an impetus to industrial development. The following figures show the monthly generation and consumption of electricity between April 1961 and February 1962.

Month	Units Generated	Units Sold
April 1961	2896	2458
May 1961	4394	2695
June 1961	7736	7111
July 1961	5334	4684
August 1961	4492	3563
September 1961	4516	3563
October 1961	7385	4378
November 1961	5692	4467
December 1961	8868	6857
January 1962	7702	6263
February 1962	8902	7273

Fuel Supply

The diesel generators utilize high-speed diesel fuel priced at Rs. 2.82 per gallon. Low speed diesel oil is available at Rs. 1.62 per gallon. Since Malpura is in a dry region, there are no forests nearby.

Electricity Tariff

Power is sold at the rate of 50-np per unit for domestic and commercial uses, and at 25-np per unit for industrial use.

List of Staff Working at Malpura Power Station

A staff of 17 persons is employed at the power station. Their position and pay are given below:

Name of Post	No.	Pay Scale	Dearness Allowance
Junior Engineer	1	150-300	40
Drivers	3	60-100	40
Helper I	2	50- 70	35
Helper II	5	30- 50	30
Lineman II	1	60-100	40
Fitter	1	60-100	40
Meter Reader II	1	50- 70	50
Lower Division Clerk	1	60-130	40
Peon	1	25- 35	30
Chowkidar (watchman)	1	25- 35	30

The monthly staff salary comes to about Rs. 1200.

Plant Expenses

The total expenses on the plant including the staff come to about Rs. 40,000 per year, and the income is about Rs. 25,000 per year. The plant is, therefore, running at a loss to the extent of about Rs. 15,000 annually.

Extension to Diggi

In view of the low utilization in Malpura itself, a transmission line is being extended to a nearby town--Diggi--about four miles in the direction of Jaipur. It is believed that with the electrification of Diggi, the utilization of electricity will improve.

Principal Impressions

The case of Malpura very clearly shows that the mere provision of electricity does not automatically ensure proper utilization or all-around industrial and agricultural development.

RAIPUR COMMUNITY DEVELOPMENT BLOCK (RAJASTHAN)

The Block is named after Raipur, which is the largest village, and its headquarters. Pali district, in which Raipur is located, has been selected for intensive agricultural work under the Package Program of the Ford Foundation. In this connection special efforts are being made in Raipur to introduce improved farm practices and to increase agricultural production. Mr. Shivlahri Sharma is the Block Development Officer.

The Raipur Block is in an arid, partly hilly, region having an average annual rainfall of between 11-13 inches. The Aravali hills touch the block in the east and proceed in a generally southward direction, leaving the rest of the territory in a fairly even plain cut across by the Luni River and its various tributaries. The river is dry except in the rainy season when the rain in the catchment area rushes forward in a southwestern direction toward Gujerat and the Rann of Cutch.

Agriculture, which is the single most important occupation in the area, is heavily dependent on irrigation. Irrigation, in turn, is accomplished principally by means of bullock-powered Persian wheels. The principal crops of the area are chillies, wheat, jowar, bajra (millets), oilseeds, cotton and gram.

A sizeable portion of the population is engaged in sheep and goat farming, and in most of the villages there are a limited number of families engaged in traditional rural industries such as weaving, tanning, and oil expelling.

The villages visited within a six-mile radius from Raipur include Deepawas, Megarda, Bar, Jhuntha, and Peepalia. Each of these villages is discussed below.

Village of Raipur

Raipur is one of the largest villages of the area with a population exceeding 6,000. It has a post and telegraph office, a public telephone, and is located two miles from Haripur, a railway station on the Jaipur Ahmedabad meter gage railway line.

Agriculture

The agricultural produce includes chillies, wheat, jowar, and bajra, oilseeds, cotton, and gram. Details of acreage under different crops for the year 1951 are given below. Because of the rather sandy soil and the dry climate, crops are irrigated at least seven to eight times. Chillies are irrigated between eight to fourteen times, wheat somewhat less, and cotton about eight times. By contrast, in some parts of Uttar Pradesh, cotton is irrigated only once or twice. Of a total crop area of 14,000 acres, 8,000 acres are irrigated.

Through discussions with some of the prominent villagers, it was indicated that at least 15 to 20 individuals would be willing to install electric water pumps, if power were to be made available. They argued that these pumps would be inexpensive, costing between Rs. 1,200 to Rs. 1,500 compared to the diesel sets which require an investment of about Rs. 2,500 to Rs. 3,000. Mr. Mohan Lal has installed a 5-hp (Cooper) diesel pumping set. There is one other man in the village who has a diesel pump. In general, Persian wheels are used for irrigation.

Industries

The existing industries include a Weavers' Cooperative Society using powerlooms, and four flour mills run by diesel engines. Among the traditional village industries are weaving (30 families), hide tanning and shoe-making (70 families) and oil expelling done by Telis (12 families).

Weavers' Cooperative Society Using Powerlooms

The name of the Cooperative is Adarsh Vastra Utpadak Sahikari Samiti Ltd., Raipur. Mumtaz Bakhsh has been responsible for organizing this Society. He has spent a good deal of his life working in large mills at Beawar, 21 miles away, and Ahmedabad, 300 miles away. The Cooperative Society has 30 members. It has raised a share capital of Rs. 7,250 and has been helped by the State Government with a loan of approximately Rs. 40,000. Recently, it was granted a loan of Rs. 8,000 from the Reserve Bank.

A 12.5-kw generator of German make is hooked up by a belt drive with an 18-hp, 475-rpm, Campbell diesel engine. The cost of the diesel engine was reported to be 5,000 rupees. There are 11 looms, each with a 0.75-hp motor. The Society is paying Rs. 3 per hour to one Ghaffar Bakhsh, who owns the diesel engine, for running it on an hourly basis. The diesel engine also operates a flour mill

which is managed by Ghaffar Bakhsh. Mumtaz Bakhsh is keen on expanding operations by bringing in new machines, but he faces two limitations: one with regard to finance, and the other with regard to electricity. Ghaffar Bakhsh indicated that he would dispose of his diesel engine if electricity were to be made available from a central source, and that he would like to install a lathe in order to manufacture tools and implements.

The Tanners' Cooperative Society

Twenty tanners have formed into a Cooperative Society. They have obtained Rs. 1,400 as subsidy from the Khadi Commission. The Panchayat Samiti, Raipur, has given them Rs. 2,200 for a common workshed, and Rs. 300 for purchase of tools. It was observed that the aid given has not encouraged or brought about technological improvements. When questioned as to how they expected to gain in the long run from the Society, in the absence of technological improvements, the tanners were at a loss to explain.

Some Prominent Individuals

1. Sri Pannalal, Sarpanch (head of the village Panchayat).
2. Sajjan Singh, son of the ex-Jagirdar of Raipur. Sajjan Singh is undoubtedly the wealthiest man of the village, owns a great number of houses in Raipur, and is reported to be looking for avenues for investment in economically productive channels.
3. Pannalal Bhandari, an agriculturist.
4. Pema Ram Sirvi, an agriculturist.
5. Mohanlal Bhandari, an agriculturist; has a 5-hp diesel pump.
6. Gallaii Mali, an agriculturist.

Potentials for Use of Electricity

1. Existing uses of electricity. The powerlooms, as already already mentioned, require 10 to 12 kw, and the flour mills can take up to 20 kw.

2. Potential uses. (a) It may be safe to assume, provided electricity can be supplied at moderate charges, that 20 to 25 electric pumps may be installed at wells. Usually a 5-hp diesel engine is used for pumping.

(b) Expansion of the existing powerlooms. There a possibility that the Adarsh Vastra Utpadak Sahikari Samiti will be expanded if electricity is available. Its power requirements might be doubled.

(c) There is also a possibility that local entrepreneurs may invest in small scale industries once electricity is available. The possibilities include a tool manufacturing unit, a unit for processing of chillies and woodworking.

(d) Some of the villagers would purchase electricity for domestic purposes.

Villages of Deepawas and Megarda

Deepawas is located about three miles southeast from Raipur. About a mile and a half north of Deepawas is Mergarda, and about two miles north is Bar. Deepawas and Megarda were visited primarily with a view to finding out whether they are in a position to use electricity productively. In both villages, the agriculturists are relatively better off economically than the other occupational groups. Though there are castes that are hereditarily engaged in the business of oil expelling, weaving, tanning of hides and shoe-making, they are all in a state of marginal existence. Most of the families find it necessary to seek employment as laborers during parts of the year when their business is slack.

The crops grown are the same as in Raipur, viz., chillies, wheat, jowar-bajra, cotton and oilseeds.

Megarda is a small village with a population of about 500. It has seven wells and is situated near the river, so that the wells have a good water supply. Chillies are the principal cash crop. The fields are manured heavily, weeded regularly, and irrigated 10 to 12 times during the season. Megarda has one Teli (oil expeller caste) family, 26 weaver families, and 10 tanners locally called 'Jattias'. The weavers are finding themselves in a "tough" spot and are anxious to learn about new methods.

Deepawas, which is larger than Megarda, has a total cultivated area of 446 acres out of which 286 acres are irrigated. This village is predominantly agricultural and has 21 wells. There are a few families of weavers and tanners. The weavers, it was reported, are not taking much interest in weaving, as they are not finding it profitable. The tanners and shoe-makers, constituting six families, are slightly better off.

Principal Impressions

Taken as a whole, it is evident that in both villages the number of wells, though well supplied with water, is small, so that the potentiality for the installation of electric pumps for irrigation is limited. It should also be noted that the average holding per individual in these two villages is rather small, and a number of cultivators share a well in common. As such, few find it profitable to invest in pumps unless the water is shared in common.

There are no existing industries using mechanical or electrical power. Under the conditions that exist, it does not appear that the people are in a position to take initiative for starting new enterprises.

Village of Jhuntha

Jhuntha has approximately 450 households, with a population of about 2,000. It is located two and a half miles northwest from Jaipur.

Agriculture

The village is primarily agricultural, and more than 50 per cent of the population is engaged in agriculture. The agriculturist castes are the Jats and the Sirvis. There are 70 wells in the village and most of them have a good water supply. It was stated that 20 to 25 wells might be electrified if electric power were available. Kaloo Ram Kumhar, one of the agriculturists, has a small 5-hp diesel engine (Cooper) connected to a pump. He owns 10 acres of land, but irrigates an additional 20 acres belonging to his brothers. The engine was purchased for Rs. 2,300, and another Rs. 300 were spent for installing the pump and the shed. Crude oil is obtained at the rate of Rs. 1.62 per gallon, and it was reported that four gallons are sufficient to run the engine for 12 hours.

Industries

Ram Chandra Lohar works in collaboration with Pema Ram, who owns a 13-1/4 hp Robust diesel engine operated on crude oil. The engine was purchased second-hand for Rs. 2,200. Both Ram Chandra and Pema Ram contributed to the cost of the engine, which is used to run a flour mill. Ram Chandra,

who is a blacksmith by caste, makes razors and scissors, and grinds them on a grinder attached to the engine. The manufacture of razors, scissors, and other small tools is carried on by a fairly large number of families in Sojat, about 25 miles west of Raipur. Ram Chandra worked in Sojat, where he learned the trade. He is doing a fairly good business and seems to be a talented man. It is possible that with proper guidance and encouragement he might be able to expand the work and be in a position to employ others.

Oil Expelling

There are six hereditary families of oil pressers (Telis). These families are using bullock drawn Ghanis. Prem Raj, one of the Telis, has installed a 10-hp diesel engine, an oil expeller, and a flour mill. He has been thinking of starting a chillies processing (grinding) business.

Principal Impressions

In comparison with Megarda and Deepawas, the agriculturists have larger holdings and due to reasons not well known, there have been attempts to start small industries as exemplified in the cases of Ram Chandra and Prem Raj. There is a family of millionaires in this village which is in a position to invest in local enterprises provided they are lucrative.

Village of Peepalia

Peepalia is three miles west of Jhuntha and six miles from Raipur. It has a total cultivated area of 2,300 acres out of which 1,083 acres are irrigated. Wells are the only source of irrigation water. There are about 45 wells in the village, and each has approximately 17 acres under its command. Being somewhat distant from the river, only a few wells have sufficient water to stand continuous use. The Sarpanch felt that pumps could be installed at 20 to 25 wells. He mentioned that in the past two years the water table has receded, and it is becoming increasingly difficult for the bullocks to pump the wells. The villagers may therefore be willing to deepen the wells and install electric pumps.

Cotton is one of the important crops of this village. During the present sowing season, about 50 acres are under cotton. About 10 to 15 maunds of cotton are produced on an acre and are sold for approximately Rs. 250 per maund.

Tanning

There are about 20 families each of tanners and weavers, and seven of Telis. The tanners have been encouraged to do collective tanning through a grant of the Khadi and Village Industries Commission. There did not, however, appear to be any consciousness among the tanners about the advantages of collective tanning. They had apparently taken to it because it did not cause them any special inconvenience. Furthermore, the economic benefits of the changeover are not obvious.

Weaving

All of the weavers weave individually, and they produce a fabric called "Reza", which has a good local demand. Its local demand enables the weavers to make a small profit. Many of them find it necessary to seek employment as laborers during some parts of the year. Recently, fly-shuttle looms have been tried with four families. These families are also continuing with the old throw-shuttle handloom. Although the fly-shuttle looms enable faster work, they do not produce the type of fabric which is locally demanded. Hari Ram, one of the weavers, felt that in due course, fly-shuttles will replace the throw-shuttles, but that before this happened the fly-shuttles should be used to produce different kinds of fabrics which, he hoped, would have a local demand.

Oil Expelling

As in other villages, oil expelling is carried on by the caste traditionally engaged in this occupation--the Telis.

Flour Mills

There is one flour mill being run by a 12-hp diesel engine. The fuel used is high-speed diesel purchased at the rate of Rs. 2.81 per gallon, including transportation charges.

Names of Prominent Villagers

1. Ratan Lal, Sarpanch (head of village Panchayat).
2. Kishan Lal, a millionaire.
3. Bhoor Sing, an agriculturist.
4. Davaji, an agriculturist.
5. Jodhaji, an agriculturist.

Village Water Supply

Principal Impressions

Peepalia village is similar to Jhuntha with respect to the potential utilization of electricity; except for agricultural uses, the potential for commercial and industrial uses is small.

Village of Bar

Bar is located six miles east of Raipur at a point where three roads take off in three different directions, viz, to Jaipur, to Jodhpur, and to Pali. Bar village has a population of 2,133. The primary occupation of the population is agriculture. Out of a total area of 3,300 acres which is under cultivation, 800 acres are irrigated. Irrigation is chiefly by wells, of which there are 107. Being relatively far away from the river, the wells in the village do not have as good a supply of water as in some of the other villages. As such, the use of pumps is greatly restricted. A hamlet of Bar, some two miles away, near village Megarda, has a good water supply, and water pumps could be installed there. The crops grown in Bar are the same as in the other villages.

Among the artisan castes are 40 families of weavers, two of carpenters, and two of blacksmiths. Approximately 300 families are Malis, who are traditional agriculturists. The 15 Gujar families have taken to sheep and goat rearing.

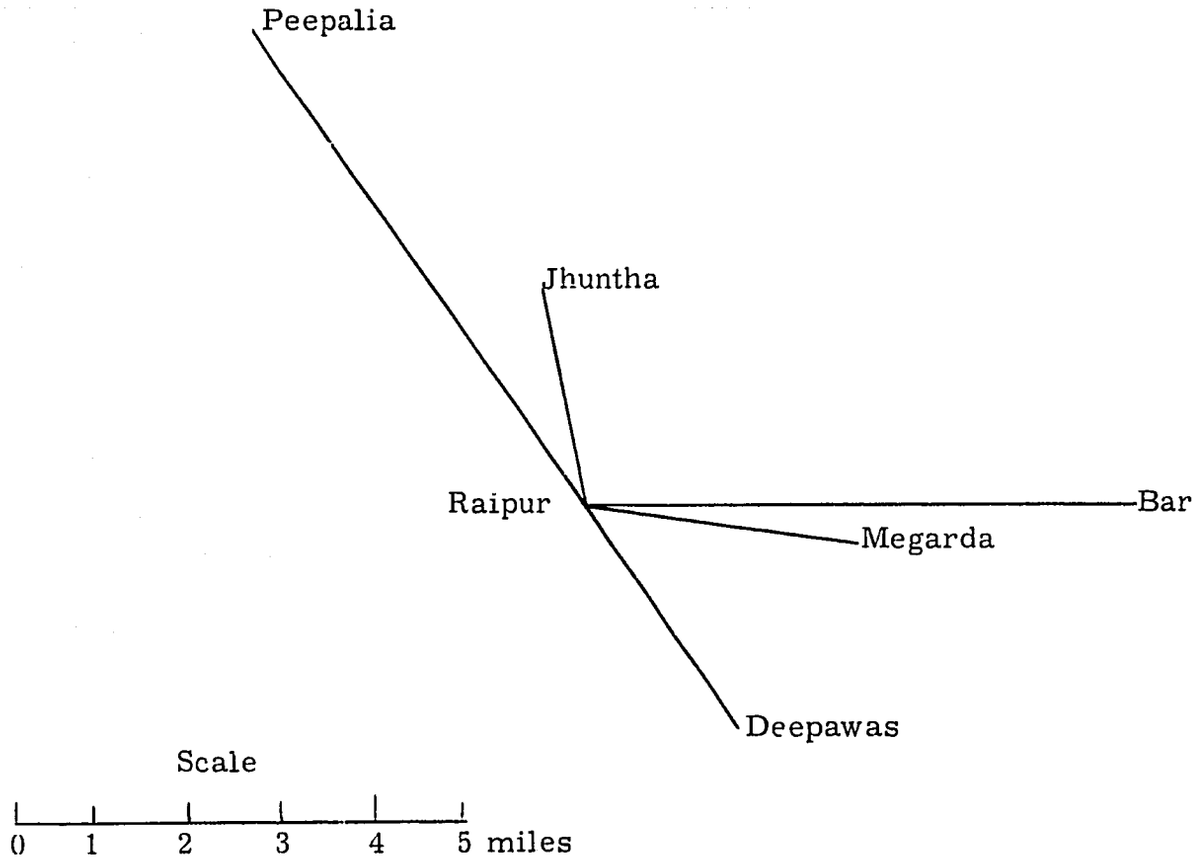
Principal Impressions

As far as could be ascertained, there is no industry in Bar which is dependent upon mechanical or electrical power. Being largely agricultural in its composition, the potentialities for the use of electricity are similar to Megarda and Deepawas. On the whole, Bar does not appear to provide good scope for the use of electricity.

Over-all Impressions - Raipur Block

Of the villages visited in Raipur Block, Raipur itself is the most promising from the viewpoint of a project in Rural Electrification and Development. There appears to be some potential for industrial use of electricity. There are a few, say six or seven, individuals who are in a position to make sizeable investments. The artisan castes, existing as they are today on a marginal or sub-marginal level, are in a frame of mind which would make them attentive to a scheme which promises higher income. Among the other villages, Jhuntha and Peepalia seem to have some potential, and if the Raipur project responds well, transmission lines could be drawn to connect these villages. In Raipur it seems reasonable to assume an existing potential load requirement to the extent of 50 kw.

A Cluster of Villages in Raipur Block



Population

Raipur	6000
Deepawas	1000
Megarda	500
Bar	2100
Jhuntha	2000
Peepalia	2500
Total	14, 100

BASIC INFORMATION ABOUT SOME VILLAGES IN RAIPUR BLOCK (RAJASTHAN), 1951)

Items	Raipur	Peepalia	Ear	Megarda
Population	5873	2500	1938	421
Families	1206	500	346	78
Occupation				
Agricultural Landowners	2739	1200	1395	286
Agricultural laborers and workers on land	1152	375	208	100
Area (acres)				
Total	14,389	38,465	9336	682
Forests	3428	56	124	-----
Cultivated Land	6946	2351	3330	380
Double cropped area	657	130	392	20
Rains and Irrigation				
Rains (inches)	13-14	12-13	12-13	11-13
Irrigation Facilities: Wells	220	56	107	7
Tanks	1	----	1	-----
Total Irrigated Area (acres)	049	1083	806	45
Crops (acreage)				
Jowar	2025	564	507	58
Bajra	983	794	852	165
Til	821	173	169	44
Chillies	193	45	166	100
Cotton	38	86	39	-----
Wheat	843	284	303	26
Gram	840	47	5675	420
Green Fodder Bajra	103	39	45	1
Cattle Wealth				
Animals	10,725	3356	7735	1887
Bullocks & Cows (adult)	3102	1000	800	143
Buffalos (adult)	387	188	166	75
Sheep	4991	1292	2788	705
Goats	2192	547	1945	709
Revenue and Taxes (Rs.)	15,435	8522	7205	746
Educational Institutions				
Junior High Schools	1	----	----	1
High Schools	1	----	----	-----
Secondary Schools	-----	1	1	-----
Industries (individuals working)				
Spinning	-----	130	----	-----
Weaving	63	35	140	140
Tanning	255	30	----	100
Cloth Printing & Dying	14	2	----	-----
Ghani	66	7	13	4

BRIDGMANGANJ (UTTAR PRADESH)

Bridgmanganj is located in the northern part of Gorakhpur district about 22 miles south of Nautanwa. It is connected by railroad with Gonda (an adjoining district), Gorakhpur city, and Nautanwa. A road links Bridgmanganj with Pharenda, the sub-divisional headquarters, which has a sugar mill and is an electrified town. Bridgmanganj has a population of about 3,500 and is in the 'Teria' area, in the foothills of the Sivalik range of the Himalayas. The area receives plentiful rainfall, and the soil is well-suited for paddy, sugarcane, and potatoes.

Bridgmanganj was first visited on May 4, and revisited on July 15. During the first visit, we were accompanied by the Assistant Development Commissioner, Gorakhpur, Mr. Bhagwan Din, the Assistant Engineer (Hydel), Mr. Mathur, and the District Industries Officer, Mr. Garg. Mr. K. D. N. Srivastava is the Block Development Officer. We were told that Bridgmanganj Block has a population of 64,000, with a density of 915 per square mile. Its area totals approximately 47,000 acres, out of which 38,000 acres are under cultivation and little less than 5,000 acres are irrigated.

The People

In the early part of the last century Bridgmanganj and the adjoining area were under forests. The cultivators living on the fringe of the forest were constantly threatened by wild animals. The British Government, in order to protect them, decided to populate the forest area. John Hall Bridgman, an indigo businessman of Ghazipur, entered into a contract with the Government to settle the land. He did this work ably, and in addition to the land given him by the Government, he acquired considerable personal property.

One gets a clear impression that there are two distinct classes in Bridgmanganj--one whom we might call the 'sons of the soil', the people who came from the neighboring area to settle in Bridgmanganj, and the other the emigrants who came from far away places looking for a better and prosperous future. The latter group, consisting of Vaishyas, the traditional businessmen, and Muslims, are among the economically ascendent and affluent group. The others, the 'sons of the soil', have small land holdings and are engaged in petty business or are employed as laborers. A majority of them live at a subsistence level. The two are more or less distinct groups, tha nature of their relationship being largely contractual and impersonal, a situation rather unusual for rural areas.

The caste composition is as follows:

Castes	Households
Vaishyas (Jaiswal, Kasaundhan, Marwari)	200
Muslims	100
Harijans	80
Brahmins	8
Others	100

Agriculture

The chief crops of the Block are:

Crops	Area (in acres)
Paddy	31,325
Wheat	3,800
Barley	3,700
Sugarcane	1,285
Potato	350
Oilseeds	425

Wheat and barley are winter crops, whereas sugarcane stands in the fields almost the entire year. It was indicated that approximately 28,000 maunds of potatoes are produced, about half of which are transported to Gorakhpur for cold storage. Sugarcane is sent to a mill at Pharenda, some 11 miles away. Paddy, which is the main crop of the area, is processed locally or transported by dealers to markets outside Bridgmanganj.

Cooperatives

Bridgmanganj Block has two large sized societies called the "Bridgmanganj Cooperative Society", covering 18 villages, and the "Bhaduri Cooperative Society", covering 34 villages. There are nine primary village societies which, together with the Bhaduri large sized Society, have formed into a Cooperative Union.

The total membership in the large and small societies comes to 3,500, and the share capital is Rs. 82,000. The societies function chiefly as credit societies, but the large sized societies have also taken up some marketing functions. The Union deals with the supply of seeds.

Cooperative Society for Paddy Husking

A Cooperative Society consisting of 25 members has been formed for hand-pounding paddy. The Society has applied for a loan of Rs. 2,000, which is to be granted shortly, and has collected a share capital of Rs. 637. The President of the Society is Mr. Kesho Prasad, and its Vice President is Mr. Sheo Shanker Jaiswal.

The Khadi Commission gives a subsidy of six annas per maund for hand-pounded paddy. The Society has already obtained seven improved Chakkis, each of which is supposed to process 10 maunds of paddy daily.

Oil Expelling

There are three mills that are doing oil expelling besides flour milling and paddy husking. Recently, a proposal for a Tel Ghani Cooperative Society has been submitted to the Registrar, Cooperative Societies. Mr. Janardan is the President, and Mr. Ram Lakha Prasad the Cashier of the Society. The latter was available for discussions. He stated that the Society, which has a membership of 25, was going to install bullock drawn Ghanis and that it will be able to compete with the mills inasmuch as a subsidy of Rs. 1.25 per maund is given by the Khadi Commission for Ghanis.

Bridgmanganj itself does not produce a large quantity of oilseeds, but the neighboring area, particularly Jarwa, about 50 miles south, is surplus in oilseeds. The oil mills get most of their raw material from Jarwa and from Nepal.

Hide Business

There are three large dealers in hides in Bridgmanganj. It is estimated that they deal with anywhere from 1 to 1.5 lakh hides annually. Information to the following effect was obtained from Mohammad Kalam, Nabi Jan, and Abdul Kalam.

Hides are collected from the markets of Barhni, Naugarh, Nepal, Chauri Chaura, and locally. The collections include buffalo hides, cow hides, and goat and sheep skins. The raw hides are treated by a process called "half tanning" so that they can be shipped to distant markets without decaying in transit. The dealers personally carry them to the markets of Kanpur, Calcutta, Bombay, Chauri Chaura and the like.

There is interest in establishing a tannery in Bridgmanganj. The dealers in hides with whom the subject was discussed are willing to make investments provided they are given the technical know-how and the assurance that a factory could be run profitably.

Furniture Industry

An industrial Cooperative Society has been formed, consisting of 30 individuals for the manufacture of furniture and related articles. Good quality wood suitable for furniture manufacture is available from the neighboring forest areas.

Fuel

Firewood is available locally in price ranges Rs. 1.00 to Rs. 1.75 per maund, depending upon seasonal variations. Crude oil is supplied in the village by local dealers who make the purchase from Gorakhpur, more than 50 miles away, at Rs. 7.75 per tin of four gallons or Rs. 1.94 per gallon. High-speed diesel is priced at Rs. 11 per tin or Rs. 2.75 per gallon.

Coal is available in Gorakhpur and is priced at Rs. 42 per ton.

Potentials for Use of Electricity

Cold Storage

With the availability of electricity, there is a very good chance of a well-to-do farmer, Mr. Gauri Shanker Singh, putting up a cold storage for potatoes.

Saw Mills

Bridgmanganj is located in an area which has a rich supply of fuel and timber wood. Already, there is a furniture industry, and if power becomes available, the possibilities of someone setting up a saw mill are promising.

Hide Tanning

The hide dealers do not tan hides for the purposes of selling them to shoe-makers. The half-tanning process which they perform merely preserves the hides sufficiently to resist deterioration until they are processed in tanning factories in Kanpur, Calcutta, or Bombay. The availability of electricity might be a favorable

condition for the establishment of a tanning facility. Mohammad Kalam, one of the hide dealers, stated that he would be willing to invest as much as Rs. 20,000 to Rs. 30,000 for a tannery.

Tubewells

There are at present 16 tubewells in and about Bridgmanganj. With the availability of power, there will be greater incentive for some who are at present feeling the necessity of improving irrigation potential to install electric pumps. The land holdings of many farmers are quite large, and they are in a position to use a well without having to share it with others. Some, it was learned, are supplying water to neighbors on rental.

Domestic and Town Use

About 30 to 40 families would be interested in using electricity for domestic purposes. Furthermore, the railway station and the town itself may be electrified.

Weaving

At present, weaving is not being carried out in Bridgmanganj proper, but in Pulmanha, a village two miles away, three families of vegetable growers have taken to weaving. This rather unusual change of occupation was accounted for by the fact that the kinds of these families in Manhdawal, about 16 miles away, were doing good handloom business. Yarn is obtained from the textile mills of Calcutta, Bombay, and Madras In the past several years, Khalilabad, which is a railway station on the Gonda-Gorakhpur railway line, has developed into a big market for handloom goods where every Monday some Rs. 15 to Rs. 20 lakhs worth of goods are transacted.

Though Pulmanha is about 40 miles away from Khalilabad, the goods find their way to the market. In view of the localization of textile industry, there may be a possibility that powerlooms could be employed if electricity became available.

Cane Crushers

Since Bridgmanganj is located in a cane growing area, there are distinct possibilities of electric power being used for cane crushing.

Some Prominent Individuals

1. Mahabir Prasad Singhania, a businessman.
2. Jhabbu Lal, a businessman.
3. Ram Das, a businessman.
4. Gauri Shanker Prasad Jaiswal, a businessman.
5. Mahabir Prasad Jaiswal, a businessman.
6. Gauri Shanker Singh, a farmer.
7. Mohammad Kalam, hide dealer.
8. Nabi Jan, hide dealer.
9. Ghanshyam Das - Jugal Kishore, proprietors of a mill doing flour milling and oil expelling.
10. Sri Ram - Pira Mal, proprietors of a mill engaged in flour milling and paddy husking.
11. Maqbul Alam, Pramukh of the Bridgmanganj Panchayat Samiti.

Principal Impressions

The potential for the use of electricity in Bridgmanganj appears to be quite good. So far, electricity is not being locally generated, although Mr. Gauri Shanker Singh is seriously considering generating electricity for a cold storage plant.

Assuming that electricity can be provided at a reasonable price, the existing load requirements come to about 50 kw, half for industrial use and the remaining for domestic, street lighting, and agricultural uses. In about a year or so after the installation of the plant, a load equivalent of 100 kw or more might develop.

Due to the fact that the potential investors are traditional businessmen, have had active interests in Nepal where the business prospects are growing bleak, and are tempermentally inclined to risk on enterprises that promise good returns on investment, the prospects of Bridgmanganj responding well to a development project are promising.

RECOMMENDATIONS FOR FUTURE WORK

The principal recommendation for future work which derives from the findings of the field survey investigations is the formulation and implementation of a research-action program on the utilization of power in rural communities, with particular emphasis on the productive application of power in agriculture and rural industry. As pointed out in the preceding sections of the report, there is a need for a power utilization program which would complement the power supply programs already in being. This is because the mere availability of power does not automatically bring about its productive application, particularly in rural communities.

Consequently, it is recommended that consideration be given to a pilot power utilization project involving analytical and empirical research field experiments and research and development on power-using equipment. Some specific suggestions on the types of research and development that would be germane to such a project are listed below.

. Identify opportunities for improving and extending the economic use of electric power in agriculture and rural industry.

. Establish criteria for the electrification of rural communities, with particular reference to the economic development potential of electricity.

. Carry out selective research and development on power-using equipment for agriculture and rural industry.

. Develop and carry out education-demonstration programs on power utilization in the field.

. Devise means for providing long term, low interest loans for the purchase of power-using equipment.

APPENDIX A

On-Site Investigations in India

MAHARASHTRA

On the advice of the officers of the Government of Maharashtra, three villages were visited. These villages -Jamner, Sonarhi and Paldhi- are located in Jalgaon district, 300 miles from Bombay, in the region known as 'Khandesh'. Geographically, Khandesh is part of the Deccan Plateau with plains and valleys; its black soil is well-known for fertility. The chief crops of this area are bananas, cotton, jowar (millets), groundnuts and chillies. Khandesh grows the bulk of the banana crop produced in India. Climatically, the country is fairly dry and agriculture prospers in areas that have the benefit of irrigation.

The three villages visited are between 20 to 25 miles from the Jalgaon railway station. The team first visited Jamner where it was met by the local government officials including the Assistant Collector of Aurangabad, Mr. Batabyal. After holding preliminary discussions with them, the team proceeded to village Sonarhi, about 8 miles away, and then to Paldhi, about a mile further to the west.

Village Jamner

Jamner is a large village and might even be called a township, having a population of 14,000. About 50 percent of the families were reported to be agricultural; that is, primarily dependent upon agriculture for a livelihood. Of the total cultivated area, which was stated to be 6709 acres, only 500 acres, or less than 10 percent, is irrigated. Wells are the chief source of water supply. Animal power and pumps operated by diesel are utilized for drawing water for irrigation. Jamner, Sonarhi and Paldhi are distinguishable from the villages visited in other parts of the country by the fact that diesel pumps are widely used for supplying irrigation and drinking water.

There are 90 irrigation and 130 drinking wells. The wells were reported to have insufficient water to permit a round-the-clock pumping. Most dried up within three to four hours but recuperated rapidly after a few hours gap.

Fuel

Diesel fuel is widely used. The price of crude oil was stated to be Rs. 1.44 per gallon. Jamner is located near a forest area which is estimated to cover 44,000 acres. However, the bulk of this area is designated as a Reserve Forest area and is not available as a source for fuel wood. The cost of wood including transport charges, at Jamner was estimated to be between Rs. 40 to Rs. 60 per ton. Normally, firewood is available at the rate of Rs. 2.50 per maund. For domestic purposes kerosene stoves are used.

Bhusawal Electric Grid

Jamner and the neighboring villages are expected to be energized in the next two years by the Bhusawal Grid. Further investigation of Jamner was not undertaken at the time due to the original orientation of the project toward smaller size, off-grid villages. Villages Sonarhi and Paldhi are not expected to have power for the next five years.

Encouragement for use of Pumps

Loans covering the total cost of pumps are provided by the Government in Jalgaon district. In Aurangabad, however, which is the adjoining district, loans up to 50 percent of the cost of the engine are provided. Roughly Rs. 560.00 per horse power are provided in loan funds for diesel engines.

Village of Sonarhi

Located at a distance of about eight miles from Jamner, Sonarhi is a small village with a population of about 1300. Agriculture is the main occupation and of the total cultivated area about 200 acres are under irrigation. Irrigation water is available from wells at a depth of about 40 feet. In many cases, there are wells of 60 feet depth. There are about 45 oil engines used primarily for irrigation pumping. The pumps cannot work eight hours at a stretch because of an insufficient water supply.

The principal crops are cotton, banana, jowar, sugarcane and chillies. It was stated that a farmer, on the average, makes a gross profit of Rs. 2100 to Rs. 2400 on each acre of land under banana.

Village Cooperative Society

Though Sonarhi is a small village, it has, like many other villages in Khandesh, a strong multi-purpose cooperative society called the "Peepal-gaon-Sonarhi Artisans' Cooperative Society". This society functions as a marketing and credit society. It deals with diesel oil, cotton, seeds and maintains a sugar shop and a cheap grain shop.

The share capital of the society is Rs. 46,000. It has been proposed that the funds of the society be used to purchase a diesel crusher for sugarcane and to provide additional irrigation facilities. In this connection, it was reported that a crusher is already in use in the village, but this could not be verified.

Village Water Supply

Sonarhi is the only village where the team found that the village people had, on their own initiative, installed a central water supply for the village. Water is pumped from a well with a 8 to 9 horsepower diesel engine which was purchased for Rs. 3000. An additional sum of Rs. 14,000 was spent for the construction of an overhead tank with a capacity of 5000 gallons. About Rs.7000 was received from the Community Development Block as a subsidy for the tank.

Village Panchayat

Sonarhi has a strong village Panchayat which is evidenced by the fact that the village has a central water supply system. The strength of the cooperative society also obtains from the leadership that the village has.

Names of Prominent Villagers

1. Eknath Ananda Patel, Sarpanch (head of the village Panchayat).

2. Rajaram Sripat, Chairman of the Cooperative Society.

3. Supada Fakera Patil, prominent agriculturist.

Principal Impressions

Sonarhi is an outstanding example of a small village full of vision and initiative. The strong Panchayat and the cooperative society show that the village can exert itself cooperatively for achieving common goals and that it is not torn by feuds and factions. However, the potential use for electricity appears to be limited to irrigation pumping.

Village Paldhi

Located about one mile from Sonarhi, Paldhi has a population of 4362. Out of the 7090 acres of cultivated land, about 800 acres are irrigated. There are 243 wells, 143 being used for irrigation. About 50 wells are being worked by diesel pumps. The agricultural produce of this village is the same as that of Sonarhi.

Cooperative Society

Paldhi has a multi-purpose cooperative society called the 'Paldhi Vividh Karya Sahikari Samiti'. The society has a share capital of Rs. 48,000 and together with the government contribution and reserve fund, its total assets exceed

Rs. 65,000. The cooperative society deals in diesel oil, seeds, gives credit to members, and maintains a fair price shop. To date it has loaned a total of Rs. 71,000 to its members with Rs. 13,000 currently outstanding. It may be noted that the Paldhi Cooperative Society is functioning more as a credit society than the one in Sonarhi. This operation is quite profitable since the cooperative bank advances loans to the member societies at an interest of 4.5 percent per annum while the society charges 7.8 percent interest on loans advanced to individuals.

Weaver Families

Paldhi has seven Koshtis (weaver families). Each family owns and operates individual handlooms. At one time, when cloth from the large textile mills was not as abundantly available as it is today, these families were doing a good business, but now they have a marginal existence. Of the seven families, only three were continuing with weaving at the time of our visit. They complained of lack of capital, and low returns in view of the time consumed in producing articles relative to the price of the finished goods.

It was learned that the weavers had approached the District Industries Board from the standpoint of the advisability of forming a cooperative but were advised that with the existing technology they would find it difficult to meet the overhead cost such as paying for the Secretary's services, meeting stationary charges, etc., which would be necessary if they formed into a cooperative society. In short, lack of capital and outdated technology have placed the weaver families in a position where they are in a virtual squeeze and how long they can continue in it is problematical.

Prominent Individuals

1. Suklal Roopsingh, Sarpanch (head of the village Panchayat).

2. Dhondu Nana Patel, prominent agriculturist.

3. Gopal Ramchandra Neve, an agriculturist.

Economic Status

The average income in this area is relatively high and the people are better off than in most parts of Maharashtra.

Local Institutions and Village Leadership

Sonarhi and Paldhi both have strong cooperative societies and a cooperative tradition exists in Khandesh for sometime in the past. The Panchayat in Sonarhi seems to be active

and the one in Paldhi may also be good. In both villages, money has been spent on village works, Sonarhi being a smaller more closely-knit village, appears to have more inherent vitality.

Use of Electricity

If electricity can be made available on reasonable rates, its uses for irrigation purposes and for village lighting are quite certain. It would be difficult to say how much electricity would be consumed in this way. Other uses of electricity could be for oil expellers, for sugarcane crusners and for cotton ginning. The mere generation of electricity, however, does not assure its use in these channels. This holds for every rural area but specifically for Sonarhi and Paldhi, both of which have little industrial tradition. With respect to the use of electricity for irrigation purposes, it may be noted that a great many farmers are operating on a marginal level. They reduce the cost of agricultural operations by investing muscle power in the operations. It appeared that such farmers or those who are in similar but slightly better conditions would be reluctant to substitute electric power for muscle power.

ORISSA

Village of Tikabali

The village of Tikabali, located at about 80 miles from Berhampore, district Ganjam, was the only site visited in Orissa. The visit was suggested by Mr. D. K. Purkayastha, IAS., Secretary Industries, Government of Orissa. Mr. Purkayastha is interested in Tikabali because the government is considering a proposal to set up a rural industrial estate there. Availability of power, which this project promises, was the main reason for the suggestion.

On the way to Tikabali, we talked to the Divisional Forest Officer, Bhanjnagar, to collect information about the type of fuel wood available and its price. Mr. Das, the officer concerned, stated that he was in charge of the Berhampore area. We were told that Tikabali was under the jurisdiction of the forest officer stationed at G. Udaigiri. We made an attempt to locate this officer at G. Udalgiri, but he was not available. From Mr. Das's account, it appeared that Tikabali itself does not have dense forests. One has to go 20 miles farther west to Pasara to reach the forest area. According to Mr. Das's estimate, the cost of wood would come to a little over Rs. 1.00 per maund, including transport charges if the Forest Department were to supply it.

Tikabali has a population of about 1500. It is located in an area which produces a large quantity of oil seeds, chillies, turmeric and ginger. Agriculture is the main occupation of the people, but the area is extremely backward and inhabited by tribal people who still, by and large, have not taken to settled agriculture.

Tikabali produces two important items--raw materials for broom sticks and Pattal, a dish made out of leaves, both of which are exported to cities as far away as Madras and Bombay. There is a cooperative society which deals in forest goods called the "Agency Marketing Cooperative Society". The Society has an annual turnover of about Rs. seven to eight lakhs and has agents in Madras and Bombay. Before this Society was established the local businessmen exploited the producers by bargaining at will and paying as little as possible. The Cooperative Society has presumably minimized the exploitation and is giving the producers (suppliers) a better deal.

Industrial Estate

There is currently no industry in Tikabali. But with the establishment of the industrial estate, for which land has already been acquired, it is possible that there might be an interest in starting small industries. The possibilities for this area are (1) Tin smithy--Since utensils are brought from Berhampore, a utensil manufactur-

ing concern may have good scope. Similarly, the manufacture of agricultural implements may be taken up. (2) Saw mill: Being located in a forest area, saw mills and related industries have a distinct possibility; and (3) Hide Tanning: There is a tannery at Boudh in Phulbani district, north of Tikabali. The hides collected in the district are sent there. It may be possible, however, if hide collection can be properly organized, to set up a small mechanized tannery.

The electricity requirements of the industrial estate are estimated to be about 50 Kw.

Oil Mill

Since oil seeds are produced in large quantities, an oil mill is a possibility. However, the question of marketing and economics of transportation will have to be considered.

Agricultural Processing

Tikabali and the neighboring areas produce spices such as chillies, turmeric and ginger. It may be possible to set up units to process these spices. For instance, they may be crushed, packed in plastic bags and shipped to distant markets.

Agricultural Uses

Use of electricity for agricultural purposes did not appear to have any clear-cut possibility.

Principal Impressions

One thing about Tikabali is very clear: The initiative for development is not local in origin but has come from the Government. Raw materials flow out from Tikabali, but those who regulate the flow do not live in Tikabali. And those who profit from this are the middlemen rather than the actual producers. It is this fact which has led the Secretary Industries to decide upon setting up an industrial estate at Tikabali. If a beginning is made and encouragement given to the people, some of them might take initiative in starting productive enterprises. However, if local enterprises are unavailable, those from Bhanjnagar, which is some 20 miles away, might take interest. This will at least have the advantage that the goods will be processed in Tikabali rather than in some far away place.

UTTAR PRADESH

The sites visited in Uttar Pradesh are Srinagar in Tehri-Garhwal district, Bridgmanganj and Nautanwa in Gorakhpur district, Chandrawal in Lucknow district, and Chandauli and Dobhi in Varanasi and Jaunpur districts respectively.

Srinagar

Srinagar is approximately 82 miles from Rishikesh on the Hardwar-Badrinath road in the interior of the Himalayas. Situated on the banks of river Alakhnanda, one of the main tributaries of the holy Ganga, Srinagar has a population of 3500. At a time when the roads were still unmotorable, Srinagar was a flourishing commercial town and a convenient halting station for the pilgrims who made the long trek from the foot of the Himalayas at Rishikesh to Badrinath, the most holy of the Hindu shrines. The pilgrims still find it convenient to halt at Srinagar although the motorbus is now the mode of transport.

The residents of Srinagar will inform any visitor that the town is no more the flourishing commercial center it used to be. This was in the pre-bus days when traders transported goods on mule back from the plains to the interior of the Himalayas, some going all the way to Tibet, where they sold manufactured goods, especially cotton fabrics, and brought back wool and other articles on the return journey. The trade is now carried on by motor vehicles. Moreover, since buses carried more, traveled longer distances, and did not require unloading of goods in transit, many of the people who depended upon the business the traders gave them, found themselves unemployed and left Srinagar. The artisan class was also adversely hit; the goods they produced ceased to have a demand.

There has been a revival of interest in Srinagar in the recent past, due to the efforts of the Government. The necessity of strengthening the Himalayan border has led the Government to develop the border areas rapidly. The vehicular traffic that passes through Srinagar or halts there has increased manifold. The people, some of whom we met, are looking hopefully to the future. Srinagar has been declared a notified area and is being looked after by a committee consisting of 10 members. Mr. Nautiyal, our chief informant, is the Vice-Chairman of the Committee. All anxiously await the day when the town will be electrified.

Local Crafts

In the past, Srinagar was well known for its arts and crafts products, such as brasswork, utensils, shoes, woodcraft and engravings. The utensil business has suffered a setback since the import of utensils from the plains. A few families of tanners and shoemakers had specialized in producing a type of extra soft and light shoes. Though some of these families still exist, this business has died out. Toy-making and the manufacture of small household decorative pieces is being encouraged by the Government which has initiated a Papri Wood scheme. Papri wood (Bauhinia Racemos or Buxes Sempervirens) is particularly suitable for toy making, for walking sticks, curtain rods, and geometrical instruments. In the past, Papri wood toys were exported through Tibet and China to the rest of the world.

Potential Uses for Electricity

The way the team was received and conducted in the town leaves little doubt as to the eagerness of the local leaders to have electricity. The Government of Uttar Pradesh is also desirous of electrifying Srinagar. They are considering three alternatives: first, bringing electricity from Pauri, the capital of Tehri, 21 miles away; second, constructing a hydel plant at Gantichara some miles away; and third, by installing diesel generators in Srinagar itself. The existing power requirement of the industrial training institute (which already has two 15 Kw diesel generators), the hospital, the Industrial Estate, for street lighting and for domestic purposes can very well consume 100 Kw and probably another 150 Kw in the near future.

Principal Impressions

It should be noted that the scope for industrialization in Srinagar is limited. It is difficult to visualize for the present productive uses of electricity other than for the Government institutions and the Industrial Estate. The latter has not yet found enthusiasm among the entrepreneurs. Even those who have allotted accommodation have not deposited the security of Rs. 2000 required for the purpose. The rental of the units or the conditions of hire-purchase have not yet been decided upon.

Srinagar has a tradition of business built around traders and pilgrims. It is a non-agricultural town and there seems to be little scope for agricultural processing industries. Other industries, such as utensil-making, may have a future.

Government Institutions in Srinagar

The government has set up an Industrial Training Institute with Mr. M. D. Gupta as principal. This institution is expected to train 260 students every year and a half. Training is given in carpentry, blacksmithing, lathe work, welding, surveying and civil and mechanical draftsmanship. At present 94 students are enrolled.

Industrial Estate

The Goverhment has set up an Industrial Estate at Srinagar consisting of 12 units. Five units have been subscribed to, although the required security deposits of Rs. 2000 have not yet been made.

Government Polytechnic

The level of training at the Polytechnic is lower than the Industrial Training Institute. Students having passed high school with science are admitted for a three-year diploma course in electrical, mechanical and civil engineering.

Hospitals and Schools

There is a 20-bed hospital and a T.B. ward is to be added soon. There are a number of educational institutions including primary and secondary schools, and an intermediate and degree college. Srinagar has an intermediate college for girls.

Agriculture

The area around Srinagar is poor agriculturally. The chief crops grown are wheat, paddy and madua. Srinagar itself is a town of shopkeepers, restaurant and hotel owners and of businessmen.

Cooperative Institutions

There are two cooperative societies. One is a Housing Society and the other a Consumers Society. Both these societies appeared to be inactive.

Village of Chandrawal

Chandrawal village is striking example of the case where the personality of an individual has affected the Government's decision to select a village for development on considerations other than merit. Ballabh Das Ji was closely associated with the freedom movement and he commands respect not only in his villages but also in the Government.

Chandrawal is about 14 miles from Lucknow in Sarojininagar community development block, about three miles from the Lucknow-Kanpur road. The approach to Chandrawal is through a canal road which cuts the Lucknow-Kanpur road about 11 miles from Lucknow.

Chandrawal is a small village with a population of about 750. About half of the population consists of Ahirs who are traditional cattle herders and another 20 percent consists of Mohammadans. None of the families has enough capital or resources to invest on industrial enterprises.

Ballabh Das Ji donated land for the Government's training-cum-production centre and an industrial estate which is still to be constructed. In addition there is a paper mill set up with the help of the Khadi and Village Industries Commission under the sponsorship of the Motilal Memorial Society of Lucknow. The Society is running a Rural Centre at Chandrawal taking up social, educational, cultural and industrial programs. Mr. Kirti Singh Vineet is the Manager of the Rural Centre. Mr. Tandon, its Secretary, and Mr. Prem Kishore Srivastava is the technical manager of the paper mill. The Khadi Commission has given a sum of Rs. 60,000 for the establishment of the paper mill.

Talks with the people reveal clearly the fact that the recent developments in Chandrawal have been and are being imposed from the top. Most of the village people do not know anything about the Industrial Estate, have no idea as to the industries that could use the facilities provided through the industrial estate, and were not certain if the paper mill or the Government's Training-cum-Production Centre were serving a useful purpose. As a matter of fact, they said that these activities were unrelated with agriculture and irrigation which were their chief problems. The area is supplied with canals so that the farmers have little difficulty in getting water. But they find it necessary to depend on wells because the canal water supply is not timely. It was reported that whenever the channels running from the wells to the farmer's fields crossed those from the canals, the canal authorities charged rentals as if the water had been supplied from canals. The cultivators were accordingly concerned about this and wanted us to help them out.

Nautanwa

Nautanwa is located on the northern extreme of district of Gorakhpur on the border of Uttar Pradesh and Nepal. It has a population of approximately 7000.

Agriculture

Nautanwa is the headquarters of a Community Development Block. The rainfall is quite good and the soil is suited for paddy. Out of the total cultivated area of 64,600 acres, about 23,000 acres is under early paddy and 33,000 acres under late paddy. Some of the other crops are sugarcane, maize, jowar and Arhar, each having about 400 acres under it.

Rice milling is being carried on in Nautanwa but it was reported that the existing regulations of the Government in regard to excise duty and the proviso that one third of the rice milled is to be supplied to the Government at prescribed rates, has made this business less profitable. There is a hand pounding paddy society and four other such cooperative societies in the Block.

Groundnuts and potatoes are produced in the area but the acreage under them is small.

Irrigation

Irrigation is required only for the Rabi crops and both tanks and wells are used. Since rainfall is good, the water level is fairly high. It is reported that the area has natural artesian wells.

Forest Areas

There is a forest area at some distance from Nautanwa, but the price of fuel wood is quite high, ranging from Rs. 2.00 to Rs. 2.50 per maund. Nautanwa is a centre for timber but there are no saw mills. Saw mills are a possibility if power becomes available.

Existing industries and Commercial Enterprises

Nautanwa has seven flour mills, two large oil mills and one Dal (pulses) mill. This Dal mill also does oil expelling. All these mills do paddy husking as a side business.

There are two cinema houses, both generating electricity by diesel engines.

Durga Oil Mills

This mill was visited with a view to getting detailed information as regards its functioning. It has two expellers, one standard and one baby. These work 50 ghanis. The mill has a 30 Hp crude oil engine. Annually 12 to 13 thousand maunds of oilseeds are crushed. The raw materials are brought from Nepal and from Harwa, which is a surplus oil seed producing area. The oil is sold in Nepal and locally.

The proprietor stated that he is facing stiff competition. An oil mill is Nepal is under-selling him but he has not been forced out of business because he deals in credit. He also mentioned that the excise duty on oil mills has also hit the business.

A 15 Kw generator has been used by the mill for lighting and other purposes. It is operated only occasionally.

Price of Fuel

Crude oil in Nautanwa is priced at Rs. 2.00 per gallon and high speed diesel oil at Rs. 3.25 per gallon.

Potentials for Use of Electricity

If power is made available at a reasonable rate, the existing industries and the cinema houses would most likely become subscribers. A good demand for domestic lighting is anticipated. There also appear to be good possibilities for other industries or business to grow including cold storage, plastic manufacture, manufacture of hume pipes, saw mills and hide tanning.

One of the local, residents, Sri Prem Chand, was stated to have applied for a loan of rupees one lakh for setting up a plastic mill. The manufacture of hume pipes is also promising because the soil and the sand are ideally suited for it. A party in nearby Nepal was reported to be already engaged in this business.

A large number of hides, estimated to be worth rupees 15 to 20 lakhs are sent to Kanpur through Nautanwa. These are reportedly brought from Nepal and some collected locally. With the availability of electricity, it is possible that a tannery could be started. Similarly, a large quantity of wool brought from Nepal passes through Nautanwa to Punjab making a wool industry a possibility.

Names of Prominent Individuals

1. Seth Chulahai Ram Murat, Proprietor of the Durga Oil Mills;

2. Banarsi Lal Mahabir Prasad;

3. Adbul Rauf Lari, ex-Congress M. L. A.;

4. Ram Lagan Dubey, Secretary, Zila Congress Committee.

Principal Impressions

Overall it is clear that the existing potential for the use of electricity is promising. It also appears that once electricity is available, a number of new industries might be established. Local entrepreneurs are looking for good avenues for investment.

It should be noted, however, that Nautanwa is not a village. It has some wealthy people who have traditionally been engaged either in the marketing business or in the manufacturing business or both. Whether electrification will encourage individuals of lesser means to undertake enterprises is not certain. At least agricultural uses of electricity seem limited. The Assistant Engineer, Sri Mathur, who accompanied the team estimated the power requirement to amount to about 250 Kw.

Village of Chandauli

Chandauli, Varanasi District, was visited to study the pattern of utilization of electricity. It has a 40 Kw generator operated by a 50 horespower high speed diesel engine.

It was difficult to get an insight into the existing utilization pattern because the officer of the State Electricity Board who was to accompany us to Chandauli could not come. Independent inquiries were, therefore, made and it was found that except for the five or six families in the canal and tubewell colonies, no use of the electricity was being made. Talks with the residents convinced us

that there was a good demand for electricity in the area but that this demand was not being met. There are two rice mills located in the neighborhood run by diesel engines. There is an oil mill, three flour mills and a few cane crushers. Why electricity was not being provided from the generator could not be ascertained to our satisfaction. One of the reasons given was that the charges were too high, amounting to ten annas per kwh.

The power generated at the Rihand Dam is likely to be supplied to Chandauli in the very near future. In this connection, the transmission lines have already been laid out.

RAJASTHAN

Two sites were visited in Rajasthan: a group of villages in Raipur Block of Jodhpur Division and Berat, some 50 miles from Jaipur, the capital of Rajasthan. The visits were made on the suggestion of the Chief Secretary to the Government, Sri B. Mehta. Malpura, a town near Jaipur, was visited to study the utilization of electricity generated by diesel generators supplied under the Colombo Plan.

Village of Berat

Berat is located 50 miles east of Jaipur on the Jaipur-Delhi highway. Mythological significance, dating to the days of the Maha Bharat, is attributed to it.

Berat has a population of 6000 including the people who live in the surrounding hamlets. Wheat, barley, maize and millets are the chief crops of the area. The annual rainfall is about 24 inches. The total cultivated area is estimated to be approximately 1081 acres, out of which 800 acres are irrigated. Diesel engines located in the Berat area include the following: three diesel pumps for irrigation--two 10 Hp and one 5 Hp; a 14 Hp, 475 rpm, crude oil diesel engine which powers a saw mill; a 17-19 Hp low speed diesel engine which powers an oil pressing facility. There are also two flour mills in the area, one of which operates a cotton gin as well. There is also an oil pressing facility powered by a 17-19 Hp low speed diesel.

In selecting Berat for a visit in connection with the project, it was thought that the neighboring forests would be a possible source of fuel wood for a steam engine generator. On inquiry, it was found that the cost of wood is between Rs. 1.50 to Rs. 2.00 per maund. The price of low speed diesel fuel is Rs. 1.62 per gallon; high speed diesel oil is Rs. 3.00 per gallon.

The Chief Conservator of Forests suggested that blocks in the forests could be reserved for the purposes of the project. Since these forests are about six to ten miles away from the village, the cost of wood per maund was estimated to vary from Rs. 1.25 to Rs. 1.50 inclusive of haulage charges. While the availability of wood for fuel is assured as long as the Government is interested in the project, continued availability is not assured. Moreover, the price of wood may increase if a number of steam engine generators are installed.

There are a number of castes and occupational groups, each having their own individual interests. There does not seem to be a clear-cut demand for power in any existing industry other than perhaps the saw mill and some of the wells where diesel pumps are in use.

APPENDIX B

Use of Electricity in a Sample of Villages in Mysore*

	1	2	3	4
Village	Aldur and 2 Villages	Kyatsandra & 3 Villages	Poduthonse	H. B. Halli
Taluka	Chikmaglur	Tumkur	Udipi	Hadagalli
District	Chikmaglur	Tumkur	S. Kanara	Bellary
State	Mysore	Mysore	Mysore	Mysore
Year of survey	1957-58	1958-59	1958-59	1957-58
Total number of families as in the year of survey	640	900	960	1,018
Total population as in the year of the survey	3,186	5,000	5,450	4,898
Number of families reporting use of electricity for:				
1. Domestic use	95	112	16	122
2. Shops & Estb.	-	-	-	-
3. Industrial Purp.	-	-	-	60 oil mills 4 flour mills 1 saw mill
4. Irrigation	-	40 pumps (3 to 10 hp) 40 lamps for str. lighting 12 lamps for public buildings	10	21

*Data supplied by Gokhale Institute of Politics and Economics, Poona.

	1	2	3	4	
Number of units of power supply consumed during the survey year:					
1. Domestic use	About 15,000	Not known	(During) (1957-58) 1,528	(During) (1956) Not known	(During) (1957) 39,446
2. Shops & establishments	-	-	1,490		
3. Industrial purposes	8,000 Rice and flour mills	-	-	88,602	1,46,001
4. Irrigation	-	1,21,600	10,626	17,539	29,355
5. Street lights, etc.	About 5,000	Not known	173	-	-
6. Cinema houses	-	-	151	-	-
Electricity rates nP. per unit:					
1. Domestic use	25 nP.	Not known	20 nP.		25 nP.
2. Indust. prod.	Not stated	-	14 nP.	8 nP.	
3. Irrigation	-	3 nP.	7 nP.		5 nP.
Source of supply	Jog Falls	Jog Falls	Jog Falls	Jog Falls	

	1	2	3	4
(a) Total area under crops (in acres)	1,391.80 Paddy & Ragi 1,430.27 Coffee Plantations	2,795.78	i) 299.90 Paddy Fields ii) 494.27 Coconut Gard.	1,673 acres
(b) Total irrigated area (in acres) during the year of the survey	-	Arecanut 298.80 Paddy 287.22 etc.	i) 197.00 Paddy ii) 494.27 Coconut Garden	17 acres
Irrigated months	-	-	October November January March April	

APPENDIX C

Data on Diesel Engine Pumping in Waghode Village, Maharashtra*

Village:	Waghode	Taluka:	Raver
District:	Jalgaon	State:	Maharashtra

Year of Survey: 1956-57

Total number of families in 1956-57	612
Total population in 1956-57	3182
Total area cultivated	2469 acres
Total area irrigated	704 acres
Source of irrigation:	Wells only
Number of wells according to village records	167
Total number of oil-engine pumping sets operating in 1956-57	98
Number of oil-engines used for other purposes - flour mill	1

Distribution of oil-engine pumping sets according to size of cultivated holding:

Size of Cultivated Holding	Number of families having oil-engine pumping sets	Number of oil-engine pumping sets
Up to 1.0 acre	-	-
1.1 - 2.0 acres	-	-
2.1 - 3.0 acres	-	-
3.1 - 5.0 acres	-	-
5.1 - 10.0 acres	17	18
10.1 - 25.0 acres	31	47
25.1 - 50.0 acres	9	15
50.1 - 100.0 acres	4	18
Non-cultivating owners	-	-
TOTAL	61	98

*Data supplied by Gokhale Institute of Politics and Economics, Poona.

Distribution of oil-engines according to horsepower:

Village	3	4	5	6	7	8	9	10	11 to 15	Above 15	Total
Waghode	3	1	18	39	2	14	2	6	12	1	98

Distribution of oil-engines according to the years of service:

Village	Up to 1 Yr.	1 Yr. old	2 Yrs. old	3	4	5	6	7	8	9	10	11 to 15	16 to 20	Total
Waghode	2	7	7	18	16	14	12	5	5	-	3	6	3	98

Distribution of oil-engines according to the place of purchase:

----------Places where oil-engines were purchased----------								
Bombay	Jalgaon	Bhusaval	Amraoti	Malegaon	Karjet	Waghode	Nearby Villages	Total
36	14	1	8	2	1	7	29	98

Horse-power	No. of engines	-Prices paid, cost of accessories and cost of connection- Prices paid, Rs.	Ave. per engine, Rs.	Cost of accessories, Rs.	Ave. per engine, Rs.	Cost of connection, Rs.	Ave. per engine, Rs.
3	3	4,050	1,350.0	900	300.0	500	166.7
4	1	1,300	1,300.0	500	500.0	500	500.0
5	18	35,040	1,946.7	5,670	315.0	5,160	286.7
6	39	92,743	2,378.1	13,511	346.4	24,904	638.6
7	2	5,750	2,875.0	700	350.0	1,300	650.0
8	14	44,025	3,144.6	8,650	617.9	6,250	446.4
9	2	4,500	2,250.0	1,100	550.0	2,200	1,100.0
10	6	18,900	3,150.0	4,000	666.7	4,600	766.7
11	3	10,750	3,583.3	1,100	366.7	3,400	1,133.3
12	3	13,500	4,500.0	2,800	933.3	2,050	683.3
13	2	11,000	5,500.0	1,000	500.0	2,300	1,150.0
14	1	3,200	3,200.0	500	500.0	1,000	1,000.0
15	3	16,500	5,500.0	1,800	600.0	3,300	1,100.0
17	1	2,000	2,000.0	650	650.0	1,200	1,200.0
TOTAL	98	263,258	2,686.3	42,881	437.6	58,664	596.6

Bullock pairs and annual farm servants before and after installation of the oil-engine pumping sets:

Village	Pairs of Bullocks		Annual Farm Servants	
	Before	After	Before	After
Waghode	105	79	114	197

Irrigation Months:

All the year round through the intensive months of February to May, and less intensive in Monsoon.

APPENDIX D

Scope of Rural Electrification in India

Table 1 provides data on the number of towns and villages electrified in India by size, in 1956 and 1961, and the Third Five-Year Plan targets for 1966. As may be seen in this Table, by 1961 India had succeeded in electrifying all towns above a population of 20,000, almost nine-tenths of the 856 towns in the 10,000 and 20,000 population range, more than one-half of the 3,101 communities in the 5,000 to 10,000 population range, but only a small fraction of the more than one-half million villages under 5,000 population. It is anticipated that the electrical grids in India will reach all communities above 5,000 population by 1966, about one-half of the 10,000 villages with populations between 2,000 and 5,000, and about seven per cent of the 545,000 villages in India with populations under 2,000. These smaller villages will be electrified dependent upon their proximity to larger towns or their being within a reasonable distance of transmission lines established between load centers and generating facilities. As a consequence, those villages electrified will typically be those most directly benefiting from the rising incomes in the urban and industrializing section of the economy and thus most able to pay the cost of electrification and able to utilize electricity productively.

The progress of the various Indian States in rural electrification differs sharply. Four States have made considerable progress--Kerala, Madras, Punjab and Andhra Pradesh. These States had electrified the following proportions of their total villages and towns--36, 32, 10, and 8 per cent, respectively (see Table 2). Various factors tended to make rural electrification easier in these States. In Kerala there is a relatively low proportion of smaller villages; only 12 per cent of the villages have a population of less than 500 as compared to the all-India average, where two-thirds of all villages have populations under 500 (see Table 2, Column 7). In Madras and Andhra Pradesh the typical village also tends to be somewhat larger in size, increasing the minimum load of the village electrical installation. Significant pumping loads supplement the lighting loads, and in addition, Madras, Kerala and the Punjab have each developed electric transmission and grid systems served by a large proportion of low-cost hydroelectric power.

Table 1

Number of Towns and Villages Electrified in India, by Size
1956, 1961 and Projection for 1966

Population Range	Total Number[a]	No. Elect. by March 1956	No. Elect. by March 1961	No. Elect. by March 1966 (est)	Percent Electrified by 1966
Over 100,000	73	73	73	73	100%
50,000-100,000	111	111	111	111	100
20,000-50,000	401	366	399	401	100
10,000-20,000	856	350	756	856	100
5,100-10,000	3,101	1200	1,800	3,101	100
2,000-5,000	10,000)			5,000	50
500-2,000	180,000)	5300	19,861)		
Less than 500	365,000)		)	33,458	6
TOTAL	560,000	7400	23,000	43,000	8%

[a]According to 1951 census.

Source: The Third Five Year Plan, Draft Report, Government of India, Planning Commission, Delhi, May 1961, p. XXIII-40.

Table 2

INDIAN VILLAGES AND TOWNS WITH PUBLIC ELECTRIC SUPPLY IN MARCH 1961

Sl. No.	Name of State	Population as per 1961 Census in millions	No. of villages and towns with population as per 1951 Census between over 0 to 500	500	Total No. of Villages & Towns as per 1951 Census	Percent of places with population up to 500 to total villages & towns Col.4x100 / Col.6	No. of villages and towns electrified as on 31.3.61 (Estimated)	No. of villages and towns per 100 square miles of area	Average population per village Col.3 / Col.6	Density of population per sq. mile as per 1961 census	Per Cent of villages and towns electrified to total Col.8x100 / Col.6	Overhead lines 2.2 KV to 37.5 KV as on 31.3.60 in Kilometres. Total in State	Average per Village Col.13 / Col.6
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1.	Andhra Pradesh	35.98	11,308	15,435	26,743(vii)	42.3(iii)	2125(iii)	25(xiii)	1345(iii)	339(vii)	7.9(iv)	10,483	0.392(v)
2.	Assam	11.86	20,060	5,295	25,355(v)	79.1(xii)	55(xiv)	30(x)	468(xii)	139(xiv)	0.2(xiv)	146	0.006(xii)
3.	Bihar	46.46	45,909	22,169	68,078(xii)	67.5(ix)	1850(v)	102(ii)	682(ix)	69(iii)	2.7(viii)	8,444	0.124(vii)
4.	Gujarat	20.62	10,332	8,131	18,463(ii)	56.0(iv)	735(viii)	26(xii)	1117(iv)	286(xi)	3.9(vii)	N.A.	N.A.
5.	Kerala	16.88	580	4,105	4,685(i)	12.4(i)	1670(vi)	31(ix)	3602(i)	1125(i)	35.5(i)	5,478	1.169(i)
6.	Madhya Pradesh	32.39	57,286	12,950	70,236(xiii)	81.5(xiii)	420(xi)	41(vi)	461(xiii)	189(xii)	0.6(xi)	2,144	0.031(x)
7.	Madras	33.65	6,511	12,135	18,646(iii)	32.9(ii)	6000(i)	37(vii)	1804(ii)	671(iv)	32.3(ii)	12,745	0.684(ix)
8.	Maharashtra	39.50	26,439	16,002	36,441(ix)	56.1(v)	690(ix)	30(xi)	1084(v)	333(viii)	1.9(ix)	N.A.	N.A.
9.	Mysore	23.55	16,320	9,847	26,167(vi)	62.2(vii)	1650(vii)	35(viii)	899(viii)	317(ix)	6.3(v)	16,362	0.625(iii)
10.	Orissa	17.57	40.654	7,783	48,437(xi)	83.9(xiv)	140(xiii)	80(iv)	363(xiv)	292(x)	0.3(xiii)	950	0.0196(xi)
11.	Punjab	20.30	12,235	8,814	21,049(iv)	58.0(vi)	2030(iv)	45(v)	964(vi)	431(vi)	9.6(iii)	9,413	0.447(iv)
12.	Rajasthan	20.15	23,830	8,101	31,931(viii)	74.7(xi)	140(xii)	24(xiv)	631(xi)	152(xiii)	0.4(xii)	1,067	0.033(ix)
13.	Uttar Pradesh	73.75	75,458	36,750	112,208(xiv)	67.3(viii)	4500(ii)	99(iii)	658(x)	650(v)	4.0(vi)	16,835	0.15(vi)
14.	West Bengal	34.97	26,105	12,486	38,591(x)	67.6(x)	480(x)	114(i)	906(vii)	1030(ii)	1.2(x)	2,286	0.059(viii)
Total for States excluding Jammu and Kashmir		427.63	367,027	180,003	547,030	67.1	22485	48	782	372	4.1	-	-

Note: 1) Details for Jammu and Kashmir are not given as no precise data is available.

2) The total No. of villages and towns electrified as on 3.3.61 is as given by Rural Electrification Directorate of Central Water and Power Commission. These are different from the figures furnished for Madras by the State Electricity Board, as hamlets are also included in the latter's count.